AD A114188

(1)

RDXR-DS-83-1

DEPARTMENT OF THE AIR FORCE

SUPPORTING DATA FOR FISCAL YEAR 1983 BUDGET ESTIMATES

SUBMITTED TO CONGRESS FEBRUARY 1982

APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

DESCRIPTIVE SUMMARIES

RESEARCH, DEVELOPMENT, TEST AND EVALUATION

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER RDXR-DS-83-1	2. GOVT ACCESSION NO. AD-A114 183	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) AF/RDT&E DESCRIPTIVE SUMMARIES Supporting Data for Fiscal Year 1983 Budget Estimates		5. TYPE OF REPORT & PERIOD COVERED Final 1 Oct 82 - 30 Sep 83 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Maj B. T. Bentley (703) 697-7169		8. CONTRACT OR GRANT NUMBER(s) In House Report
9. PERFORMING ORGANIZATION NAME AND ADDRESS HQ USAF/RDXR Washington, DC 20330		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS See Item 9		12. REPORT DATE February 1982 13. NUMBER OF PAGES 1338
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) See Item 9		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Approved for Public Release, distribution unlimited

18. SUPPLEMENTARY NOTES

Submitted to Congress February 1982

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Descriptive Summaries
Research, Development, Test and Evaluation Summaries
Budget Estimates
Supporting Data

Summaries

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This document provides information on the United States Air Force (USAF) Research, Development, Test and Evaluation (RDT&E) Program to Congressional Committees during the Fiscal Year 1983 hearings. This information is in addition to the testimony given by DoD witnesses.

A Descriptive Summary is provided for each program element within the USAF FY 1982 RDT&E Program. Also included are Descriptive Summaries of projects requiring $5 million or more within an element in FY 1983. A Test and Evaluation

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

section is provided for major weapon systems.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS OF
THE DEPARTMENT OF THE AIR FORCE RESEARCH AND DEVELOPMENT PROGRAM
FY 1983
FEBRUARY 1982

INTRODUCTION AND EXPLANATION OF CONTENTS

This document has been prepared to provide information on the United States Air Force (USAF) Research, Development, Test and Evaluation (RDT&E) Program to Congressional Committees during the Fiscal Year 1983 hearings. This information is in addition to the testimony given by DoD witnesses.

A Descriptive Summary is provided for each program element within the USAF FY 1983 RDT&E Program. Also included are Descriptive Summaries of projects requiring $5 million or more within an element in FY 1983. A Test and Evaluation section is provided for major weapon systems.

The formats and contents of this document are in accordance with the guidelines and requirements of the Congressional Committees insofar as possible. The RDT&E funding information contained in the Descriptive Summaries is consistent with data contained in a separate document entitled, "Justification of Estimates for Fiscal Year 1983 RDT&E, AF," except where noted on the individual Descriptive Summaries.

The "RESOURCES" portion of the Descriptive Summaries includes, in addition to RDT&E funds, procurement funds and quantities, Military Construction Appropriation funds on specific development programs, Operation and Maintenance Appropriation funds where they are essential to the development effort described, and where appropriate, Department of Energy (DOE) costs.

Classified pages bear the appropriate security classification. Classified data is bracketed [ ].

TECHNOLOGY BASE

TECHNOLOGY BASE

TECHNOLOGY BASE

ADVANCED TECHNOLOGY DEVELOPMENT

ADVANCED TECHNOLOGY DEVELOPMENT

STRATEGIC PROGRAMS

STRATEGIC PROGRAMS

STRATEGIC PROGRAMS

TACTICAL PROGRAMS

TACTICAL PROGRAMS

TACTICAL PROGRAMS

TACTICAL PROGRAMS

TACTICAL PROGRAMS

INTELLIGENCE AND COMMUNICATIONS

INTELLIGENCE AND COMMUNICATIONS

INTELLIGENCE AND COMMUNICATIONS

DEFENSE-WIDE MISSION SUPPORT

DEFENSE-WIDE MISSION SUPPORT

DESCRIPTIVE SUMMARIES

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61101F
DOD Mission Area: Defense Research, #510

Title: In-House Laboratory Independent Research
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1934 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	10,177	11,258	13,124	15,580	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This effort is spread among thirteen research and development laboratories and provides discretionary funds to the Laboratory Directors to pursue new work of high promise or importance. The program is personally reviewed annually by the Assistant Secretary for Research, Development and Logistics. No higher headquarters approval or justification is required prior to starting the work, which is usually a one-time effort to initiate activities on time-critical ideas.

(U) BASIS FOR FY 1983 RDT&E REQUEST: To provide the Laboratory Directors discretionary funds to pursue new high-promise work in a timely manner.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Estimated Costs
RDT&E	10,200	11,500	13,600		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #61101F
DOD Mission Area: Defense Research, #510

Title: In-House Laboratory Independent Research
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides discretionary authority to Laboratory Directors of the Air Force Systems Command for new research work judged to be of high promise or importance. The Air Force has set up and administered this program in strict compliance with the intent that it would be unencumbered by restrictive reviews and procedures or justifications and documentation prior to beginning work. Laboratory Directors meet annually with the Assistant Secretary of the Air Force for Research, Development and Logistics to account for their research projects.

(U) RELATED ACTIVITIES: Efforts accomplished through this program are of significant importance and are an integral part of the total work being done in the Air Force Laboratories. Usually funds are used to start or expand particularly promising work and continue for one year or until the work is transitioned to the regular program. The responsibility for insuring against unwarranted duplication of efforts rests with the Laboratory Directors. Similar programs are funded by the Army and Navy.

(U) WORK PERFORMED BY: Numerous small and moderate size contracts are placed with universities and industry each year, in conjunction with directly related in-house laboratory efforts, to investigate promising new areas of Research and Exploratory Development. Directors of the Air Force in-house Laboratories are supported by and participate in this program. The ten major contractors were: Southeastern Center for Electronic Engineering, Inc.., Orlando FL; Raytheon Service Co., Burlington MA; University of California, San Diego CA; Systems Research Laboratories, Inc., Dayton OH; Massachusetts Institute of Technology, Cambridge MA; Texas A & M University, College Station TX; Scientific Technology Associates, Inc., Princeton NJ; Martin Marieta Corp, Santa Monica CA; Decision-Science Applications, Inc., Arlington VA. There are 125 additional contractors doing work under 150 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments:

(1) Direct Driven Spool for Hydraulic Actuators: The requirement for hydraulic actuators has become more complex with the advent of the fly-by-wire aircraft. In order to reverse this trend, an electrical force-motor was successfully substituted for the first stage hydraulic control loop. If this new actuator had been available for use on the F-18 aircraft we could have (a) saved 77 pounds per aircraft; (b) eliminated 14 solenoids, 20 wires, 10 failure sensors, and 48 relays; (c) greatly simplified the hydraulics; (d) substantially reduced hydraulic system heat rejection thereby eliminating several heat exchanges; and (e) realized an estimated life cycle cost saving of $13M based on a fleet size of 800 aircraft.

(2) Multiple Pulse Ignition System for Advanced Air-Launched Missiles: The application of pulse motor technology to air-launched missile systems introduced the need for an arm/fire device to mechanically interrupt the ignition sequence from inadvertently igniting all pulses. The design and analysis of a remotely actuated arm/fire device to initiate three or more pulses on command and in any combination was completed. The component development and tasking has transitioned into exploratory development for feasibility demonstration.

(3) Concentric Radial Pulse Motor Demonstration: Prior technology efforts were focused upon the development of a tandem grain, radial pulse motor for several new missile systems such as advanced medium range Air-to-Air Missile (AMRAAM), InterLaboratory Air-to-Air Technology (ILATT), Advanced Intercept Auto Air Missile (AIAAM). Design studies for

the first two systems indicated that the tandem concept lead to high burn rate requirements to provide the desired boost thrust levels with low burning surface area. The test results of the concentric radial pulse motor substantiated low burn rates, lower inert weight and higher performance than the tandem approach.

(4) Co-Pyrolyzed Carbon-Carbon Composites: Developed and demonstrated a method for processing co-pyrolyzed carbon-carbon composites with superior matrix/fiber interfacial bonding. This method significantly reduces the processing time and cost, relative to conventional carbon-carbons, by eliminating at least three impregnation/carbonization and possible graphitization cycles. These composites are candiate substrates for oxidation-resistant materials for air-breathing and gas turbine engine uses.

(5) Inflight Doppler Bubble Sensor for Warning of Bends Risk: Successfully developed a method to detect intravascular precardial bubbles which can be used in an inflight system to warn high altitude aircraft pilots of impending bends. This method will be used at the USAF School of Aerospace Medicine and by the Strategic Air Command in chamber research and pilot screening.

(6) Wideband Interferometric Spectrum Analyzer: A new approach using the inherent parallel processing nature of acoustic-optic spectrum analysis for handling multiple, simultaneous threat signals over a large dynamic range was defined and evaluated. This new approach was sufficiently promising that it has been transitioned to regular laboratory program for hardware development and experimentation.

(7) Guided Projectile Feasibility Study for Aircraft Application. Determine the feasibility for developing small caliber guided projectiles which can be fired from aircraft gun systems. This guidance capability results from using a portion of the projectile ogive nose as a control surface. This effort has transitioned into the regular exploratory development program.

(8) Precise Geodetic Measurements using the Global Positioning System (GPS). Developed a technique that accurately measures the distance between two points on earth using signals from Global Positioning System satellites and small man portable radio receivers. These Miniature Interferometric Terminal for Earth Surveying are transitioning into exploratory development for system prototype demonstration.

(9) Moisture Protection of Optical Fiber. Developed a hermetic coating process using ion deposition of dielectric and metallic materials for moisture protection of optical fibers. Advantages include increased lifetimes, smaller, easily deployable fiber and reduced electromagnetic propagation and detectability.

(10) Advanced Windblast Restraint. Completed the design study evaluation of the two windblast protection system concepts. The arm protection enclosure that is deployed from the crew members torso harness and lap belt were discarded because of high speed deployment problems. The net/epaulet concept performed well in all evaluation categories. Consistent high scores were received in the areas of biomedical loading, deployment, windblast and torso positioning, encumberance and donning/doffing.

Program Element: #61101F
DOD Mission Area: Defense Research, #510

Title: In-House Laboratory Independent Research
Budget Activity: Technology Base, #1

(11) Target Identification Using Target Motion Resolution. Developed an advanced signal processing technique that results in images which have higher information content than obtained with conventional methods, which permits improved target identification performance. This work has application in the synthetic aperture radar and inverse synthetic array radar sensors.

2. (U) FY 1982 Program: The distribution of $11.258 million was approved by the Assistant Secretary of the Air Force for Research, Development and Logistics. Participating Laboratory Directors will again select projects of high promise to be supported.

3. (U) FY 1983 Planned Program: The program will continue as in FY 1982. Individual tasks will be determined during discretion of the Laboratory Directors, who will be participating in this program.

4. (U) FY 1984 Planned Program: The program will continue with individual tasks being determined during the year at the discretion of the Laboratory Directors, who will be participating in this program.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Descriptive Summery: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	116,435	135,999	165,858	178,048	Continuing	Not Applicable
2301	Physics	12,994	14,657	15,831	16,996		
2303	Chemistry	11,926	13,778	18,065	19,524		
2304	Mathematics	10,700	12,604	15,932	17,258		
2305	Electronics	13,463	16,142	17,167	18,472		
2306	Materials	16,346	18,064	19,916	21,343		
2307	Mechanics	16,946	20,552	22,261	23,941		
2308	Energy Conversion	7,654	9,304	13,163	14,308		
2309	Terrestrial Sciences	2,259	2,417	2,647	2,870		
2310	Atmospheric Sciences	8,115	8,888	9,603	10,270		
2311	Astronomy and Astrophysics	4,976	5,264	5,712	6.128		
2312	Biological and Medical Sciences	5,794	8,092	9,067	9,876		
2313	Human Resources	5,262	6,237	6,494	7,062		
2314	University Research Instrumentation	0	0	10,000	10,000		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element is dedicated to the advancement of military aerospace technology through scientific research.

(U) BASIS FOR FY 1983 RDT&E REQUEST: A broad base of scientific research will be carried out with the project resources listed above. Increased funding for FY 1983 will be used for three new major space related initiatives: (1) Space Propulsion and Power ($3.0 million, Project 2308), (2) Spacecraft Structures and Materials ($3.0 million, Project 2303), and (3) Spacecraft Image Processing ($2.0 million, Project 2304). Details of these initiatives are described in the section, "FY 1983 Planned Program", which follows and also in the descriptive summaries of the projects which encompass them. A new project (2314) will begin in FY 1983 to upgrade and modernize research equipment in the university community ($10.0 million). All programs are directed toward the improvement of Air Force technology.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E ($ in Thousands)	118,540	142,700	178,700		Continuing	Not Applicable

Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element supports the entire Air Force research program including extramural and in-house investigations. It encompasses those scientific areas in which technological progress is judged essential for advancing Air Force capabilities. The principal thrusts of these research programs are in the areas of aerospace structures and aerodynamics; materials; propulsion and power; electronics; directed energy; conventional weapons; terrestrial, atmospheric, and space sciences; and life sciences.

(U) RELATED ACTIVITIES: Program coordination among government agencies is achieved through annual interagency meetings and data exchange with the Army, Navy, National Science Foundation, Department of Energy, National Aeronautics and Space Administration, Federal Aviation Administration, Defense Advanced Research Projects Agency, Defense Nuclear Agency, and other Federal research activities. Other means of coordination include annual briefings to the Under Secretary of Defense for Research and Engineering, attendance at technical symposia and topical reviews covering research areas of common interest, and other activities such as the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Propulsion Committee. In addition, particularly effective coordination is accomplished on an informal basis among individual Air Force program managers and their counterparts in other agencies or with scientists whose research is supported by other government sources.

(U) WORK PERFORMED BY: The Air Force basic research program is conducted predominantly under extramural grants and contracts with academic institutions and industry. The entire Air Force research program, extramural and in-house, is managed by the Air Force Office of Scientific Research, Bolling AFB, DC. Research is now underway in-house at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; Air Force Armament Laboratory, Eglin AFB, FL; Air Force Weapons Laboratory, Kirtland AFB, NM; Air Force Rocket Propulsion Laboratory, Edwards AFB, CA; Air Force Geophysics Laboratory, Hanscom AFB, MA; Air Force Human Resources Laboratory, Brooks AFB, TX; Aerospace Medical Division, Brooks AFB, TX; Frank J. Seiler Research Laboratory, USAF Academy, CO; and the Rome Air Development Center, Griffiss AFB, NY. The ten major contractors are: Stanford University, Stanford, CA; University of California, primarily at Berkeley and Los Angeles, CA; Massachusetts Institute of Technology, Cambridge, MA; University of Southern California, Los Angeles, CA; University of Texas, Austin, TX; Universal Energy Systems Incorporated, Dayton, OH; SRI International, Menlo Park, CA; Systems Research Laboratories, Dayton, OH; Texas Tech University, Lubbock, TX; and Princeton University, Princeton, NJ. In total, there are 330 contractors with 1,200 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Following is a selected sample of recent accomplishments resulting from research conducted under this program element:

(1) Free Electron Laser: The first demonstration of the free electron laser was sponsored by this program element in 1978. Since then, research has continued to advance various aspects of such devices. During 1981, key accomplishments

involved the first demonstration of a free electron laser in the visible region of the spectrum, and the first demonstration in a storage ring. Storage ring operation is important because the energy remaining in the electron beam is reused after radiation is extracted, thereby leading to the possibility of very high efficiency at very high powers in relatively compact devices.

(2) Ionization Front Accelerator: A milestone has been reached toward creating a new acceleration technique for positive ions. While work in collective field accelerators has been ongoing for several years, accurate control of the acceleration process was not possible. The ionization front accelerator has, for the first time, demonstrated accurately-controlled motion of the potential well at the head of an intense relativistic electron beam. This work has potential for extremely compact, high voltage accelerator designs in support of the particle-beam program.

(3) Polymer Research: Long term research sponsored under this program element has produced self-reinforced, long chain ordered polymers which; in comparison with other polymers, carbon, glass, and steel fibers; have superior tensile strength and ultra high modulus concurrent with excellent thermal stability and environmental resistance. During 1981 processing research on these new ordered polymers resulted in the capability to manufacture large quantity batches having the same superior properties as the earlier research-size batches. In related work molecular level alloying in polymers was achieved for the first time, resulting in significant improvements in the tensile strength, optical transparency, and use temperature of polymer sheets and films. The outstanding mechanical and thermal properties of advanced polymers will provide a new high performance lightweight structural material for missile, spacecraft, and aircraft applications.

(4) Broadband Optically Transmitting Glasses: New chemically durable, non-toxic optical glasses based on metallic fluorides and fluorochlorides rather than oxides have been developed which have excellent optical transparency from the ultraviolet to nine microns in the infrared region of the spectrum. New preparation techniques have resulted in oxygen-free, water-free glasses with non-detectable iron and copper impurities which are responsible for the high optical attenuation of current materials. The outstanding optical and chemical durability properties of these new glasses are expected to provide a new high performance material for long wavelength fiber optic communications, optical waveguides, windows, lenses, and infrared domes.

(5) Theory of Forging: Research on the theory of forging has produced a breakthrough in the ability to predict the optimal die shapes and metallurgical properties of the forged part for axisymmetric shapes such as turbine engine discs. Significant savings will be achieved in cost and lead time in designing and procuring forging dies.

(6) Rapid Runway Repair Concrete: Research sponsored under this program element has produced water compatible polymer concretes for use in rapid repairs for bomb-damaged runways. Requirements for such concrete are simple and rapid placement, fast curing (less than one hour) under all weather conditions, high strength, and durability. Previous candidates failed to meet one or more of these requirements, most notably, compatability with wet aggregate and strength gain at low temperatures. During tests of the new concretes, one hour compressive strengths in excess of 2000 psi were achieved using water saturated aggregates. Similarly, strength requirements were met or exceeded at temperatures as low as -20 degrees Centigrade. The work has been transferred to the Air Force Engineering and Services Laboratory for field testing.

Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(7) Turbulent Drag Reduction: Experimental observations of the structure of turbulent boundary layer flow have indicated that ring or loop vortex interactions with the surface may be a major source of turbulent friction drag. Research is continuing to investigate techniques for turbulent drag reduction through manipulation or control of turbulent vortex characteristics. Such research has potential for significant drag reduction for future fuel-efficient aircraft.

(8) Photochemical Ignition: Current aircraft combustion systems are limited by combustion associated phenomena such as flammability, flame propagation, ignition, and stable combustion. These limitations are basically system dependent and are not necessarily fundamental limitations. During research conducted under this program element, ignition and combustion enhancement of fuel-air mixtures by photochemical energy addition was successfully demonstrated. Ignition with a continuous light source could lead to a breakthrough in flame stabilization. The technique holds the potential for use as a "zero pressure drop," optical-radiative flame stabilizer, replacing the present gas turbine bluff-body flameholders which can incur a 5-6 percent pressure loss, and therefore holds the potential for higher gas turbine fuel efficiency and/or higher developed thrust.

(9) Mesoscale Weather Forecasting: Long term research sponsored under this program element is formulating the theoretical foundation and numerical techniques to permit the creation of mesoscale (2-500 kilometer) weather forecasting capabilities. The classical approach to mesoscale predictive models is to create an instrument network dense enough that a mesoscale feature is large compared to the data grid--an unacceptably expensive concept for worldwide application. However, the new mesoscale model can generate mesoscale features 12-24 hours in advance based upon conventional sparse weather data. This research demonstrates that high resolution forecasts can be produced from the existing worldwide weather observing network. Battlefield-scale weather forecasting may be significantly enhanced by this research, directly aiding operational planning and execution.

2. (U) FY 1982 Program: See individual project descriptive summaries.

3. (U) FY 1983 Planned Program: The FY 1983 research program includes three new major initiatives.

(1) Space Propulsion and Power: This initiative will include programs to address (a) more efficient orbit transfer propulsion; i.e., programs aimed at improving the energy efficiency of orbit-to-orbit propulsion systems using both conventional and unconventional approaches and/or propellants; (b) increased energy efficiency of space vehicle low power (tens of kilowatts) electrical power sources; and (c) space vehicle high power (megawatt) electrical power sources and associated power storage and conditioning systems, the type of power sources and systems that must be available if space-based directed energy weapons are to be developed. This initiative will be carried out under Project 2308.

Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(2) Spacecraft Structures and Materials: This initiative will include programs for research to provide fundamental information on new materials, structures, and structural dynamics leading to improved, stable spacecraft with extended life. Chemistry and materials research will focus on new ceramic, polymeric, and carbon-carbon concepts for dimensionally stable, environmentally resistant space composites; vibration damping materials; and non-welded, in-place joining and space processing of multiple composite units. Structural dynamics research will address active distributed control concepts and modeling for shape control, orbital transfer dynamics, and damping enhancement, and nonlinear large motion dynamic modeling for slewing and attitude control. This initiative will be carried out under Project 2303.

(3) Spacecraft Image Processing: This initiative will include research to exploit promising ideas emanating from the field of computer science and apply them to the processing of information/image data obtained from space-based surveillance platforms. Specific research efforts will be directed toward the following: novel computer architecture, promising an order of magnitude greater computer power; mathematical image models, useful for data compression for transmission efficiency; time varying imagery, in which important information is detected by observing target motion against a stationary background; and three-dimensional imagery, with possible advances coming from stereo-vision, determining shape from logical inference, and methods depending on laser radar returns. This initiative will be carried out under Project 2304.

In addition to the above new major FY 1983 initiatives, the FY 1983 research funding request will permit the Air Force to continue the following FY 1981 and FY 1982 initiatives:

(1) Research programs to explore aerodynamic phenomena which will enhance the energy efficiency and capabilities of tactical air vehicles. Specific research efforts will continue to be directed towards the aerodynamics of friction and form drag reduction, and lift and thrust enhancement from unsteady, large amplitude wing motions. The potential application of active control of wing motion to reduce drag and enhance efficiency will continue to be explored. This initiative is being carried out under Project 2307.

(2) Research programs which explore the aerodynamic phenomena associated with very low speed take off and landing Included in this initiative are efforts to understand interaction of high speed jets with surfaces, the aerodynamic interaction of propulsive lift jets, and the mixing of confined co-flowing turbulent streams. This initiative is being carried out under Project 2307.

(3) Research in systems automation which is exploring artificial intelligence (AI) techniques leading to smart, autonomous systems. AI is a subfield of computer science that deals with having computers perform tasks requiring the human trait of intelligence. Advances in AI will lead to systems having the capability to sense, think, and act. Examples of such systems include unmanned atmospheric and space vehicles capable of reacting to situations encountered, and expert systems that assist humans in complex tasks such as scheduling of resources and the diagnosis and maintenance of complex mechanical and electronic equipment. This initiative is being carried out under project 2304.

Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(4) Research directed to the sciences of manufacturing. This program is emphasizing technologies associated with the latter stages of the manufacturing cycle when the value of assembled and tested products is highest. These technologies are optical recognition and metrology, computer vision, robotic controls, multistate acceptance, and nondestructive evaluation. This initiative is being carried out under Project 2305.

(5) Research directed toward the defense of Air Force systems and personnel against chemical agents. This research is incorporating efforts in analysis of the chemical properties of chemical agents, detection systems, transport of chemical agents by the environment, protective products, and the physiology and biochemistry of chemical agents. This research program is being coordinated with, and is complementing, Army chemical defense research. This initiative is being carried out under Project 2312.

(6) Research directed toward those scientific areas expected to contribute to the development of directed energy weapons. Free electron laser oscillator experiments will be conducted. Research will be conducted on the creation and neutralization of negative ion beams for exoatmospheric applications. Theoretical studies of the propagation of neutralized and ion beams from the exoatmospheric region into the atmosphere are planned. An expanded effort in X-ray sources will probe the basic physics necessary for the generation of directed energy at X-ray wavelengths. The free electron laser and ionization front accelerator accomplishments described above are examples of the progress made during FY 1981 in this initiative. This initiative is being carried out under Project 2301.

The FY 1983 research funding request will also allow for a continuation of the broad core program in basic research required to provide the advancements needed by the Air Force to maintain technical excellence. Detailed information on the specific research to be conducted in the various scientific and technical areas is contained in the individual project descriptive summaries.

4. (U) FY 1984 Planned Program: See individual project descriptive summaries.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

Project: #2301
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Physics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: All Air Force systems, from space surveillance systems to transport aircraft, are deeply dependent for effective operation on accurate knowledge of physical principles. Whether the question is safety and reliability of explosives, the ability of a laser weapon-guidance beam to read the target through a rain shower, or more detailed understanding of combustion processes to develop a more powerful fighter aircraft engine, the study of physical processes is the only source of answers. Continued progress and prevention of technological surprise require a dynamic research program in physics. This project provides scientific information to the technology base to help solve Air Force problems in new weapon systems development, electromagnetic countermeasures, nuclear weapons effects, nondestructive and nonintrusive testing and analysis, and new materials development. To provide the necessary scientific knowledge, work is supported in optical physics, plasma physics, electricity and magnetism, atomic and molecular physics, particle beam technology, and physics of collective phenomena.

(U) RELATED ACTIVITIES: Program coordination among government agencies is achieved through interagency meetings involving the Army, Navy, Department of Energy, Defense Advanced Research Projects Agency, Defense Nuclear Agency, and the National Science Foundation; program briefings to the Under Secretary of Defense for Research and Engineering; formal and informal discussions among scientists and engineers in the Services; and by attendance at symposia and topical reviews covering research areas of common interest. In addition, the Air Force research program in physics is related to other Air Force programs through discussion with laboratory personnel at technical reviews and through participation in various technology planning meetings. For example, during FY 1981 the particle beam program was briefed to the Director of Directed Energy for the Department of Defense on four occasions, at a 40-organization technical interchange symposium, and at three reviews at the Defense Advanced Research Projects Agency.

(U) WORK PERFORMED BY: In-house research is now underway at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH and the Air Force Weapons Laboratory, Kirtland AFB, NM. The ten major contractors are: Texas Tech University, Lubbock, TX; University of Arizona, Tucson, AZ; Stanford University, Stanford, CA; Systems Research Laboratories, Dayton, OH; Massachusetts Institute of Technology, Cambridge, MA; University of Southern California, Los Angeles, CA; University of Illinois, Chicago, IL; Princeton University, Princeton, NJ; SRI International, Menlo Park, CA; and University of California, Santa Barbara, CA. In total, there are 82 contractors with 132 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) Free electron laser amplification has been demonstrated for the first time in a storage ring (at 4886 Angstroms). This is the first and only demonstration of a free electron laser in the visible region of the spectrum, and the first and only demonstration in a storage ring. Storage ring operation is important because the energy remaining in the electron beam is reused after radiation is extracted, thereby leading to the possibility of very high efficiency at very high powers in relatively compact devices. (2) A milestone has been reached toward achieving a new acceleration technique for positive ions. While work in collective field accelerators has been ongoing for several years, accurate control of the acceleration process has not been possible. The ionization front

Project: #2301
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Physics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

accelerator has, for the first time, demonstrated accurately-controlled motion of the head of an intense relativistic electron beam. Controlled accelerating fields of 50 million electron volts per meter (over 10 times larger than conventional accelerators) have been achieved over a distance of about 10 centimeters. This work has potential for extremely compact, high voltage accelerator design in support of the particle-beam program. (3) An all-purpose, rigorous program for molecular calculations has been formulated which incorporates models and theories not previously combined. These computationally efficient methods permit more accurate calculations than were previously possible. They are being used to determine vibrational excitation cross sections needed by the Air Force Rocket Propulsion Laboratory and the Defense Advanced Research Projects Agency in the design of missile detectors. (4) Research in collective electromagnetic effects in plasmas has led to near millimeter wave production from the world's shortest wavelength Cerenkov source. This source offers the possibility of scaling to relatively small sizes and could have important uses in communications, radar, electromagnetic warfare, and directed energy systems.

2. (U) FY 1982 Program: The directed energy thrust is continuing. Increased emphasis is being given to both theoretical and experimental studies of ion and plasmoid beam propagation in the exo-atmosphere, as well as charged particle and neutral beam propagation across atmospheric density gradients. Work is also being increased in the area of negative ion formation and electron detachment in support of space-based neutral beams. Pulsed-power research, especially the physics of high-power, repetitively-operated switches, is continuing to receive heavy emphasis. Basic research into the generation of space-based prime power is receiving emphasis. The effort in nonlinear optics in single crystal fibers is being expanded into a major program. The ability to take advantage of nonlinear optical processes on the scale of a meter and longer rather than the centimeter scales currently used will lead to dramatic new capabilities in optical sources, frequency converters, etc., for application to optical countermeasures, recording magnetometers, and time standards. Another new program area in laser-induced, nonequilibrium processes at surfaces is underway. This work will lead to dramatic new capabilities in surface diagnostics, preparation, and coating. A program in laser detection of very small amounts of materials is being given additional emphasis.

3. (U) FY 1983 Planned Program: Demonstration of recovery of the energy from a electron beam in a radio frequency linear accelerator will be initiated. This is the last key principle in the feasibility demonstration of high efficiency, ultra high energy free electron lasers using radio frequency linear accelerators. Funding for studies of the generation of incoherent and coherent X rays will increase and the application of these sources to material studies will be initiated. Pulsed-power studies will remain level, while funds for specific aspects of particle acceleration, propagation, and detection will increase. Funding for studies of countermeasures to particle beams will be increased. The thrust in the directed energy area will continue. Emphasis will shift from collective effects acceleration studies to such efforts as advanced high efficiency radio frequency sources. Propagation experiments, especially ion beam propagation, will be expanded. Pulsed-power studies, specifically the exploration of advanced switching concepts such as plasma instability and optogalvanic switches, will be expanded. Space-based prime power research will expand to include such basic studies as dielectric behavior at high temperatures, advanced thermodynamics, high energy density storage, photovoltaics and photoionics, and high-pressure electrochemistry. The program in collective mechanisms for the enhanced production of radiation from plasmas will address the more difficult problem of generation of radiation at wavelengths shorter than those of the previous year's effort.

Project: #2301
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Physics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

4. (U) FY 1984 Planned Program: Energy recovery studies in free electron lasers will be completed, thereby demonstrating, individually, the feasibility of all of the elements necessary for high energy, high efficiency devices. Specially designed free electron laser accelerator facilities will be initiated to demonstrate that the elements can work together to produce high energies. Photochemical materials processing and diagnostic efforts will be expanded. Advanced particle-beam research areas such as microparticle acceleration will receive new emphasis, as will countermeasures research. Electron propagation research will be phased down in favor of ion/plasmoid experimental work. Pulsed-power studies will remain level, space-based prime power generation research will be further expanded, and funds for aspects of particle-beam acceleration and detection will be increased.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	12,994	14,657	15,831	16,536	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
	13,080	14,900	16,600		Continuing	Not Applicable

The $769 thousand reduction in the FY 1983 estimate compared with last year's FY 1983 estimate was accomplished partially by scaling back the planned growth in the overall program, and partially by reducing the planned rate of outyear growth for the FY 1981 initiative in directed energy weapons.

Project: #2303
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Chemistry
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Research in chemistry includes: (1) synthesis and characterization of materials for utilization in structural composites, lubricant systems, sealants, and fluids; (2) atmospheric chemistry responsible for influencing the operational Air Force environment; (3) methods for synthesis of advanced ingredients for rocket fuels and explosives; (4) electrochemical processes important for improved batteries; (5) new analytic methods for utilization in combustion diagnostics; and (6) energy conversion processes fundamental to high energy laser development.

(U) RELATED ACTIVITIES: The Air Force chemistry program is coordinated through a federal interagency panel which includes participation by the Army, Navy, Department of Energy, National Science Foundation, National Institutes of Health, National Aeronautics and Space Administration, and the Environmental Protection Agency. Coordination is also achieved through triservice programs; e.g., the Joint Technical Coordinating Group for Munitions Development; or special topical reviews of the Under Secretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: In-house research is now underway at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; the Air Force Weapons Laboratory, Kirtland AFB, NM; the Air Force Geophysics Laboratory, Hanscom AFB, MA; the Frank J. Seiler Research Laboratory, USAF Academy, CO; and the Air Force Rocket Propulsion Laboratory, Edwards AFB, CA. The ten major contractors are: SRI International, Menlo Park, CA; University of California, Los Angeles, CA; Stanford University, Stanford, CA; Massachusetts Institute of Technology, Cambridge, MA; Harvard University, Cambridge, MA; University of Florida, Gainesville, FL; University of Texas, Austin, TX; University of Southern California, Los Angeles, CA; Columbia University, New York, NY; and Rockwell International Corporation, Thousand Oaks, CA. In total there are 73 contractors with 130 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) Polymer alloys, uniform at molecular levels, have been produced from two component polymers. The alloys possess higher strength and can endure higher temperatures than either component polymer. Molecular level alloying was confirmed with the first polymer application of laser Raman phonon spectroscopy. The outstanding mechanical and thermal properties of advanced polymers will provide a new high performance lightweight structural material for missile, spacecraft, and aircraft applications. (2) The full potential of iodine fluoride for chemical lasing in the visible (green) spectrum has been demonstrated. Suitable methods of energizing the system with activated oxygen are under investigation. Earlier research (in 1977) produced the iodine, activated oxygen transfer chemical laser emitting in the near infrared and (in 1966) the first entirely chemical series of infrared emitting chemical lasers that included the hydrogen fluoride system. (3) A new family of metallic fluoride glasses has been discovered that has broader band transmittance (infrared, visible, ultraviolet), greater chemical durability, and reduced toxicity than competitive materials. (4) Fibers from a polymer whose molecular architecture has been designed for maximum strength and stiffness have been consistently produced in tens of pound experimental batches. Up to 25% increases in fiber tensile strength and stiffness, compared to the best competitive fibers, have been achieved.

Project: #2303
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Chemistry
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

2. (U) FY 1982 Program: The four areas of technical emphasis are: molecular kinetics, non-metallic structures, surface dependent properties, and synthesis. Included in molecular kinetics are the rates and mechanisms of chemical reactions, the dynamics of energy transfer processes, and applied spectroscopy for chemical analysis. Growing emphasis is being placed on chemical reactions in the upper atmosphere which are the sources of background auroral radiation. Evaluation efforts continue in shorter wavelength emitting, visible chemical laser systems. Non-metallic structures research includes structure-property relationships of polymers, glasses, and ceramics. A major program addresses an advanced concept of molecular reinforced polymer composites for high strength fibers, films, and bulk structures. Special attention is also provided ion transport mechanisms in solid state and liquid electrolytes for specialized battery systems. The program in surface dependent properties addresses contamination processes limiting performance of thin film electronic devices as well as lubrication and corrosion. Research in synthesis is directed at storable, energetic propellant ingredients; processible, higher performance composite matrix resins; and advanced hydraulic fluids with controlled viscosity and high temperature stability.

3. (U) FY 1983 Planned Program: A large new research initiative will address requirements for large scale, stable spacecraft and platforms of long lifetime. Emphasis will be on new classes of polymer and ceramic composite materials, novel processing and joining concepts, material structural properties, and structural dynamics. The overall levels of funding for molecular kinetics and synthesis will be maintained with real growth foreseen for non-metallic structures and surface dependent properties. Surface research will consider the importance of particle surface structure and purity in quality control of ceramic processing. Also, growing emphasis will be given selected aspects of the interface chemistry of semiconductor materials. New polymer systems with optimum electrical conductivity will be sought by molecular substitution to define intrinsic limits followed by systematic addition of low levels of soluble additives (or dopants).

4. (U) FY 1984 Planned Program: The research initiative for spacecraft structures and materials will continue. Research in molecular kinetics will address new concepts for short wavelength chemical lasers based on oxidation of two component metal vapors. Structural materials research will seek new electroactive polymers for optical devices. The effort in surface chemistry will place growing emphasis on the mechanism of nucleation and growth of protective coatings. An expansion is foreseen in research on synthesis and characterization of higher performance materials for lubricants, energy transfer fluids, and sealants.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2303
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Chemistry
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	11,926	13,778	18,065	19,524	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	12,140	13,740	17,000		Continuing	Not Applicable

The $1,065 thousand increase in the FY 1983 estimate compared with last year's FY 1983 estimate partially funds the new initiative in spacecraft structures and materials.

Project: #2304
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Mathematics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of the research program in the mathematical sciences is to produce new mathematical and computational techniques needed to solve mathematical and computer problems occurring in Air Force aerospace systems; aerodynamic design of aircraft, missiles, and weapons; command, control, computers including software, and communications systems; surveillance and reconnaissance systems; systems reliability and maintainability; and resource allocation systems for logistics and operational activities.

(U) RELATED ACTIVITIES: The coordination of this program among government agencies is achieved through annual interagency meetings involving the Army, Navy, Department of Energy, and the National Science Foundation; annual program briefings to the Under Secretary of Defense for Research and Engineering; and by attendance at symposia and topical reviews covering research areas of common interest. In addition the Air Force program in mathematical research is tied to other Air Force research and development programs through participation in planning activities, and through coordination with Air Force laboratory personnel at annual technical reviews of programs. For example, the annual meeting of the Interagency Committee for Extramural Mathematics Program was held in the fall of 1980 at the National Science Foundation. The Air Force, Army, Navy, National Science Foundation, Department of Energy, National Security Agency, National Institutes of Health, National Bureau of Standards, and Lawrence Berkeley Laboratory participated.

(U) WORK PERFORMED BY: In-house mathematics research is now underway at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; the Air Force Armament Laboratory, Eglin AFB, FL; the Air Force Weapons Laboratory, Kirtland AFB, NM; and the Rome Air Development Center, Griffiss AFB, NY. The ten major contractors are: University of Southern California, Los Angeles, CA; University of California, Berkeley, CA; University of Maryland, College Park, MD; University of Pittsburgh, Pittsburgh, PA; Stanford University, Stanford, CA; University of Texas, Austin, TX; Massachusetts Institute of Technology, Cambridge, MA; State University of New York, Stony Brook, NY; University of North Carolina, Chapel Hill, NC; and Florida State University, Tallahassee, FL. In total there are 78 contractors with 194 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) New results in computer science have produced computer architectures that employ multiple instruction and multiple data streams. To demonstrate and test these ideas an experimental design of a network computer consisting of a number of microprocessors has been completed. This multiprocessor can parallel process in several ways. Processors in a group can operate independently with a means of communicating with other processors in their group or the processors in the group can operate in the mode where all the processors simultaneously execute the same instruction but apply the operation to a different set of data. This level of parallel processing technique is needed to handle images at real-time video rates. (2) A new way of representing continuous input data for digital communication has been discovered. It is ideally suited for the type of data used in complex signal processing applications. The method avoids the need for lengthy computer operations and can be implemented by low cost electronic devices. This discovery promises to significantly speed up the processing of many forms of communication that require low-distortion, digitally efficient processing. For example, immediate applications lie in digital speech communication,

Project: #2304
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Mathematics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

and further work along this line should benefit image processing. (3) A new stochastic cumulative damage model has been formulated which describes and predicts the life of materials under fatigue, crack growth, and wear. The new model takes into account the major sources of variability including damage due to original material, manufacturing methods, duty cycle severity, and environment. This model allows one to study the influence of combinations of variability on all aspects of a materials life. It can assess influence of changes in service conditions, determine inspection times and number of spares needed, and minimize testing needed for specific ranges of operating conditions. When cost factors are introduced, the model can assess cost of changes in usage and life cycle cost. All this leads to correct assessments of durability.

2. (U) FY 1982 Program: A major research initiative is underway in large systems automation through artificial intelligence. Other major efforts continue to investigate methods to improve reliability and reduce costs for software in computer systems and to study the architecture of computing systems with a large number of processors. Preliminary analysis is being made in research on direct control theory of flexible structures. Adaptive control continues as the major thrust in this area. Computational mathematics is starting to emerge as a major new thrust in this project. Investigations are beginning to examine parallel processing algorithms for major engineering problems. This is the next major way to maintain the impetus of increased computer power. In statistics, major efforts continue to extend reliability theory to include more realistic constraints. In the general area of stochastic processes new, expanded programs are underway. Nonparametric techniques for signal processing are becoming a major part of this program. In system science, programs are being continued in distributed decision modeling, which hold promise of application to command, control, and communications theory. We are also expanding the programs in nonparametric statistical communications techniques and initiating new work in algorithms for parallel processing.

3. (U) FY 1983 Planned Program: A major initiative will investigate and define research issues in image processing with emphasis on space applications and automation. Research will continue in systems automation addressing mathematical modeling and control strategies underlying the guidance and control of stand-off weapons, remotely piloted vehicles, and unmanned space systems. These two research programs will combine basic research in mathematics, artificial intelligence, decision and control theory, and other areas of computer science. These fields are the ones most likely to make important contributions toward future systems in which the most advanced automation is possible. They define a technology base for stand alone systems that would achieve cost savings, new capabilities, and the ability to operate in hazardous environments. Research will continue in computer science designed to automate programming and to combine this method with the formal methods of proof-of-correctness to obtain more efficient ways of coding and verifying software. FY 1982 starts in computational mathematics that emphasize parallel algorithms will be continued and expanded. Continued emphasis will be placed on chaos, solitons, multivariate reliability analysis, and stochastic processes. New in-house research will address decision aids for command and control. Signal processing will continue to be a major part of this program.

Project: #2304
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Mathematics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

4. (U) FY 1984 Planned Program: A major new initiative on computational mathematics emphasising fast and parallel algorithms is planned. Emphasis will center on software reliability techniques, systems automation techniques, statistical communication theory, and advanced numerical and nonlinear techniques for parallel processors. Stochastic processing research will be continued in order to enhance Air Force capabilities for signal processing. Continued effort will be placed on making advanced mathematical techniques available to in-house Air Force scientists and engineers engaged in solving problems occurring in aerodynamics, command and control, communications, and various Air Force operational problems. Additional funds will be used to support new activities in communication theory, computer science, nonlinear mathematics, and distributed processing.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	10,700	12,604	15,932	17,258	Continuing	Not Applicable
8. (U) Comparison with FY 1982 Descriptive Summary:	11,070	13,440	20,200		Continuing	Not Applicable

The $4,268 thousand reduction in the FY 1983 estimate compared with last year's FY 1983 estimate was accomplished partially by scaling back the planned growth in the overall program, and partially by reducing the planned rate of outyear growth for the FY 1982 initiative in large systems automation.

Project: #2305
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Electronics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The research program in electronics seeks to provide the fundamental knowledge required to advance the Air Force capabilities in surveillance, guidance and control, information and signal processing, communications, and command and control. These topics include optical signal processing for target recognition and terminal guidance, compound semiconductor devices for high speed digital signal processing and for microwave power generation, electromagnetic propagation, antennas, target signatures, microwave tube science, magnetostatic and electro-acoustic analog signal processing devices, integrated optics for advanced gyroscopic sensors, nuclear radiation hardening, and robust communications techniques for command and control.

(U) RELATED ACTIVITIES: Electronics research is coordinated through the program reviews of the Under Secretary of Defense for Research and Engineering including the Technical Coordinating Paper on Electronics. Coordination with other research agencies is obtained through data exchange with the Office of Naval Research, the Army Research Office, and the National Science Foundation. The Joint Services Electronics Program is funded within this project and is managed by a Technical Coordinating Committee with one representative from each Service and a Technical Review Panel with representatives drawn from the three Services. In FY 1982 the Joint Services Electronics Program Triservice Committee will review and evaluate the research programs at Harvard University, Polytechnic Institute of New York, Columbia University, and the University of Southern California to identify the most promising research in solid state electronics, quantum electronics, information electronics, and electromagnetic theory.

(U) WORK PERFORMED BY: In-house electronics research is now underway at the Rome Air Development Center, Griffiss AFB, NY; the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; and the Air Force Armament Laboratory, Eglin AFB, FL. The ten major contractors are: Varian Associates, Palo Alto, CA; University of Southern California, Los Angeles, CA; Southeastern Center for Electrical Engineering Education, Orlando, FL; University of Texas, Austin, TX; Polytechnic Institute of New York, Brooklyn, NY; University of California, Berkeley, CA; Stanford University, Stanford, CA; Cornell University, Ithaca, NY; University of Illinois, Urbana, IL; and University of Pennsylvania, Philadelphia, PA. In total, there are 59 contractors with 97 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) The wavelength of infrared detector photoresponse was extended significantly for silicon charge coupled detectors indicating the possibility of extremely lightweight and low cost imaging systems for infrared surveillance and air-to-air missiles. (2) A laboratory demonstration of extremely high resolution radar was achieved that could produce high quality radar images of aircraft for identification by ground-based surveillance radars. The concept of synthesizing a large imaging aperture by sweeping the frequency of the incident illumination was employed. The frequency concept is based on the fact that scattering or diffraction patterns, resulting from the illumination of an object by coherent radiation, will expand and contract as the frequency of radiation is increased and decreased. This allows the use of a small array of receivers that will detect all of the information in the diffraction pattern as it sweeps across the array. (3) A breakthrough has been achieved in the sensitivity of laser

Project: #2305
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Electronics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

gyroscopes fabricated with fiber optics and solid state lasers. An accuracy of 0.1 degree/hour was demonstrated, a factor of 15 improvement over previous results. The use of fibers and solid state lasers offers the possibility of extremely rugged and compact gyroscopes.

2. (U) FY 1982 Program: A new FY 1982 initiative is underway in this project to lower the cost of assembly of aerospace systems through research on manufacturing sciences, including robotic assembly and computer control of the entire manufacturing process. Surveillance research is continuing to advance techniques for achieving higher resolution radar through better understanding of the scattering characteristics of targets and background. A demonstration is being conducted of the high resolution imaging radar technique using aircraft targets of opportunity. Navigation research is continuing on the newly improved fiber optic gyroscope and on new methods of characterizing the laser mirrors in conventional laser gyroscopes. Command and control research is continuing on improved time and frequency standards using new laser standards and stability from conventional quartz standards. Adaptive nulling antennas with greater bandwidth and conformal shape for reduced drag on aircraft are being studied. Ionospheric effects on communication are being studied using satellite probes. Signal processing research is a major component of the electronics project and supports surveillance, guidance, communications, and command and control. The emphasis in signal processing is on novel methods that overcome the limitations imposed on silicon integrated circuit processors by the serial manner in which they process data. Parallel processors are being pursued using new silicon architectures, optical processors, analog magnetic processors, surface acoustic waves, and superconducting processors.

3. (U) FY 1983 Planned Program: The surveillance, guidance, communications, and command and control research will continue. Navigation, guidance, and control research will pursue new alternatives to rotational rate sensing, optical and acoustical techniques to improve accelerometers, and real-time image processing for terminal guidance. Communications research will continue to determine if electromagnetic propogation channels in the ionosphere are suitable for robust emergency communications systems, to provide real-time detection of stochastic and spread spectrum signals, and to provide ultra-wideband signal processing capability. Parallel processors will continue to be pursued using optical processors, analog magnetic processors, superconductor processors, and hybrid processors. The manufacturing science initiative will provide support for centers of research to improve productivity and provide researchers trained in the interdisciplinary skills necessary to automate the manufacturing of aerospace weapons system.

4. (U) FY 1984 Planned Program: The electronics program for FY 1984 will expand the program areas above, while seeking to stimulate fundamental innovative science in areas of intelligent sensors, high speed information processing, target identification and terminal guidance, inertial guidance, and communications. Increased emphasis will be given to the development of a superconducting hybrid analog processor and electronic router with ultra wideband signal processing capability to preprocess large volumes of data. The hybrid techniques will use superconducting and optical processors to feed manageable parcels to very high speed integrated silicon circuits, compound semiconductor circuits, or superconducting digital processors. High critical temperature superconducting material will be pursued. Ultra-submicron electronics research will continue to be investigated with emphasis on compound semiconductor, very large scale integrated circuits.

Project: #2305
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Electronics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	13,463	16,142	17,167	18,472	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

13,480	19,240	22,500		Continuing	Not Applicable

The $5,333 thousand reduction in the FY 1983 estimate compared with last year's FY 1983 estimate was accomplished partially by scaling back the planned growth in the overall program, and partially by reducing the planned rate of outyear growth for the FY 1982 initiative in manufacturing sciences.

Project: #2306
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Materials
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force materials research program investigates phenomena which have potential for improved performance, cost, and reliability of both structural materials and electronic materials. The structural materials research program studies a broad range of material properties such as strength, fatigue resistance, and corrosion resistance of airframe and turbine engine materials with primary emphasis on titanium, aluminum, and nickel based alloys as well as ceramics. A strong program of research in non-destructive evaluation of these materials complements research on improved properties. The electronic materials research program is concerned with semiconductor, optical, and magnetic materials of interest for avionics, surveillance, communications, guidance, and electronic warfare. Emphasis is placed on compound semiconductors, superconductors, surface acoustic wave and magnetostatic wave materials, fiber optic and integrated optic materials, and high purity quartz for time and frequency standards. An increasing program of research on reliability of semiconductors and on their radiation hardness complements the research on improved properties.

(U) RELATED ACTIVITIES: Materials research is coordinated through the Under Secretary of Defense for Research and Engineering Materials Technology Coordinating Paper and the Interagency Materials Coordinating Group which includes the National Science Foundation, Department of Energy, National Aeronautics and Space Administration, and the military Services. As a specific example, powder metallurgy research is coordinated semi-annually with the exploratory development and engineering development project managers in the Air Force and other agencies.

(U) WORK PERFORMED BY: In-house materials research is now underway at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; and the Rome Air Development Center, Griffiss AFB, NY. The ten major contractors are: Massachusetts Institute of Technology, Cambridge, MA; Stanford University, Stanford, CA; Systems Research Laboratories, Dayton, OH; Rockwell International Corporation, Thousand Oaks, CA; University of California, Los Angeles, CA; Battelle Memorial Institute, Columbus, OH; University of Chicago, Chicago, IL; Honeywell Incorporated, Bloomington, MN; SRI International, Menlo Park, CA; and Dayton University Research Institute, Dayton, OH. In total there are 75 contractors with 132 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) Research on the theory of forging has produced a breakthrough in the ability to predict the optimal die shapes and metallurgical properties of the forged part for axisymmetric shapes such as aircraft turbine engine discs. Potential savings in cost and lead time in designing and procuring forging dies are very significant. (2) The highest purity quartz ever grown was produced by the ongoing research program in materials for time and frequency standards. The stability of quartz clocks for long mission duration satellites is expected to be greatly increased by this research. (3) The reliability of complex integrated circuits has not been a major concern for the United States semiconductor industry since about 95% of their market is for commercial applications. The Air Force needs the improved performance of this technology, but requires considerably greater reliability. A research effort to improve the Air Force ability to diagnose causes of failure in complex integrated circuits has produced a new technique for visualizing the location of defects in these circuits by computer control of a liquid crystal display.

Project: #2306 | Title: Materials
Program Element: #61102F | Title: Defense Research Sciences
DOD Mission Area: Defense Research, #510 | Budget Activity: Technology Base, #1

2. (U) FY 1982 Program: Research on the theory of forging is being extended to consider non-axisymmetric shapes. Research on structural materials is emphasizing titanium and nickel based alloys for turbine engines and powder metallurgy of aluminum for airframes. Research on ceramic coatings to improve the oxidation and corrosion resistance of turbine materials, missile ablators, and laser hardened optical components is continuing. Research on non-destructive evaluation of structural materials is emphasising ultrasonic imaging of flaws. Electronic materials research concentrates on semiconductors for signal processing, glasses for fiber optics, quartz for timekeeping, magnetic and acoustic materials for signal processing, and super-conductors for power generation.

3. (U) FY 1983 Planned Program: A new effort is planned to improve the survivability of satellites through greater resistance to laser radiation and improved covertness. Research in structural and electromagnetic materials will continue at the same level as in FY 1982 but with more emphasis on new materials and fiber optic glasses with improved radiation hardening. The ceramics coatings research will be expanded to include thermal barrier as well as oxidation resistance coatings while the emphasis on ceramic turbine engine materials will shift toward understanding how microscopic structure affects properties. Both areas are designed to increase operating temperatures and, therefore, the effiency of advanced turbine engines. The research in non-destructive evaluation of structural materials will continue to focus on the development of improved ultrasonic imaging systems with planned expansion into the areas of photoacoustic and optical imaging. Investigation of thin film durability under laser radiation will be started. The superconducting materials research will shift emphasis from power generation to electronic signal processing and applications.

4. (U) FY 1984 Planned Program: Materials research will continue to support the technologies vital to reliability and advanced performance of Air Force equipment. The synthesis and characterization of metals and ceramics promising long lifetime and a high degree of resistance to high temperature and corrosive environments will be supported. Semiconducting, superconducting, and acoustic materials research will continue as a basis for components with enhanced performance and high reliability to meet the communications and power handling requirements of Air Force systems. Emphasis will continue to be placed on powder metallurgy, joining and forming, non-destructive evaluation, and submicron electronic materials science.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2306
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Materials
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	16,346	18,064	19,916	21,343	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
	16,640	18,010	23,700		Continuing	Not Applicable

The $3,784 thousand reduction in the FY 1983 estimate compared with last year's FY 1983 estimate was accomplished by restricting research increases planned primarily for synthesis and characterization of electronic materials.

Project: #2307
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Mechanics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Mechanics research provides fundamental knowledge pertaining to aerodynamics and structural principles required for improving the efficiency, effectiveness, and safety of current and future Air Force aerospace vehicles, and civil engineering technology for field installations. Investigations are conducted in fluid mechanics, solid mechanics, flight dynamics, and soil and field structure mechanics. The results of this work provide the generic aerodynamic and structural technologies with new insights and concepts necessary to assure the design and production of superior aerospace weapon systems and installations.

(U) RELATED ACTIVITIES: Department of Defense topical reviews and the Technical Coordinating Paper on Structures published by the Under Secretary of Defense for Research and Engineering provide overviews of the mechanics research of the three Services. Overall project coordination takes place in annual triservice reviews. Meetings of special interest are also held involving the National Aeronautics and Space Administration, Army Research Office, Army Materials and Mechanics Research Center, Office of Naval Research, and National Academy of Engineering, as well as with universities and industry. For example, the Department of Defense review of fluid mechanics, structures, and propulsion research was held on 3-4 March 1981 at the National Academy of Sciences with representatives from the Army, Navy, Air Force, and Defense Advanced Research Projects Agency.

(U) WORK PERFORMED BY: In-house research in mechanics is now underway at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; the Frank J. Seiler Research Laboratory, USAF Academy, CO; the Air Force Armament Laboratory, Eglin AFB, FL; the Air Force Rocket Propulsion Laboratory, Edwards AFB, CA; and the Air Force Weapons Laboratory, Kirtland AFB, NM. The ten major contractors are: Massachusetts Institute of Technology, Cambridge, MA; Stanford University, Stanford, CA; California Institute of Technology, Pasadena, CA; Princeton University, Princeton, NJ; Texas A&M University, College Station, TX; Georgia Institute of Technology, Atlanta, GA; University of Pittsburgh, Pittsburgh, PA; University of Washington, Seattle, WA; University of Southern California, Los Angeles, CA; and University of Cincinnati, Cincinnati, OH. In total there are 96 contractors with 184 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) Controlled acoustic feedback using adjacent reflecting surfaces to increase the mixing rate (spreading rate) of turbulent rectangular subsonic and under-expanded supersonic jets has been demonstrated. This work is of importance to a wide range of flows involving turbulent jets, particularly to the thrust augmenting ejector. Thrust augmenting ejectors have promise for use in flight vehicles capable of very low speed take-off and landing. (2) Experimental observations of the structure of turbulent boundary layer flow have indicated that ring or loop vortex interactions with the surface may be a major source of turbulent friction drag. Research is continuing to investigate techniques for turbulent drag reduction through manipulation or control of turbulent vortex characteristics. Such research has potential for significant drag reduction for future fuel-efficient aircraft. (3) A model has been developed which predicts the occurrence of liquefaction in saturated soils due to blast, a condition in which the

Project: #2307
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Mechanics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

saturated soil deposit exhibits a sudden loss of shear strength and flows like a dense liquid. Liquefaction has only recently been recognized as having a significant influence on crater size and shape, and ground motions, resulting from nuclear events at the Pacific Proving Grounds. The research to date has examined the Pacific craters (wet geologies), low yield nuclear craters in Nevada (dry geologies), and high explosive simulations in both saturated and dry soils, and determined that vulnerability/survivability assessments for hardened structures may be in error if liquefaction is not considered. The research is continuing to validate the model for specific soil properties and site conditions. (4) Research sponsored under this program element has developed water compatible polymer concretes for use in rapid repairs for bomb-damaged runways. Requirements for such concretes are simple and rapid placement, fast curing (less than one hour) under all weather conditions, high strength, and durability. Previous candidates failed to meet one or more of these requirements, most notably, compatability with wet aggregate and strength gain at low temperatures. During tests of the new concretes, one hour compressive strengths in excess of 2000 psi were achieved using water saturated aggregates. Similarly, strength requirements were met or exceeeded at temperatures as low as -20 degrees Centigrade. The work has been transferred to the Air Force Engineering and Services Laboratory for field testing.

2. (U) FY 1982 Program: Research initiatives which address the aerodynamics of fuel efficient aircraft and the aerodynamics of low speed take off and landing are being implemented. The turbulence program is receiving increased emphasis in the areas of mathematical modeling and computation of organized flow features. Research in computational grid generation for complex geometries and in unsteady, large scale flow separation is being expanded. Highly deflected, energetic jets characteristic of vertical/short take off and landing aircraft are also being investigated at an accelerated pace. Computational methods for flows through geometrically complex passages and studies of time dependent flows in axial flow compressors are dominating the internal aerodynamic program. New activity is exploring aerodynamic heating on wing-store geometries in supersonic streams. The solid mechanics program is being restructured to emphasize five areas: design methods, dynamics, aeroelasticity, structure concepts, and durability. The dynamics and aeroelasticity efforts are being increased and durability (fatigue and fracture) is being decreased, although it will still be nearly half of the program. New efforts to develop turbomachinery deflection predictions and wing-with stores flutter analysis techniques are being conducted. Studies of piezoresistance gauge-matrix interaction are being expanded to develop gauges capable of measuring in-place stresses in soil masses. Efforts to model the constitutive properties of geotechnical materials, including the response to three dimensional states of stress arising from nuclear and conventional detonations, are continuing. Studies are underway to develop constitutive relations for materials for alternate launch and recovery surfaces.

3. (U) FY 1983 Planned Program: The FY 1982 initiatives in fuel efficient aircraft and low speed take-off and landing will receive continued emphasis. In fluid mechanics, research in the transonic regime will focus on three-dimensional flows with strong shock waves and significant viscous interaction effects. Increased emphasis will be placed on research into the mixing processes of co-flowing, turbulent streams and, in particular, of multiple jets in confined regions. Turbulence research will emphasize the physics of structural flow features which might be exploited to control turbulence characteristics. The levels of effort in experimental characterization of turbulence structure and laminar-turbulent transition will decrease slightly to accommodate increased activities in analytical modeling and

Project: #2307
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Mechanics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

computation of turbulence. Support for research in unsteady flows with time-dependent boundary conditions including separated flows will level off after two prior growth years. In the continued exploration of computational grid generation procedures, emphasis will be on adaptive grids which maintain the most dense portions of the grid in regions of large gradients as the solution evolves. In solid mechanics, emphasis will be on the iteration logic of integrated design, dynamics of flexible structures, and durability of composites. In civil engineering, theories will be developed which accurately predict the response of geotechnical materials to complex stress paths such as result from multiple nuclear detonations. Mathematical models will account for plastic flow, shear-volumetric coupling, hysteretic effects, and strain softening. Theories will be formulated which account for the transfer of free-field stresses and motions to Air Force strategic structures, thereby providing design and analytic tools to insure their survivability. Strain rate effects in geotechnical materials and reinforced concrete will be studied to better describe tensile and shear response.

4. (U) FY 1984 Planned Program: In fluid mechanics, the research efforts on jet interacting flows and jet mixing in confined regions will be phased down. Work will continue on devising the logic for adaptive grid generation in generalized 3-D flows and on improving understanding of complex viscous, compressible flows with large separation regions. Previous results obtained from turbulent shear layer control investigations, including those which probe mixing processes in co-flowing turbulent streams and burst suppression in transitional and fully turbulent boundary layers, will influence the direction and emphasis of the turbulence research program. Results of research in unsteady flows will determine whether this area receives increased growth or reduction in emphasis.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Total Additional to Completion	Estimated Costs
RDT&E Funds	16,946	20,552	22,261	23,941	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

17,390	22,530	28,700		Continuing	Not Applicable

The $6,439 thousand reduction in the FY 1983 estimate compared with last year's FY 1983 estimate was accomplished by reducing planned funding for the continuing program and the two major new initiatives in aerodynamics of low speed take off and landing and aircraft fuel efficiency.

Project: #2308
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Energy Conversion
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project is concerned with combustion, detonation, and propulsion. The areas in which new knowledge is being sought include: (1) combustion and ignition phenomena associated with rocket and aircraft engines, both present and future; (2) advanced diagnostics and instrumentation needed to advance propulsion, materials, and weapons technologies; and (3) solid and gaseous detonation mechanisms associated with advanced conventional weapons and with improved safety in the use of energetic materials. The goal is to reduce the cost and to increase the flexibility and effectiveness of future Air Force systems.

(U) RELATED ACTIVITIES: This research is actively coordinated within the Department of Defense by annual triservice reviews by the Under Secretary of Defense for Research and Engineering and within the Air Force through extensive participation of user organizations in both planning and evaluation. Coordination with other government agencies includes participation in such formal mechanisms as the Interagency Advanced Power Group and the Joint Army-Navy-National Aeronautics and Space Administration-Air Force (JANNAF) Propulsion Committee, as well as less formal but continuous contact with the National Science Foundation, the National Research Council of the National Academy of Science, and the Department of Energy. For example, on 19-23 October 1981 the 18th JANNAF Combustion Meeting was held at the Jet Propulsion Laboratory. The Air Force representatives served on the planning committees, acted as session chairmen, and presented technical papers.

(U) WORK PERFORMED BY: In-house research is now underway at the Air Force Armament Laboratory, Eglin AFB, FL; the Air Force Rocket Propulsion Laboratory, Edwards AFB, CA; and the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH. The ten major contractors are: Stanford University, Stanford, CA; Princeton University, Princeton, NJ; Georgia Institute of Technology, Atlanta, GA; Purdue Research Foundation, Lafayette, IN; University of Dayton, Dayton, OH; University of California, Berkeley, CA; Atlantic Research Corporation, Alexandria, VA; Wright State University, Dayton, OH; Purdue University, West Layfette, IN; and Exxon Research and Engineering Company, Linden, NJ. In total there are 34 contractors with a total of 45 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) Using properly contoured swirlers in place of existing flameholders in current volume limited ramjet dump combustors, combustion efficiency was improved and total pressure loss reduced by about 10%. This makes feasible the use of very short aspect ratio combustors. These improvements in combustor performance and more efficient packaging can result in over 50% increase in range over existing integral ram rocket configurations. (2) Ignition and combustion enhancement of fuel-air mixtures by photochemical energy addition has been successfully demonstrated. This technique holds the potential for use as a "zero presssure drop" optical-radiative flame stabilizer, replacing the present gas turbine bluff-body flameholders which can exhibit a 5-6% pressure loss. (3) Spatially and temporally-resolved temperatures and multi-species in turbulent flames were measured using multi-detector Raman scattering. This technique provided, for the first time, probability density functions required for the development and validation of turbulent combustion theories. (4) The unexpectedly high infrared emission from the plumes of metallized

propellants has been explained by accounting for the surface waves on the condensed alumina particles. The emissivity attributed to the surface waves is very dependent on small levels of carbonaceous material entrained in the alumina and on particle diameter.

2. (U) FY 1982 Program: Strong emphasis is being directed to diagnostic methods and instrumentation applicable to reacting flows. The dynamics of high-speed turbulent steady-state and transient chemically reacting flows are being investigated theoretically and experimentally. Research on the pyrolysis and oxidation kinetics of hydrocarbons is continuing with emphasis on representative aromatic hydrocarbon constituents of shale oil or coal derived future fuels. Research continues on exploring phenomena associated with undesired ignition from multiple sources. Research is being conducted on alternate means of ignition and flame holding for airbreathing engines. An increase is planned in efforts pertaining to the combustion of alternative fuels and high-energy/high-density fuels (e.g., carbon and boron slurries), to ramjet combustion instability, and to supersonic and dual mode (subsonic and supersonic) combustion. Efforts are continuing on particulate and soot formation and on other combustion generated exhaust emissions and plumes. Efforts are being initiated to explore the phenomena associated with rocket motor combustion to provide knowledge needed to improve performance and efficiency. Physical and chemical reactions in rocket plumes along with a number of radiation phenomena are being investigated. Efforts relating to rocket combustion dynamics are being emphasized. New efforts are being started to understand the processes required to rapidly and efficiently burn metals. The potential of realizing improved propellants through additional research on synthesis is being addressed.

3. (U) FY 1983 Planned Program: A major new initiative will address the scientific issues underlying future space propulsion and power requirements including power generation, switching, and beaming; thermal management technology; and more energetic propellants. Several of the approaches resulting from the research initiatives on nonintrusive techniques to obtain reliable experimental measurements from reacting flows will be validated and compared to theoretical results. Attention will be given to advanced diagnostics for performing research on energetic materials, particularly condensed phase processes. Research will continue on new techniques which are essential to understand combustion systems, air-breathing and rocket engines, effective fuel utilization, and exhaust plume signatures. Continuing research will be directed at the dynamics of high-speed turbulent steady-state flows and transient chemically reacting flows with emphasis placed on realistic modeling and characterization of the flow field, processes and phenomena occurring in dump-type ramjet, gas turbine, and ducted rocket combustors. Attention will be given to establishing the research needs associated with the combustion of alternative fuels and high-energy, high-density fuels; ramjet combustion instability; and ducted rocket and supersonic/dual mode combustion. Efforts will continue to explore the phenomena associated with rocket motor combustion to provide knowledge needed to improve performance and efficiency of tactical, strategic, and space propulsion systems. Physical and chemical reactions in rocket plumes along with a number of radiation phenomena will be studied in Air Force laboratories and through contracts. Efforts relating to rocket combustion dynamics will continue to be emphasized with the long range goal of making a priori assessments of the likelihood of stable motor operation. This will be the third year of the research to understand the processes required to burn metal, in particular boron, in ducted and ram rockets fueled by either slurries or solid propellant gas generators.

Project: #2308
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Energy Conversion
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

4. (U) FY 1984 Planned Program: The space propulsion and power initiative will continue as a major effort in 1984. Additional growth is expected in efforts pertaining to ramjet and ramrocket performance and combustion instability and to supersonic/dual mode combustion. Some growth is expected in efforts pertaining to the combustion of metalized fuels for air-breathing systems. Fuel-air explosion research will probably remain constant. Additional research on space propulsion and power is expected.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	7,654	9,304	13,163	14,308	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
	8,780	9,640	12,200		Continuing	Not Applicable

The $963 thousand increase in the FY 1983 estimate compared with last year's FY 1983 estimate partially funds the new initiative in space propulsion and power.

Project: #2309
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Terrestrial Sciences
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The capability of a ballistic missile to strike a target on the other side of the earth is derived directly from accurate knowledge of many aspects of terrestrial sciences. The very stringent accuracy requirements of the new missile generation demands increasingly detailed understanding of the earth and increasingly imaginative methods and instruments for obtaining that understanding. This project supports Air Force objectives in missile system guidance, control, and delivery; advanced guidance component testing; and missile site selection. Research in geodesy is required to determine the exact position of targets with respect to missile launch sites. Research in gravity is required to determine its effect on missile guidance systems along flight paths. Research in seismology is required to determine the effects of earthquakes, nuclear explosions, and other natural or system-generated noise on the degradation of missile guidance systems before launch.

(U) RELATED ACTIVITIES: Complementary research is conducted by the Army, Navy, National Aeronautics and Space Administration, National Science Foundation, and the United States Geological Survey. Coordination with the Army and Navy is accomplished through the Environmental Sciences Technology Coordinating Paper and during Under Secretary of Defense for Research and Engineering annual reviews. Additional coordination is accomplished through interagency groups (e.g., the Interagency Geophysics Discussion Group, a ten-agency group which meets monthly) and scientific symposia.

(U) WORK PERFORMED BY: In-house research is now underway at the Air Force Geophysics Laboratory, Hanscom AFB, MA. The ten major contractors are: Massachusetts Institute of Technology, Cambridge, MA; Systems Science and Software Incorporated, LaJolla, CA; Stanford University, Stanford, CA; University of Colorado, Boulder, CO; University of Alaska, Fairbanks, AK; Nova University, Fort Lauderdale, FL; Ohio State University Research Foundation, Columbus, OH; Canadian Commercial Corporation, Hull, Quebec, Canada; Weidlinger Associates, Menlo Park, CA; and Sierra Geophysics Incorporated, Arcadia, CA. In total there are 16 contractors with 21 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) Advances have been achieved in satellite radar altimetry, lunar laser ranging, absolute gravity measuring instrumentation, and techniques for combining various types of gravity data into earth gravity models enabling the Air Force to improve ballistic missile accuracies and to calculate precision orbits for military satellites. (2) The Air Force Geophysics Laboratory has demonstrated that rapid precise geodetic measurements can be made between two points on the earth over short distances by recording and comparing signal phase differences from the Global Positioning System on man-portable radio receivers. This significant accomplishment and demonstrated technique could be used as a rapid surveying system for determining the required locations of possible mobile missile launch sites. This system requires less than one-tenth the time previously required. (3) A program was implemented to test and compare all instrumentation used for measuring the true long-period ground motion occurring at sites used or planned to test, calibrate, and evaluate future missile guidance systems. A standard for comparison now exists for determining the true ground motion at low frequencies.

Project: #2309
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Terrestrial Sciences
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

2. (U) FY 1982 Program: The reduction and analysis of additional data from intercontinental radio interferometry and lunar laser ranging is being continued for the determination of variations in earth rotation and polar motion. Theoretical and experimental studies are being continued on improved earth motion measurements. Improved knowledge of irregular earth rotation and polar motion are required to assess and test advanced inertial sensors for navigation and guidance. An improved gravity field model is required to meet the navigation and guidance accuracy requirements for the mid-1980s. To further improve the gravity field model, detailed geoid and earth gravity fields are being derived for selected geographical areas from satellite altimetrical data. Ocean and earth tide models are being studied to make tidal corrections to absolute gravity measurements. Refinement in the representation of the geoid surface is being achieved by removal of tidal and other disturbing effects. The testing of prototype miniature interferometer terminals for rapid earth surveying is being conducted. Research in seismology, seismic wave propagation, and new instrumentation is being continued to provide the necessary data to predict the effects of spurious earth motions on advanced missile guidance systems. The third prototype cryogenic gravity gradiometer is being used in an experiment to test the inverse square gravitation law at laboratory distances.

3. (U) FY 1983 Planned Program: The Air Force will participate in organizing the international project on Monitoring Earth Rotation and Intercomparison of Techniques (MERIT) to determine the earth rotation by intercomparing densely spaced observations by various modern and classical techniques. Gravity field model improvements will be made possible by research programs in earth-to-satellite and satellite-to-satellite tracking techniques, satellite altimetry, mobile gravity gradiometry, geodesy theory, and computer software and hardware. The evaluation of the cryogenic gravity gradiometer techniques will be completed and recommendations made as to system development transfer. Phase differencing techniques using satellite signals from the Global Positioning System will be used for making high precision geodetic measurements using the Miniature Interferometer Earth Surveying (MITES) technique. Techniques will be further developed for predicting the nature and magnitude of ground motion (amplitude and frequency) which can be expected from earthquakes and distant nuclear attacks on land-mobile missile systems. Increased funding will be used to expand seismic ultrasonic techniques to test model materials matching typical earth properties for sites selected for missile systems.

4. (U) FY 1984 Planned Program: The field tests and data analysis on the MITES technique will continue. The technique and system for processing data from the new altimetry satellite being launched during 1984 will be determined. The study to reassess the potential of aerial gravity mapping using improved navigational capabilities and tracking techniques will be completed. The geophysical and geological parameters required for the prediction of the ground motion in the basin-range structures for MX sites will be finalized in computer models. The joint-agency program to test and compare various types of instruments measuring strain, stress, and tilt will be completed. Finite element and seismic ray-tracing computer codes will be finalized and ready for use to predict seismic wave propagation in realistic geological structures.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

Project: #2309
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Terrestrial Sciences
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	2,259	2,417	2,647	2,870	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

2,080	2,430	2,700		Continuing	Not Applicable

Project: #2310
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Atmospheric Sciences
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The design and operation of Air Force systems are affected by atmospheric properties such as density, optical transmission, winds, temperature, precipitation, and infrared emissions. The research program in atmospheric sciences involves the study of the earth's environment from the surface to orbital altitudes. Research in the lower atmosphere is concerned primarily with the characteristics of clouds and aerosols (e.g., haze, dust, or smoke) that impact on optical or infrared weapons guidance and delivery systems and on the prediction of weather phenomena at medium scales, i.e., battlefield scale. Research in the structure and dynamics of the upper atmosphere is directed at enhancing the capabilities of communications and surveillance systems.

(U) RELATED ACTIVITIES: Complementary research programs in atmospheric sciences are conducted by the Army, Navy, and other Federal agencies. Coordination within the Department of Defense is accomplished through triservice reviews. Coordination with other agencies is through the Committee on the Atmosphere and Oceans and the Office of the Federal Coordinator for Meteorology. Special topical reviews in FY 1981 included mesoscale meteorology and numerical weather prediction. Comprehensive project-wide reviews are held annually by the Office of the Under Secretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: The basic research in atmospheric sciences is conducted through contracts with industrial, academic, and not-for-profit organizations as well as in-house at the Air Force Geophysics Laboratory, Hanscom AFB, MA. The ten major contractors are: Utah State University, Logan, UT; SRI International, Menlo Park, CA; Physical Sciences Incorporated, Woburn, MA; University of Missouri, Rolla, MO; University of Lowell, Lowell, MA; Massachusetts Institute of Technology, Cambridge, MA; University of Massachusetts, Amherst, MA; Northeastern University, Boston, MA; University of Utah, Salt Lake City, UT; and University of Wisconsin, Madison, WI. There are a total of 40 contractors with 81 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) Several advances were made in understanding the physics and dynamics of small-scale processes in the lower atmosphere and in methods of predicting them. Snow growth is an important modeling parameter in both microphysical and mesoscale dynamics and for precipitation forecasting. Observations of snow, using a new airborne observational procedure, aided the development of a new theory to explain characteristics of snow growth, including size and number concentration parameters, that were not well defined by previous theory. These results provide a basis for future research on processes in the melting layer and will ultimately permit better parameterizations in numerical models. (2) Development of a numerical prediction model to predict small-scale weather phenomena based on input data from a dense network yielded the result that these small-scale phenomena could also be predicted from conventional weather data because of the improved methods of incorporating the data into the numerical grid. (3) Ionospheric measurements by radar and by rocketborne instruments have provided the first observations of detailed structure in the ionosphere during a geomagnetic disturbance which severely affected radio transmissions. A relationship is indicated between such disturbances, which tend to occur near the poles, and the occurrence of a region of depleted electron density in the ionosphere at lower latitudes.

Project: #2310
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Atmospheric Sciences
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

2. (U) FY 1982 Program: Research is addressing the physics and dynamics of the melting layer, where the transition of snow to rain absorbs heat from the air. Observations by airborne instruments and by two Doppler radars are planned in conjunction with theoretical investigations to explain the interacting processes and their effects on weather system development. Ground-based radar is investigating wind structure and variation in the lower atmosphere. Joint observations by three ionospheric research radars are providing a global view of auroral processes and other ionospheric phenomena. A major effort in ionospheric modification is being undertaken in the Brazil Ionospheric Modification Experiment (BIME). The effect of a release of water in the ionosphere is being documented by radar and optical measurements from the ground, by instrumented aircraft, and by rocketborne instruments. An expanded ionospheric modeling effort is being aimed at understanding the role of plasma instabilities, the existence of which was first recognized in FY 1981. These and other projects will increase our understanding of natural processes in the ionosphere and of the extent to which these may be modified, either inadvertently or intentionally.

3. (U) FY 1983 Planned Program: Development of the Space Shuttle will provide new research opportunities to study the modification of the ionosphere by powered vehicles. An ionospheric research radar located at Chatanika, Alaska will be relocated to Sondrestrom, Greenland to permit the first radar observation of the ionosphere from the northern side of the auroral zone and extend an approximate north-south chain of ionospheric research radars. This will permit improved documentation of high-latitude geomagnetic disturbances and the development of electron density fluctuations which are thought to originate there and move to lower latitudes. Prediction of ionspheric variability and structure is critical to assessing the real time performance of such systems as the Over-The-Horizon radar surveillance system. Continuing research with ground-based radars will yield improved understanding of small-scale atmospheric dynamics and also elucidate the dynamics of the 10-100 kilometer altitude region, referred to as the middle atmosphere. This region is the focus of a multi-year international research effort. In lower atmospheric research, efforts in the physics of the melting layer will continue, data obtained during a 1982 planetary boundary layer experiment will be analyzed, and further theoretical cloud physics studies will be performed in anticipation of the completion of a large cloud simulation chamber which has been in development since 1979.

4. (U) FY 1984 Planned Program: The anticipated completion of a cloud simulation chamber will provide new opportunities for research in the formation and evolution of clouds. This major facility will permit precise and repeatable control of all parameters affecting cloud development and thus will permit testing of hypotheses and verification of theoretical models. Participation in a national effort aimed at understanding regional variations in the small-scale structure of large weather systems is planned. Support will be continued and expanded on ground-based radar studies of atmospheric dynamics. Experimental opportunities on the Space Shuttle will be utilized in ionospheric research.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2310
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Atmospheric Sciences
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	8,115	8,888	9,603	10,270	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
	7,830	8,720	10,600		Continuing	Not Applicable

The $997 thousand reduction in the FY 1983 estimate compared with last year's FY 1983 estimate was accomplished by restricting earlier planned growth in investigations of middle atmospheric (10-100 kilometers altitude) dynamics, cloud particle physics, and thermospheric (above 126 kilometers altitude) dynamic influences on weather at lower altitudes.

Project #2311
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Astronomy and Astrophysics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Space environmental conditions produced by radiation and atomic particles can endanger the mission and degrade the performance of military spacecraft, disrupt the detection and tracking of missiles and satellites, distort communications, and interfere with surveillance operations. This research project provides basic knowledge of the space environment for the design and calibration of advanced Air Force systems. The project also supports the Air Weather Service by improving observing and forecasting techniques that support operational military systems. Experimental and theoretical means are used to study: (1) methods to improve space surveillance systems, (2) solar outbursts and their travel to the earth where they affect communications and satellite systems, (3) composition of the space environment in which Air Force systems operate and changes caused by natural and man-made disturbances, and (4) the response of spacecraft systems and operations to the space environment.

(U) RELATED ACTIVITIES: The Navy, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, and National Science Foundation are conducting/sponsoring complementary research. Coordination is accomplished through the Environmental Sciences Coordinating Paper, during reviews by the Under Secretary of Defense for Research and Engineering (held 6-9 July 1981), through formal and informal discussions among government scientists on programs of mutual interest, and through attendance at symposia and scientific meetings. Cooperative programs include Air Force and National Aeronautics and Space Administration particle sensors flown on Air Force satellites and quarterly Space Forecasting Workshops to support Air Weather Service requirements.

(U) WORK PERFORMED BY: In-house research in astronomy and astrophysics is now underway at the Air Force Geophysics Laboratory, Hanscom AFB, MA. The ten major contractors are: Emmanuel College, Boston, MA; Regis College, Weston, MA; Johns Hopkins University, Laurel, MD; University of California, LaJolla, CA; University of Michigan, Ann Arbor, MI; Analytic Information Processing Incorporated, Danville, CA; Rice University, Houston, TX; Boston College, Chestnut Hill, MA; University of Arizona, Tucson, AZ; and Environmental Research Institute of Michigan, Ann Arbor, MI. In total there are 53 contractors with 70 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) Theoretical studies have indicated, and satellite observations have verified, that spacecraft are vulnerable to cosmic rays approaching from beneath the spacecraft. They can affect the performance of onboard surveillance and communication systems. These results will be used to describe the actual high energy radiation in the space environment and will assist in solving problems in the reliability of high technology solid state devices aboard spacecraft. (2) A study of auroral phenomena in the polar regions has been completed which will provide data for specifying and predicting the space environment in which Air Force systems must operate. These studies describe the entrance of particles and energy from the sun into near-earth space and their affects on the polar and high latitude ionosphere. (3) A forecasting study has been completed for solar flares whose radiation and atomic particles propagate to the earth and disrupt the near-earth space environment and the radio propagation properties of the upper atmosphere. The results are superior to the conventional method of solar flare forecasting and the solar parameters most significant in the prediction analysis can be identified.

Project: #2311
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Astronomy and Astrophysics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

2. (U) FY 1982 Program: The analysis of satellite measurements of electrons is continuing in order to study specific events in the polar regions and to produce statistical surveys for the understanding and prediction of radar and radio propagation problems. Data on solar protons is being used to develop models of these disturbances, which can degrade Air Force communications and satellite systems. Data on solar flare precursors from radio, X-ray, and optical measurements are being combined to produce forecasts of solar outbursts which effect Air Force communication systems and the charged particle environment in which Air Force spacecraft orbit. Work is continuing on techniques for imaging space objects from ground based telescopes for the surveillance and tracking of spacecraft.

3. (U) FY 1983 Planned Program: A study will be made of solar proton events and their relation to solar X-rays and gamma rays which flow through interplanetary space, enter the region around the earth and the earth's upper atmosphere, and affect radio transmissions and long-range radar. A comparison will be made of three techniques for imaging solar features to aid in identifying solar disturbances which cause storms in space that disrupt Air Force communication and satellite systems. Understanding gained through both of these efforts will enable better forecasting of periods of temporary interference and of permanent damage to systems and will enable improved system designs to reduce both temporary and permanent loss of capability caused by solar phenomena. Experiments will be designed and hardware fabricated for satellite measurements of the earth's charged particle environment in which Air Force space systems must operate. Thorough understanding of the particle environments existing in various regions of near-earth space will aid the design of space systems which will be more reliable in presently-used orbits, and which can survive in presently unused severe-environment orbits.

4. (U) FY 1984 Planned Program: Methods to improve the observation of faint space objects will be investigated for application to the identification, surveillance and tracking of spacecraft. Relationships will be sought between solar disturbances and those in near earth space which can degrade communications and satellite systems and affect Air Force radio and radar transmissions. The study of satellite data on the space environment and of celestial background radiation will continue in order to reduce, avoid, or forecast adverse interaction effects upon Air Force operations.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2311
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Astronomy and Astrophysics
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	4,976	5,264	5,712	6,128	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	4,710	5,220	6,300		Continuing	Not Applicable

The $588 thousand reduction in the FY 1983 estimate compared with last year's FY 1983 estimate was accomplished by restricting earlier planned growth in magnetospheric, solar, and stellar physics.

Project: #2312
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Biological and Medical Sciences
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides fundamental knowledge in biotechnology required in the development and operation of effective manned weapon systems. Toxic materials such as Air Force unique fuels and propellants as well as electromagnetic radiations are studied to assess their potential hazard and to devise corrective measures. Research in aerospace physiology and biomechanics provides knowledge for improving personnel protection and performance in varied stress environments encountered during flying. Research in neurobiology is intended to investigate alternative architectures to that of the conventional digital computer, with an emphasis on neurobiologically oriented approaches to machine intelligence. Research is conducted in environmental quality to assess, measure, and control Air Force generated pollutants to meet national environmental concerns while maintaining operational flexibility.

(U) RELATED ACTIVITIES: The Air Force Biological and Medical Sciences program is coordinated through several interagency panels and groups which include participation by the Army, Navy, Federal Aviation Administration, National Aeronautics and Space Administration, Defense Advanced Research Projects Agency, Environmental Protection Agency, National Institutes of Health, Food and Drug Administration, and Department of Agriculture. For example, uniqueness and non-relation to other agency work of a new initiative in neurobiology was determined at the September and November 1981 meetings of the Interagency Working Group for Neuroscience. This group is composed of program directors from five institutes of the National Institutes of Health, National Science Foundation, Society for Neuroscience, Veterans Administration, Navy and Air Force.

(U) WORK PERFORMED BY: Research in the biological and medical sciences is now underway in-house at the Air Force School of Aerospace Medicine, Brooks AFB, TX; the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH; and the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH. The ten major contractors are: University of California, Irvine, CA; Ohio State University, Columbus, OH; University of Connecticut, Storrs, CT; University of Kentucky Research Foundation, Lexington, KY; University of Texas, Austin, TX; Texas A&M University, College Station, TX; Monsanto Research Corporation, Dayton, OH; University of Wisconsin, Madison, WI; Harvard Medical School, Boston, MA; and University of Miami, Miami, FL. In total there are 44 contractors with 69 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) Research on the effects of Air Force chemicals on immune response has demonstrated that unsymmetrical dimethyl hydrazine inhibits suppressor cell function. Decreased suppressor cell function could result in a high incidence of autoimmune disease and increased susceptibility to infection. Studies with cellular flourescent probes indicate that hydrazine alters cell surface and mitochondrial membranes. Such alterations may have adverse effects on cell transport, intercellular communication, and cell energy utilization and storage.
(2) A hardy strain of bacteria has been developed using plasmic vector techniques which is capable of degrading solvents used in Air Force paint stripping operations. These organisms can efficiently degrade large quantities of such compounds which, if not degraded, could shutdown air base wastewater treatment plants. (3) Research on the subject of flash blindness has revealed that small flashes that produce a small spot on the retina (0.7 millimeter and 2.3 millimeter) are sufficient to cause flash blindness. It was also determined that light flashes producing a spot size of 0.4 millimeters were as effective at a frequency of 1 Hertz as they were at a frequency of 10 Hertz. These results have important

Project: #2312
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Biological and Medical Sciences
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

implications for target tracking during flashblinding. (4) Research in biomechanics has resulted in the formulation of a model to predict the response of intervertebral discs to any force function. Other work has described and documented vertebral bone fractures from sudden compressive loads similar to those experienced by pilots during impact of ejection forces. These studies will result in better ability to predict aircrew injuries due to forces of impact or acceleration/deceleration, and serve to improve the safety of aircrews operating in advanced weapon systems.

2. (U) FY 1982 Program: A major initiative will study the basic physiological and biochemical responses to chemical warfare agents in order to provide novel means of protection and therapy for personnel. Chemical characterization and degradation of organic phosphorous compounds is also part of the chemical defense thrust. The pharmacokinetics and metabolic pathways of Air Force chemicals are receiving increased study in order to define the ultimate disposition of these compounds in the body. The new initiative in the biological basis for advanced information processing systems is being continued. This research is intended to show that brain cells adapt to their environment through feedback mechanisms and that these mechanisms may be used to design adaptive computer components for use in advanced information/decision systems. Flashblindness research, in its final year, will concentrate on studies of the frequency of flash, the flash duration, and the spot size produced on the retina. Studies in aerospace physiology are concentrating on completion of the heart and vessel model of effects of acceleration, and beginning a more intense effort to examine how feedback mechanisms serve to control the function of heart, lung, the circadian rhythms of the body, and other physiologic parameters that are important in limiting performance of man in the operational aerospace environment. Biomechanics studies are being reduced and focused on definition of those material properties of bones, joints, and ligaments that are not known so that predictive models of impact injury may be refined and validated. An in-house research project is being directed at developing valid, subjective performance scales, as well as physiologic and electrophysiologic performance methods for assessing fatigue and workload during operational activities.

3. (U) FY 1983 Planned Program: The research initiative in defense against chemical agents will be expanded to include new approaches in quantum chemical analysis, new emphasis on the effects of sublethal doses of nerve agents on the visual system and new efforts examining organophosphate induced delayed neurotoxicity. New efforts in toxic hazards research will employ novel genetic approaches to determine actual mechanisms of chemical mutagenesis for Air Force chemicals. Toxicant-cell membrane interaction will also be emphasized. The effects of electromagnetic radiation and the enzymatic process will be investigated as a new area of in-house research emphasis. Research on the environmental fate and biological effects of Air Force chemicals will emphasize studies at the biochemical and population parameter levels. The research thrust in neurobiologically based information processing mechanisms will be expanded to include investigation of positive and negative reinforcement in nerve cell adaptation, and the goal-seeking behavior in higher level organizational units in the nervous system. This work in neurophysiology will be complemented by research to utilize basic nerve cell mechanisms to design an adaptive computer component. Research in aerospace physiology will concentrate on studies to define central nervous system control of the heart, lungs, and circadian pacemakers; and to provide the fundamental methodology to objectively measure stress and/or fatigue. Biomechanics studies will maintain an emphasis on defining failure/fracture mechanisms of bone and supporting biologic components for accurate predictive models for use in advanced aircraft crewsystems design. Research in toxicology, chemical defense, and biomechanics will help the Air Force

Project: #2312 — Title: Biological and Medical Sciences
Program Element: #61102F — Title: Defense Research Sciences
DOD Mission Area: Defense Research, #510 — Budget Activity: Technology Base, #1

meet environmental and safety standards without compromise of operational effectiveness and flexibility. This research will provide the basis for future development of new, less toxic fuels and propellants; biomedical countermeasures against chemical weapons; and development of criteria for restraint systems for aircraft ejection and side-to-side maneuvers. Efforts in physiology will devise approaches to counteract fatigue and performance deterioration of aircrews. Research in neurobiology will provide an alternate approach in the development of intelligent machines for use in image recognition, decision making and robotics. This will complement efforts in mathematics and electronics that are involved in research on intelligent processors.

4. (U) FY 1984 Planned Program: Strong programs in environmental toxicology and defense against chemical warfare agents will continue to be emphasized. A major new research initiative in molecular regulation of responsiveness will begin. The biochemical approaches to be employed in this initiative could realistically result in the ability to alter human response time by a factor of three and could provide significant benefit to the Air Force in terms of enhancement of human performance. This new initiative will be complemented by an increase in ongoing studies to define how the central nervous system, through a variety of feedback loops, controls the function of the heart, lungs, and circadian rhythms. This work is also directed at defining limitations of human performance and the possible discovery of means to enhance performance of the human in the aerospace environment. Continued and increased emphasis will be placed on studies of neurobiologically based intelligent processing components, with adaptive components being evaluated in Air Force laboratories for utilization in advanced weapon systems.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	5,794	8,092	9,067	9,876	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	5,750	8,380	10,100		Continuing	Not Applicable

The $1033 thousand reduction in the FY 1983 estimate compared with last year's FY 1983 estimate was accomplished partially by scaling back the planned growth in the overall program, and partially by reducing the planned rate of outyear growth for the FY 1982 initiative in defense against chemical agents.

Project: #2313
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Human Resources
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides the knowledge required to insure that Air Force personnel are fully prepared to develop, operate, maintain, and manage current and future weapons systems. Specific objectives include: establishment of an improved manpower and personnel system, advanced education and training methods, and definitions of the role of the operator in the design and operation of increasingly complex operator-machine systems. Research is conducted to characterize and predict human capabilities relative to military occupational requirements. Major areas of concentration are: (1) evaluation of basic human abilities, (2) quantitative measures of workload, (3) human operator performance requirements in advanced aerospace systems, (4) studies to advance the use of simulation in flying and technical training, (5) visual processing in simulation training and in system design, and (6) information processing/decision aiding in command and control contexts.

(U) RELATED ACTIVITIES: The Air Force Human Resources program is coordinated through several interagency panels and groups which include participation by the Army, Navy, Federal Aviation Administration, National Aeronautics and Space Administration, and the Defense Advanced Research Projects Agency. Coordination is also achieved through the Technical Coordinating Paper on Human Resources of the Under Secretary of Defense for Research and Engineering. For example, quarterly meetings with the Army Research Institute, the Defense Advanced Research Projects Agency, and the Office of Naval Research resulted in the decision to discontinue an Air Force research program in learning and to strengthen the Navy program.

(U) WORK PERFORMED BY: In-house research in human resources is now underway at the USAF Academy, CO; the Air Force Human Resources Laboratory, Brooks AFB, TX; and the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH. The ten major contractors are: Virginia Polytechnic Institute and State University, Blacksburg, VA; Texas Tech University, Lubbock, TX; University of California, San Diego, CA; Rutgers, The State University of New Jersey, New Brunswick, NJ; Massachusetts Institute of Technology, Cambridge, MA; University of Illinois, Urbana, IL; Northwestern University, Chicago, IL; McDonnell-Douglas Electronics Corporation, St Charles, MO; New York University, New York, NY; and Ohio State University, Columbus, Ohio. In total, there are 45 contractors with 53 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: (1) Significant progress continues to be made in understanding the relationship between fidelity of a flight simulator and its value as a trainer. Research results specify which parameters must be duplicated for combat flight training to be effective as well as clarify those situations where fidelity of detail inhibits training because it interferes with the trainee's ability to perceive and absorb essential relationships. These findings have important implications for effective and economical simulator design. Related research has determined novel ways to use sophisticated simulators for teaching critical combat skills, particularly those skills that are impossible to train in real aircraft in peacetime because of safety considerations. (2) A component of the human brain event related potential has been identified to index workload. (3) Human visual processing research has provided important implications for pilot selection and training procedures, for cockpit and display design, and for model development of electronic visual systems. The development of new, more accurate visual standards has progressed far enough to be transitioned to

exploratory development. Efforts during the past two years have resulted in the development of simple visual and visual-motor tests which have high predictive power for future flying performance.

2. (U) FY 1982 Program: Experiments are continuing to measure and code brain wave and related physiological activity. The automated coupling of such activity to man-machine systems will improve their design and effectiveness. In addition, new magnetoencephalographic techniques are being used to index complex sensory and cognitive information processing capabilities in relation to varying human operator workload demands in high data rate environments. The learning ability of enlistees is being studied to predict their adaptability and trainability in various Air Force occupations. Research is also underway to describe the nature and limitations of neural mechanisms responsible for Air Force relevant types of visual information processing. Related research specifies the constraints imposed on visual information processing by nonsensory factors such as attention, memory, and eye movements. We will complete the basic research efforts involving novel training procedures for complex skills and support its transition to exploratory development.

3. (U) FY 1983 Planned Program: The FY 1983 program will concentrate on developing a unitary workload metric based on new electrophysiological and neuromagnetic indices of human information processing and performance capabilities under increasingly complex display conditions of operational relevance. Major attention will be focused on coding and differentiating neurophysiological bases of brain wave activity for biocybernetically linking man to machine for shared system operation. The vision programs will focus on development of a comprehensive integrated quantitative model of visual information processing. The model is a necessary prerequisite for the optimal design of heads-up displays, control panels, and other operator interactive components of highly sophisticated weapon systems. A major effort in visual interactions will integrate earlier work on neural mechanisms and explore their mutual interactions in complex visual functioning. This thrust relates to combat environments in which the pilot must rapidly interpret dynamic, complex patterns of visual cues.

4. (U) FY 1984 Planned Program: The vision research program will be redirected to concentrate on coupling models of neural processing with computer moderated "visual" sensors. Models of biological image processing will be interrelated with electronic and mathematical basic research. This merger should result in experimental efforts directly confronting the problem of developing robotic visual systems as well as creating new approaches to interactive visual displays. The biocybernetics/workload program is aimed at developing a unitary performance metric. This program will explore the utility of psychophysiology and related measures as well as brain wave activity for evaluating and predicting human operator effectiveness. A neurophysiological test battery will be developed to evaluate operational behavior under varying workload conditions in high data rate environments.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2313
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: Human Resources
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	5,262	6,237	6,494	7,062	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
	5,590	6,450	8,100		Continuing	Not Applicable

The $1,606 thousand decrease in the FY 1983 estimate compared with last year's FY 1983 estimate was accomplished partially by scaling back the planned growth in the overall program, and partially by the conclusion of a multi-year program which explored techniques to attract qualified students to engineering and scientific careers with the Air Force.

Project: #2314
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: University Research Instrumentation
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project has been initiated to manage the additional resources identified by DOD to rebuild basic research facilities and equipment at universities in areas important to the national defense.

(U) RELATED ACTIVITIES: The Army, Navy, and Air Force equally participate in this program. Coordination among the Services will be achieved through meetings and reviews as required by the Under Secretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: This project will be directly administered by the Air Force Office of Scientific Research. This project is planned to start in FY 1983; therefore no list of major contractors is available.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: None.

2. (U) FY 1982 Program: This is a new start planned for FY 1983.

3. (U) FY 1983 Planned Program: An Interagency Working Group on University Research Instrumentation concluded that the deterioration of research facilities at universities in the United States has reached a crisis stage. In order to restore the university research base in areas supporting DOD objectives, the Office of the Secretary of Defense has recommended that each Service increase its research budget by $10 million starting in FY 1983. For comparison, the Air Force research program normally provides $2 to 5 million per year for research equipment. Air Force plans are to utilize the increased monies to fund research equipment purchases associated with grants and contracts to the university community for scientific research directed to the advancement of military aerospace technology. The Air Force Office of Scientific Research will administer this program by a minor modification to current procedures; i.e., by selecting research proposals for funding based upon significance to the Air Force, scientific merit, competence of the investigator, and reasonableness of the proposed cost, but with added criteria relating to the value to the Air Force of the increased research capability resulting from the proposed research equipment purchases. Funds designated for this project will be tracked through standard accounting procedures.

4. (U) FY 1984 Planned Program: Present guidance from the Office of the Secretary of Defense is to continue this project at the funding level of $10 million in FY 1984.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2314
Program Element: #61102F
DOD Mission Area: Defense Research, #510

Title: University Research Instrumentation
Title: Defense Research Sciences
Budget Activity: Technology Base, #1

7. (U) Resources: ($ in Thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	0	0	10,000	10,000	Continuing	Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62101F
DOD Mission Area: Environmental and Life Sciences #522

Title: Geophysics
Budget Activity: Technology Base #1

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	31,259	33,485	37,780	39,195	Continuing	Not Applicable
06GL	Laboratory Operations	17,774	17,633*	18,660	19,010		
4643	Aerospace Radio Propagation	1,729	2,140	2,400	2,400		
6670	Meteorological Development	1,330	1,440	1,610	1,700		
6687	** Middle Atmosphere Effects	664	820	900	900		
6690	Upper Atmosphere Technology	1,420	1,655	1,700	1,700		
7600	*** Terrestrial Geophysics	675	680	800	800		
7601	Magnetospheric Effects on Space Systems	1,092	1,255	1,700	1,900		
7659	Aerospace Probe Technology	594	680	700	600		
7661	**** Spacecraft Environment Technology	1,435	1,865	3,510	3,900		
7670	Optical/IR Properties of the Environment	4,546	5,317	5,800	6,285		

* Excludes 1 Oct 1981 civilian pay raise (4.8%).

** Project title change from Stratospheric Environment.

*** Project title change from Missile Geophysics.

**** Project title change from Spacecraft Charging Technology.

Program Element: #62101F

DOD Mission Area: Environmental and Life Sciences #522

Title: Geophysics

Budget Activity: Technology Base #1

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Geophysical effects have the capacity to modify, limit or nullify completely the performance of Air Force systems and operations. Prime examples are missile guidance, air launch and recovery, space vehicle tracking and satellite surveillance and communications. The technology developed in this element enables Air Force system planners, designers and operational commands to exploit or mitigate the effects of the geophysical environment. This program also provides for the operation and management of the Air Force Geophysics Laboratory, Hanscom AFB MA.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program represents 10.1% real growth over FY 1982. This growth is reflected in the special emphasis that is being given to the new initiatives that help the Air Force use space for military purposes. Early measurements of the space shuttle radiation and contamination environment will be the first step in the generation of specifications for payload design, vehicle cleanliness, and operating modes to enhance the use of Department of Defense payloads on future flights. Shuttle-based spectrally resolved infrared background measurements on a global scale will start to become available to guide surveillance system design. Development of instrumentation to measure the radiation belt environment will begin in order to determine its effect on the microelectronic devices of future military space payloads. There will be a well focused effort on boundary layer meteorology to define the conditions under which disruptive phenomena, such as atmospheric induced anomalous microwave propagation or fog formation over a battle space, can be expected.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	31,100	35,100	42,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #62101F | Title: Geophysics
DOD Mission Area: Environmental and Life Sciences #522 | Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION. The objective of this program is to develop the technology needed to assist Air Force and other Department of Defense system planners, designers and operational decision makers in mitigating and/or exploiting the effects of the geophysical environment on existing, proposed, and future Air Force electronic, space, missile, and aeronautical systems. While new, sophisticated and complex weapon systems generally are far more capable than the systems they replace, there is growing realization that they also are more sensitive to the geophysical environment in which they are deployed. Often in the past, the extent of such sensitivity has not become known until after system development, when failures and anomalous performance occurs in the field. Because of the lack of follow-on 6.3/6.4/6.5 programs in most geophysical technology areas, it falls to this program element to help provide after the fact fixes for problems discovered in the field, as well as provide input for future force readiness needs. Examples of geophysical dependencies of major systems are: increased Intercontinental Ballistic Missile accuracy is limited by incomplete knowledge of variations in gravity along missile trajectories; the use of directed energy weapons demands knowledge of the potentially adverse environmental interactions with high energy beams; the use of precision-guided munitions requires the development of techniques to predict battlefield weather elements not currently observed or predicted; the optimum design of infrared surveillance and space defense systems requires detailed atmosphere and celestial background infrared emission data; improved radio frequency communication and surveillance systems demand global capability to specify and predict fluctuations that occur in the ionsophere; space vehicle orbit and reentry predictions are inaccurate due to uncertain variations in upper atmosphere density; operational satellites are damaged by energetic protons and electrons released in solar storms; and new airframes such as the cruise missile require an improved aircraft icing prediction capability. To meet the increasingly stringent requirements for improved systems, such as greater reliability, higher accuracy and survivability, extended remote coverage and minimum life cycle cost. This program element provides the technology to address the geophysical environment as an integral and interacting part of the systems themselves. The program in geophysics is concentrated in five areas: Space Effects on Air Force Systems, Optical/Infrared Systems Technology, Upper Atmosphere Impact on Air Force Systems, Terrestrial Effects on Air Force Systems, and Weather Effects on Air Force Operations. This program element, in addition to being the primary technology base exploratory development effort in geophysics, provides technical support to other Air Force and Department of Defense agency programs and receives reimbursement for the services provided.

(U) RELATED ACTIVITIES: This program greatly benefits from research performed in Program Element (PE) 61102F, Defense Research Sciences. Major beneficiaries of the technology developed in this program are PE 63410F, Space Systems Environmental Technology; PE 63424F, Missile Surveillance Technology; PE 63428F, Space Surveillance Technology; PE 63438F, Satellite Systems Survivability; PE 63707F, Weather Systems (Advanced Development); and PE 63703F, Continental United States Over-The-Horizon-Backscatter Radar System. Programs in the broad area of geophysics are conducted by the Army and Navy and other non-military federal agencies such as the National Oceanic and Atmospheric Administration and National Aeronautics and Space Administration. When applicable to Air Force requirements, information gathered by others is used in the Air Force program. In addition to such complementary programs, joint or coordinated programs are conducted with other agencies when mutual interests exist. The work within this program element was coordinated (1) at the annual triservice briefings to the Office of the Undersecretary of Defense for Research and Engineering during apportionment

Program Element: #62101F   Title: Geophysics
DOD Mission Area: Environmental and Life Sciences #522   Budget Activity: Technology Base #1

review, (2) through the National Aeronautics and Space Administration/Air Force Space Research and Technology Interdependence Working Group which meets semiannually, (3) with National Oceanic and Atmospheric Administration and other federal agencies engaged in geophysical sciences through committees of the Federal Coordinating Council for Science, Engineering, and Technology and the Federal Coordinator for Meteorological Services and Supporting Research, and (4) through working groups set up by Air Force Geophysics Laboratory such as in satellite meteorology. Examples of joint or coordinated programs are: Joint Doppler Operational Progam, a program with the National Oceanic and Atmospheric Administration to develop techniques for using Doppler radar for reliable severe storm detection; Spacecraft Charging and Spacecraft Environment Interactions, joint programs with the National Aeronautics and Space Administration to determine causes and means of controlling undesired electrical charge buildups on satellies, and to develop environmental specifications for future large space structures; Atmospheric Transmission, a coordinated program with the Army and Navy to develop the capability and the computer codes to predict the obscuring effect of the atmosphere on visual, infrared and millimeter wave precision guided munitions; Intercontinental Ballistic Missile Accuracy, a coordinated program with the Defense Mapping Agency to develop techniques and geophysical instrumentation to improve intercontinental ballistic missile targeting accuracy; and Nuclear Weapons Effects, a program with the Defense Nuclear Agency to model the nuclear-disturbed environment.

(U) WORK PERFORMED BY: Work performed under this line item is conducted and managed by Air Force Geophysics Laboratory, Hanscom AFB MA. Off-base field sites are: Weather Radar Site, Maynard, MA; Weather Test facility, Otis AFB, MA; Goose Bay Ionsopheric Observatory, Goose Bay, Labrador; and Balloon Launch Detachment, Holloman AFB NM. There were approximatey 75 contractors doing work under 125 contracts utilizing FY 1981 62101F funds. Ten of the major contractors were: Utah State University, Logan UT; Boston College, Boston MA; Northeastern University, Boston MA; Emmanuel College, Boston MA; University of California System, CA; Systems and Applied Sciences Corp., Riverside MD; Tri-Con Associates, Cambridge MA; University of Lowell, Lowell, MA; Massachusetts Institute of Technology, Cambridge MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The spacecraft charging technology program has been succesfully concluded with delivery to the Air Force Systems Command Space Division of a comprehensive specification of the geosynchronous space environment, a method for calculating electrical potentials on and near spacecraft and detailed techniques for controlling spacecraft potential. Satellites already benefiting from the Air Force Geophysics Laboratory's spacecraft charging expertise include Defense Support Program, Global Positioning System, Defense Satellite Communications System and Air Force Satellite Communication System. The fifth version of the standard Department of Defense Low Resolution Atmospheric Transmission code has been distributed to users. One important application of this code is its use in developing Tactical Decision Aids which allow operational commanders to determine quickly which type of guided munitions to order uploaded. The rocket probe measurements of the infrared zodiacal light background which supports the Miniature Homing Vehicle and Space Based Surveillance Systems programs was successfully completed. Ionospheric and auroral observations and propagation experiments were conducted by the Air Force Geophysics Laboratory's Airborne Ionospheric Observatory during Electronic Systems Division sponsored system performance tests of the Over-the-Horizon-

Program Element: #62101F Title: Geophysics
DOD Mission Area: Environmental and Life Sciences #522 Budget Activity: Technology Base #1

Backscatter experimental radar system. The resulting ionospheric specification models were crucial for the final go-ahead decision on that system. The initial operational test and evaluation for that operational radar system will be carried out beginning in FY 84. The Air Force Geophysics Laboratory identified and determined the effect of ionospheric F region irregularities on the performance of the Air Force Satellite Communication System in the polar region. The severity and diurnal and seasonal rate of occurrence of conditions affecting communication system fade margins can now be anticipated and planned for by forces operating at high latitudes. The study of seismic hazards was computed for six designated Minuteman wings as a prelude to studies which will encompass all MX designated sites. The very long baseline interferometry technique was confirmed as an accurate way to determine intercontinental distances within a few centimeters, the accuracy required by Defense Mapping Agency to authenticate the scale of the Department of Defense World Geodetic System. The key analysis software for the joint Department of Defense, Department of Commerce, and Department of Transportation Next Generation Weather Radar automated diagnostic technique was developed. Forecasters can now perform three-dimensional storm identification, tracking and heavy rain prediction. A statistical cloud model was developed that provides estimates of cloud presence at any level in the atmosphere given the basic climatological input. These new modeling techniques make possible improved cloud-free line-of-sight estimates and cloud distributions for war gaming and military flight operational planning.

(2) (U) FY 1982 Program: The Air Force Geophysics Laboratory will deliver the following two payload assemblies for Shuttle launch during this period. The first is Cryogenic Infrared Radiance Instrumentation for Shuttle payload, that will measure the atmospheric infrared background radiation and characterize the shuttle infrared contamination environment The second payload has instruments to further define the Shuttle contamination environment, ambient electric fields around the vehicle and the energetic particle flux, as well as ultraviolet atmospheric backgrounds. Computer modeling will get underway to develop techniques to mitigate adverse environmental effects on Air Force spacecraft missions. Efforts in charged particle beam ejection efficiencies from space vehicles, improved survivability and reliability of space systems and recognition of hostile beam threats will begin. The particle ejection systems and environmental sensors for a rocket experiment will be constructed. Preparations will begin for the design of instruments and experiments for a radiation satellite investigation of the earth's radiation environment and its effect on advanced microelectronics. Other major thrusts include: The formulation and testing of techniques to enable operational prediction of weather parameters adversely impacting electro-optical systems performance. These methods will be tested against actual field measurements. A new millimeter wavelength spectrometer will be tested. Millimeter observations are needed in support of weapons and surveillance system developments. A Target Engine Module probe flight will be conducted to obtain moderate thrust post-boost vehicle engine infrared signatures. High latitude measurements of phase and amplitude scintillation data at Thule and Goose Bay will be correlated with expected decreasing solar activity. The use of Global Positioning System transmissions to determine total electron content and phase scintillation will be evaluated. The effects of artificial modification of the ionosphere, i.e., heating with the Arecibo telescope, will be correlated with the occurrence of scintillations. An F-region ionospheric modification experiment, using rocket explosive water

Program Element: #62101F Title: Geophysics
DOD Mission Area: Environmental and Life Sciences #522 Budget Activity: Technology Base #1

releases will take place and will be monitored by measurement of satellite transmissions through the disturbed region. Data from the successful auroral-E program will be published. An electrostatic accelerometer will be prepared for flight as part of the Defense Mapping Agency's navigation package to provide improved satellite navigation, as well as improved data on atmospheric density, winds and vertical motions. The technology for direct measurement of atmospheric optical turbulence will be investigated and the development of thermosondes for the indirect determination of optical turbulence will continue. A prototype two-color refractometer will be completed, which will correct for atmospheric refraction when taking astronomic measurements to determine locations on the surface of the earth. Procurement of a pre-production model of this instrument is scheduled for FY 1983. To support alignment and positioning of Air Force systems, a prototype laser gyroscope will be designed to measure azimuth and latitude with sub-arc second accuracy. Analysis of SEASAT data will result in significant improvements in altitude resolution of oceanic areas. Ground motion measurements will continue at selected sites to determine far- and near-field ground transfer characteristics. From these studies techniques will evolve to reduce false alarm rates in the triservice Base Installation Security System. An electro-optical nephelometer for the tactical airborne determination of atmospheric transmission at visual and infrared wavelengths will be developed. A low cost, fast response humidity sensor will be developed for deployment by dropsonde or remotely piloted vehicle. The feasibility of using visible and infrared radiometric techniques to characterize cloud cover will be determined. Radar reflectivity measurements will be combined with satellite imagery to develop improved cloud ceiling and visibility predictions. Experimental and theoretical studies will begin which will enable identification of the atmospheric conditions controlling microwave propagation.

3. (U) FY 1983 Planned Program: This program continues the emphasis on space activities. In the laboratory, space chamber studies will be started to identify interactions between the space environment and large spacecraft that would act to seriously limit system capabilities. Within the radiation satellite program, instruments will be fabricated. Planning and coordination will begin for participation with National Aeronautics and Space Administration in the Active Magnetospheric Particle Tracer Experiments which are designed deliberately to create instabilities in the magnetosphere leading to substorms. The magnetosphere response will be characterized in part by the Air Force Geophysics Laboratory's magnetometer network. In the particle beam work, a rocket probe experiment will test advanced concepts of beam formation, ejection, detection and control. Continue development and fabrication of the Cryogenic Infrared Radiance Instrumentation for Shuttle 1A, which will obtain the data base for the development of design criteria needed for the advanced surveillance, detection and tracking systems of the post 1985 time period. High altitude rocket experiments such as the Zodiacal Infrared Program, Earth Limb Infrared Atmospheric Structure will be conducted to enhance the data base necessary to define the IR backgrounds, and a rocket version of the Cryogenic Infrared Radiance Instrumentation for Shuttle will be initiated. The Low Resolution and High Resolution Transmission Codes as well as the Fast Atmospheric Signature Code will continue to be expanded and updated to meet future system requirements. Additional efforts in FY 1983 include: Direct measurements at gravity of altitudes up to 50 kilometers will be made for the first time, to test and verify predictions of the vertical dependence of gravity. Completion of SEASAT data analysis will allow implementation of a new common height reference system, resulting in more accurate elevation data. Development of a gravity gradiometer will begin to

Program Element: #62101F Title: Geophysics
DOD Mission Area: Environmental and Life Sciences #522 Budget Activity: Technology Base #1

extend gravity measurements from first order reference points. Construction of the laser gyroscope will be completed and testing of its ability to measure azimuth and latitude with sub-arc second accuracy will begin. The capabilities of the improved Automated Azimuth Measuring System will be exploited to determine the effects of crustal instabilities on Air Force Systems. To advance battlefield weather surveillance systems, expendable infrared visibility meters and a low cost, fast response humidity sensor will undergo field testing. Remote broadband radiometry along with in-situ measurements will be evaluated for feasibility in measuring cloud cover, tops and bases. A prototype supersaturaton sensor will be tested for use on aircraft to study precipitation growth in the atmosphere. Improved temperature inversion algorithms will be developed to compute accurate temperature and water vapor profiles from satellite infrared and microwave radiance data. Laser Doppler techniques will be tested for their effectivneess in detecting wind hazards near airbases. Doppler weather radar techniques will also be developed for detection of severe storm precursors to improve warning time performance of the Next Generation Weather Radar. Radar, satellite, and conventional weather data will be joined to develop models for short-range (0-6 hours) cloud ceiling and visibility prediction. Measurements and theoretical studies of atmospheric conditions affecting microwave propagation will be carried out. A new fog predicton model will be tested with data taken at the Otis Weather Test Facility. Work will begin on techniques to predict dispersion of hazardous gases and vapors following inadvertent propellant releases from Air Force facilities. The reason for the FY 1983 reduction of $5M from last year's summary is a reduction in scope of seven projects by at least 20%. The exceptions are: 06GL - Laboratory Operations, 7661 - Spacecraft Environment Technology, and 7670 - Optical/IR Properties of the Environment.

4. (U) FY 1984 Planned Program: The emphasis on space-related activities in this program element will continue. A worst case, high latitude substorm model will be defined and made available to space system designers. The environmental definition will be accomplished by analysis of simultaneous Defense Meteorological Satellite Program data and the Explorer Satellite particle energy and flux data. The radiation satellite instrumentation will be ready for integration into the satellite and the necessary data reduction programs will be developed. The Active Magnetospheric Particle Tracer Experiments to create disturbances in the magnetosphere will be carried out and the effects analyzed. Data collected from the particle beam rocket probe experiment will be compared with the theory and the results will be applied to the detailed design of space shuttle experiments. As the Cryogenic Infrared Radiance Instrumentation for Shuttle 1A data becomes available, it will provide a seasonal, geographic and temporal data base of the earthlimb and atmosphere for system design criteria. Efforts will continue to keep the transmission code current. The spatial scale and frequency statistics of index of refraction variations and their relation to atmospheric optical turbulence will be modeled for use in designing laser weapons and communication systems. Models of stratospheric ion and aerosol composition will be developed from data obtained from mass spectrometer measurements made as low as 20 kilometers in altitude. Development of a three-dimensional dynamic atmospheric model will be completed. It will allow prediction of worldwide atmospheric structure between 50 and 400 kilometers as a function of varying energy input from the sun. A rocket experiment will measure insolation at extremely short ultraviolet wavelengths during the downside of the solar cycle. The ground-based Light Detection and Ranging Instrumentation will be tested at Kwajalein Missile Range to determine atmospheric density along the reentry corridor of missiles launched from Vandenberg AFB CA. The Horizon Ultraviolet Program instrument will be flown on a satellite through the Space Test Program to assess the potential of ultraviolet as a satellite attitude sensor. The ultraviolet auroral imager will be flown on the Defense Nuclear Agency's beacon satellite as a test of whether ultraviolet imaging can be used as a means to improve significantly the specification of auroral effects on Air Force Communications

Program Element: #62101F
DOD Mission Area: Environmental and Life Sciences #522

Title: Geophysics
Budget Activity: Technology Base #1

Command Control and Intelligence systems. Signals generated by the beacon satellite also will be received in coordinated ground-based and airborne measurements of radio frequency fade and phase changes caused by the ionosphere at high latitudes. Additional data obtained during early Over-The-Horizon-Backscatter operations will be used to improve generic ionospheric specification and prediction codes. Development of a prototype radar-based turbulence sensor will be initiated for potential airbase use in avoiding regions of hazardous turbulence in clouds. The prototype regional observing and forecasting system supported by National Oceanic and Atmospheric Agency will be exercised extensively to conduct intensive mesoscale weather forecasting tests. Forecaster effectiveness will also be evaluated in an automated operational environment.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #06GL Title: Air Force Geophysics Laboratory Operation Program
Element: #62101F Title: Geophysics
DOD Mission Area: Environmental and Life Sciences #522 Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for operation of the Air Force Geophysics Laboratory, Hanscom AFB MA, including pay and related costs of civilian scientists and support personnel, travel, transportation, rents, communications, and utilities costs, procurement of supplies and equipment, and contractor support services. The Air Force Geophysics Laboratory performs research and exploratory development in the geophysical sciences, i.e., geodesy, geokinetics, meteorology, optical physics, ionospheric physics, upper atmosphere physics, and space physics in support of the immediate or potential needs of Air Force operational systems.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element.

(U) WORK PERFORMED BY: The program is managed by the Air Force Geophysics Laboratory, Hanscom AFB MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Plans and accomplishments are discussed in the overall program element which is included in this submission.

1. (U) FY 1981 and Prior Accomplishments: Not applicable.

2. (U) FY 1982 Program: Not applicable.

3. (U) FY 1983 Planned Program: Not applicable.

4. (U) FY 1984 Planned Program: Not applicable.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	17,774	17,633 *	18,660	19,010	Continuing	Not Applicable

* Excludes 1 Oct 1981 civilian pay raise (4.8%).

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982	FY 1983
	16,458	17,921	18,310

Project #7670 Title: Optical/IR Properties of the Environments
Program Element: # 62101F Title: Geophysics
DOD Mission Area: Environmental and Life Sciences #522 Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to measure, model and predict the optical and infrared properties of the earth, the atmosphere, and space environment; and to determine their effects on Air Force and Department of Defense surveillance, reconnaissance, and weapons guidance systems. The optical and infrared properties of particular concern are background emissions of the earth, the atmosphere, the earthlimb, the celestial sky and near-earth space, and the transmissivity of the atmosphere. As sensor technology continues to improve, the natural optical/infrared environment becomes a major factor in limiting the availability, sensitivity, range, and coverage capability of future electro optical/infrared systems including space-based systems. Knowledge of both the spectral structure and the spatial/temporal structure of backgrounds and targets is required in order that both the spectral pass band of sensor optics and the electrical pass band in subsequent data processing be optimized.

(U) RELATED ACTIVITIES: This project greatly benefits from research performed in Program Element (PE) 61102F, Defense Research Sciences. Direct beneficiaries of the technology developed in this project include PE 63424F, Missile Surveillance Technology; PE 63428, Space Surveillance Technology; PE 63402, Space Test Program; PE 63707, Weather Systems (Advanced Development); PE 63435, Intergrated Operational Nuclear Detection System; and PE 12431, Defense Support Program. The Defense Advanced Research Projects Agency is a principal sponsoring agency for many efforts in ground-aircraft- and satellite-based infrared and electro-optical surveillance, target signature and background measurements being conducted by Air Force, Navy and Army Laboratories. As such, it performs an effective coordinating function jointly with Air Force development organizations through such activities as the annually conducted Space Surveillance Symposia. Programs of a related or collaborative nature include the Defense Advanced Research Projects Agency's TEAL RUBY, and HALO. Navy programs include studies of optical transmission in a marine environment and aircraft target signature measurements conducted by Naval Research Laboratory and Naval Weapons Center, respectively. Army's Night Vision Electro-Optical Laboratory and Atmospheric Sciences Laboratory programs concentrate on battlefield conditions. Navy and Army efforts are coordinated with Air Force Geophysics Laboratory as part of the Department of Defense atmospheric transmission plan. Within the Air Force, efforts which relate are Armament Division Test Center's PAVE PRISM, Air Force Weapons Laboratory's Advanced Radiation Technology Program and the Avionics Laboratory's Systems Characterization Facility and tail-warning receiver development. Outside the Department of Defense, National Aeronautics and Space Administration activities include celestial infrared emission measurements, atmosphere pollution measurements, and satellite remote sensing of meteorological variables. Programs in this project are coordinated through several groups including the Technical Coordination Program, Subgroup J Department of Defense; Atmospheric Transmission Modeling Annual Review Conference, Department of Defense; HALO Study Group, Defense Advanced Research Projects Agency; Infrared information Symposia, Department of Defense; Strategic Surveillance Satellite Meetings, Defense Advanced Research Projects Agency; Interagency Propulsion Committee Meetings, Department of Defense/National Aeronautics and Space Administration; North Atlantic Treaty Organization RSG-8 of Panel IV (AC 243) and selected Department of Defense study panels. In addition, there is a coordinated and cooperative program in atmospheric nuclear weapons effects with the Defense Nuclear Agency.

Project #7670 Title: Optical/IR Properties of the Environments
Program Element: # 62101F Title: Geophysics
DOD Mission Area: Environmental and Life Sciences #522 Budget Activity: Technology Base #1

(U) WORK PERFORMED BY: Air Force management of this project is provided by the Air Force Geophysics Laboratory, Hanscom AFB, MA. There were 11 contractors performing work under 17 contracts utilizing FY 1981 PE 62101F funds. The contractors were Utah State University, Logan, UT; University of California, San Diego, CA; Boston College, Boston, MA; Sonicraft, Chicago, IL; University of Lowell, Lowell, MA; Colorado State University, Fort Collins, CO; University of Wyoming, Laramie, WY; Aeronutronic Ford, Newport Beach, CA; Photometrics, Burlington, MA; Aerodyne, Bedford, MA; Visidyne, Burlington, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1981 and Prior Accomplishments: Project 7670 is described separately in a descriptive summary for the first time. As part of the Department of Defense atmospheric transmission program, the world standard data base of atmospheric gas spectroscopic quantities was created by this project. This data base is maintained, updated, and distributed to all military and civilian groups requiring it. In addition to the data base on uniformly mixed atmospheric gases and selected trace gases, the following computer codes have been developed. 1) The Low Resolution Transmission Code has advanced to the fifth edition. Calculations, both of atmospheric transmission and of radiance, are now readily made for a selection of model atmospheres and arbitrary slant paths through the atmosphere. Tactical theater requirements will continue to be a dominating factor in determining the future direction of this research. This fifth edition also includes verified aerosol scattering models. 2) The High Resolution Transmission Code utilizes the data base at infinite resolution and can be degraded in resolution to match any desired instrument function. 3) The Fast Atmospheric Signature Code implementation of the High Resolution Transmission Code now provides accelerated line-by-line calculations extending into the microwave spectral region from the visible. This project has a long history of innovative instrument development and of measurements of atmospheric infrared background radiation, both for the natural atmosphere and during nuclear weapons tests. Essentially the entire data base of infrared background measurements upon which atmospheric, celestial and zodiacal background radiation models are based have been carried out, either within this project, or in promotion of the advantages of Michelson interferometry as an observing tool, and the realization in practical instruments of the gains in detectivity which arise from the reduced thermal background radiance levels in sensors held at cryogenic temperatures. The best of these techniques are combined in the Cryogenic Infrared Radiance Instrumentation for Shuttle sensors; the first of these is scheduled for an early space shuttle flight to provide a mid-latitude baseline of infrared spectral structure of the earthlimb radiance as seen from space. In anticipation of the needs of the Miniature Homing Vehicle and Space Based Surveillance System programs at Space Division, technology developed in this project has been successfully used in rocket probe measurements of the infrared zodiacal light background. The resulting model of the ultimate background limiting the performance of cold body tracking and surveillance systems will serve the needs of space defense system planners for the foreseeable future. EXCEDE, the highest power electron accelerator space experiment ever attempted, was successfully conducted from a rocket platform. The benchmark data obtained will be a cornerstone of the Defense Nuclear Agency nuclear scenario infrared background codes used for Department of Defense systems performance analyses. Using a research version of those codes, this project provided data and models of atmospheric nuclear burst backgrounds as input

Project #7670 Title: Optical/IR Properties of the Environments
Program Element: # 62101F Title: Geophysics
DOD Mission Area: Environmental and Life Sciences #522 Budget Activity: Technology Base #1

to programs at Space Division, simulating surveillance system response under stressed conditions. This project instruments and operates a flying infrared laboratory in a KC-135 aircraft. Atmospheric nuclear tests have been documented in the infrared from this platform, as well as airglow and aurora. Measurements made from this aircraft represent the greatest part of the data base of specral and spatial infrared signatures of in flight aircraft from all aspects and against varied backgrounds. This project develops the infrared sensors and carries out the measurements which are reimbursed by Missile Surveillance Technology program. These include the Balloon Altitude Mosaic Measurements which, to date, have provided the existing data base of background measurements against which to test the staring mosaic sensor concept, and the Multispectral Measurements Program which is producing the data base of spectral and spatial signatures of small post-boost vehicle rocket engines.

2. (U) FY 1982 Program: The first Cryogenic Infrared Radiance Instrumentation for Shuttle payload will be delivered for integration to the space shuttle pallet. It will determine the infrared spectrum of atmospheric background radiation in mid-latitude regions as seen from space. It also will measure and characterize the contamination environment that military infrared sensors will encounter on subsequent shuttle flights. Two Long-Wave Infrared radiometric probe measurements of the celestial background are scheduled. An Earth Limb Infrared Atmospheric Structure probe flight will determine the spatial structure of short wave infrared atmospheric background radiance in the auroral region. A cryogenic field-widened interferometer probe flight will obtain short wave length infrared spectra of the atmosphere during an auroral event. Other major thrusts include: The formulation and testing of techniques to enable operational prediction of weather parameters adversely impacting electro-optical systems performance. The Transportable Optical Atmospheric Data System will begin deployment to various locations to study specific adverse weather conditions, beginning with participation in the SNOW 1A measurement program in Vermont. This technology forms part of the data base upon which the Tactical Decision Aid development depends. A model compatible with the Low Resolution Transmission Code will be completed which treats radiation transport by multiple scattering in atmospheres containing both molecular and aerosol constituents. Development of an application oriented atmospheric transmittance and radiance model, based on the Fast Atmospheric Signature Code algorithm will be completed. It includes spherical geometry for any slant path and a choice of model atmospheres and aerosol distribution models. Ground tests of a new millimeter wavelength spectrometer will be conducted. This instrument is planned for installation in the KC-135 flying infrared laboratory. Observation of earth and atmospheric radiation background and target signatures in the millimeter region are required for weapons and surveillance systems development. The third flight in the Target Engine Module series will be conducted under the Multispectral Measurements Program. In-situ measurements of the spectral, spatial and temporal signatures of a moderate thrust post-boost vehicle engine will be obtained. In the Balloon Altitude Mosaic Measurement Program, balloon altitude spectral and radiometric short wavelength infrared measurements under low solar scattering angle conditions and against mountains and high lakes are planned.

Project #7670 Title: Optical/IR Properties of the Environments
Program Element: # 62101F Title: Geophysics
DOD Mission Area: Environmental and Life Sciences #522 Budget Activity: Technology Base #1

3. FY 1983 Planned Program: Instrumentation development and fabrication for the Cryogenic Infrared Radiance Instrumentation for Shuttle 1A flight to obtain the detailed spectral and spatial infrared structure of the earthlimb and aurora from space shuttle platforms will continue. This data base will provide the critical design criteria for advanced surveillance, detection and tracking systems. High altitude rocket probes will be flown to measure, radiometically, the long wavelength infrared earthlimb and celestial background. The results from the Zodiacal Infrared Program will be made available to system planners as a model of the diffuse zodiacal infrared radiance in the galactic plan. Data from the Earthlimb Infrared Atmospheric Structrure rocket probe measurements of auroral and airglow emissions will be analyzed and modeled to provide a first order capability to predict short wavelength infrared background clutter. Construction of a rocket probe version of the Cryogenic Infrared Radiance Instrumentation for Shuttle sensor will be initiated. This Spectral/Spatial Infrared Radiometer Interferometer, Telescoped will be launched into an aurora in FY 1984. In other efforts, measurements relating to optical quantities and meteorological variables in Germany will continue in cooperation with the Army's Atmospheric Sciences Laboratory. They will characterize the vertical structure of hazes and fogs under low visibility conditions. Locally optical/infrared transmission will be studied under well documented conditions of snow, rain, fog, and heavy haze. The Low Resolution Transmission Code will receive a subroutine for calculating the background radiation field from scattered solar or lunar radiation. The Fast Code implementation of the High Resolution Transmission Code will be applied to engine plume signatures. Airborne measurements of terrain and cloud backgrounds in the submillimeter spectral region will begin. Airborne infrared spectral measurements of targets will be extended to long range with the use of telescopic instrumentation. The first of the High Performance Target Engine Measurements in the Multispectral Measurements Program will take place.

4. (U) FY 1984 Planned Program: Data from the Cryogenic Infared Radiance Instrumentation for Shuttle will provide the first links to a synoptic model of auroral and airglow spectral and spatial structure. The EXCEDE rocket probe flight will measure the spatial profile of ultraviolet, visible and infrared emissions induced in the upper atmosphere by a 100 kilowatt electron accelerator. This dosing of the atmosphere and associated measurements provide a calibration of effects produced by atmospheric nuclear detonations. These and other data will continue to find application in weapons effects codes used in surveillance system simulation programs. The data from local and Europe-based correlated measurements of optical/infrared transmissions and meteorological variables will be used to establish a statistical data base relative to the vertical structure of hazes and fogs. The Low Resolution Transmission Code will incorporate new band model parameters for uniformly mixed and trace gases, and the procedure will be applied to non-equilibrium atmospheric radiance problems. The second High Performance Target Engine Model flight will take place, extending the data base of measurements of atmospheric interaction radiation associated with post-boost vehicle rocket engine exhausts. The NKC-135 infrared laboratory aircraft will continue to be used for selected target and background measurements and will take measurements in support of the TEAL RUBY experiment.

Project #7670
Program Element: # 62101F
DOD Mission Area: Environmental and Life Sciences #522

Title: Optical/IR Properties of the Environments
Title: Geophysics
Budget Activity: Technology Base #1

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
4,546	5,317	5,800	6,285	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Budget Data:

4,700	4,900	6,100

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62102F
DOD Mission Area: Engineering Technology (ED), #523

Title: Materials
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	38,285	42,156	46,174	49,866	Continuing	Not applicable
06ML	Laboratory Operations	14,408	14,734*	15,632	15,874		
2417	Thermal Protection Materials	2,877	3,385	3,993	4,280		
2418	Metallic Structural Materials	4,900	5,480	5,627	6,630		
2419	Nonmetallic Structural Materials	4,300	4,807	4,970	5,950		
2420	Aerospace Propulsion Materials	3,000	3,462	4,219	4,350		
2421	Fluid, Lubricants and Fluid Containment Materials	2,800	3,365	3,795	3,903		
2422	Protective Coatings and Materials	2,700	3,173	3,695	4,098		
2423	Electromagnetic Windows and Electronic Materials	3,300	3,750	4,243	4,781		

*Excludes 1 Oct 81 Civilian Pay Raise.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element conducts the entire Air Force exploratory development program in materials. It develops new and improved materials which are required to meet the increased performance, reliability and survivability of current and future aerospace systems. The needs of Air Force aircraft, spacecraft and missiles are specialized and unique and cannot be satisfied by research and development directed solely at civilian needs. The program also provides management and operational support for the Materials Laboratory, Wright-Patterson Air Force Base, OH, as the Air Force agency concerned with all aspects of materials research, development and manufacturing technology.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program represents a 4.5 percent real growth over FY 1982. The FY 1983 funds will be used to support materials technology programs which address current and projected deficiencies in materials technology which impact the Air Force mission. The projects conducted under this program element, while addressing all Air Force materials needs, will highlight metal-matrix composites and rapid solidification powder metal lurgy; erosion resistant carbon/carbon composites for strategic reentry vehicles and higher performance, more fuel efficient gas turbine engines; the reduction of critical/strategic metals content in current and future systems; and methods of protecting both personnel and systems from the effects of high energy laser radiation. Emphasis will continue to be on those technologies which are currently deficient to meet Air Force systems needs; and will balance materials performance, durability, reliability and cost.

Program Element: #62102F
DOD Mission Area: Engineering Technology (ED), #523

Title: Materials
Budget Activity: Technology Base, #1

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	37,600	44,000	53,800		Continuing	Not applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Military Construction			20,600	16,768		

The $7.626 million reduction in FY 1983 will delete or delay programs to: develop erosion resistant carbon/carbon composites for nosetips and heatshields of maneuvering reentry vehicles; new antenna and radome materials; strategic penetration aids; erosion resistant infrared window material for use at Mach 2+; carbon/carbon composites for aircraft and cruise missile engines; and the adhesive bonding, thick laminate processing and nondestructive testing necessary for successful application of composite materials to large aircraft such as air-launched strategic missile carriers and advanced technology bombers.

Program Element: #62102F
DOD Mission Area: Engineering Technology (ED), #523

Title: Materials
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop new and improved aerospace materials; provide reliable materials property design data for new materials; to better utilize existing materials; and to maintain the Materials Laboratory as the center of Air Force expertise on operational materials problems, materials processing and materials failure analysis. All areas of materials development and processing are addressed with special emphasis on thermal protection materials for strategic reentry vehicles and missile propulsion; metal and nonmetallic structural materials; all materials used to make turbine engines; oils, hydraulic fluids, seals and sealants; coatings for protection from environmental and laser damage; nondestructive inspection and corrosion prevention techniques; and electronic/electromagnetic materials for infrared detectors, space surveillance systems, optical components for high energy laser systems, and semiconductor devices. This program element is not only the primary technology base materials exploratory development effort in the Air Force, but also it provides technical support to other Air Force and Department of Defense agencies and is partially reimbursed by those agencies for the services rendered. The Materials Laboratory is fully reimbursed for basic research efforts by PE 61102F, Defense Research Sciences. The project break reflects the best estimate considering these anticipated reimbursements, but may require adjustment to the degree that reimbursements are actually earned.

(U) RELATED ACTIVITIES: All three military services, Defense Advanced Research Projects Agency, the National Aeronautics and Space Administration, the Department of Energy, and industry, through the Independent Research and Development program, carry out research and development programs in materials technology specifically related to their requirements. Coordination is provided by the exchange of planning documents, joint agency technical planning committees, and activities such as the Department of Defense Metal-Matrix Composite Steering Committee, the Materials Development Coordination Committee for Advanced Strategic Reentry Vehicles, the Department of Defense Materials and Structures Technology Conference, and the Tri-Service Laser Hardened Materials and Structures Group. These joint planning meetings and materials coordination activities highlight the specialized materials requirements of each organization and are determining factors in the formulation of complementary, nonredundant materials research and development programs. Interface with industry and the civilian community is reinforced by active participation in academic and professional organizations and societies. This program element receives specific input from PE 61102F, Defense Research Sciences, and provides technical output to other program elements such as PE 63211F, Aerospace Structures and Materials, and PE 78011F, Manufacturing Technology.

(U) WORK PERFORMED BY: The Materials Laboratory, Wright-Patterson Air Force Base, OH, is the organization responsible for the management of this program. Ten major contractors in FY 1981 were: Avco Corporation, Greenwich, CT; General Electric, Schenectady, NY; General Dynamics, St. Louis, MO; Honeywell, Minneapolis, MN; Hughes, Culver City, CA; McDonnell Douglas Corporation, St. Louis, MO; Rockwell International, El Segundo, CA; Systems Research Laboratories, Beavercreek, OH; United Technologies, Sunnyvale, CA; and University of Dayton Research Institute, Dayton, OH. In addition to the above, there are 49 other industrial contractors, 24 non-profit contractors and a total of 148 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Developed the carbon/carbon composites used in the Minuteman III and MX strategic reentry vehicles nosetips to achieve required system target accuracies and the carbon/carbon for the MX rocket

Program Element: #62102F
DOD Mission Area: Engineering Technology (ED), #523

Title: Materials
Budget Activity: Technology Base, #1

motor nozzles. A nonflammable hydraulic fluid and associated system seals were developed for use in new military aircraft to reduce the Air Force's $12 million per year average loss to hydraulic related fires which, between 1965 and 1980, effected 156 aircraft, killed 5, and injured 13 personnel. The increased performance and reliability of current jet engines was made possible through improved materials for discs, blades, vanes, fans and compressors, and gas path seals developed under this program element. Initiated programs to conduct Department of Defense and Congressionally directed emphasis of erosion resistant carbon/carbon and metal-matrix composite technologies. Erosion resistant radome coatings were developed which give a tenfold decrease in maintenance requirements and are in use on most Air Force and commercial aircraft. Infrared and laser window materials were developed which made possible current weapon systems like PAVE TACK and high energy laser devices. New coatings (paint) for visual and infrared camouflage were successfully formulated and are now in use on A-10, F-15, F-16 and other operational aircraft. Developed the technologies which made possible the advanced composite materials such as boron and graphite reinforced epoxies, and developed the advanced superplastic forming titanium metalworking.

2. (U) FY 1982 Program: The FY 1982 program will continue the support of erosion resistant carbon/carbon and metal-matrix composite technologies. Increased emphasis will be placed on rapid solidification rate powder metal technology. The applicability of ceramics and carbon/carbon composites to gas turbine engines will be determined and the development of necessary oxidation resistant coatings for carbon/carbon will begin. Emphasis will be placed on programs which reduce the dependence on critical/strategic metals and natural petroleum products both by new materials development and improved manufacturing processes. Laser hardened materials technology programs will be continued with increased emphasis on tactical applications. Also highlighted will be synthetic hydrocarbon chemistry; contamination control in space; aircraft paints, coatings, and stripping techniques compatible with environmental restrictions, as well as a broadly based program in nondestructive inspection technology designed to increase detection capability while decreasing the requirement for human judgements.

3. (U) FY 1983 Planned Program: The FY 1983 planned program will continue active support of rapid solidification rate powder metallurgy and erosion resistant carbon/carbon composite technologies. Laser hardened materials technology will emphasize means to protect satellite and tactical electro-optical systems from pulsed laser damage. Programs will be initiated to develop, jointly with the Defense Advanced Research Projects Agency, those materials and processing technologies necessary to allow industrial base advanced manufacturing methods using robots with artificial intelligence and real-time production process control. Materials development will be initiated on new types of strategic reentry vehicle antenna windows. Programs will be initiated in nondestructive inspection of large composite structures which will be required for next generation fighter, bomber and cargo aircraft. Other FY 1982 programs will be continued with emphasis determined by the results in FY 1981 and FY 1982.

4. (U) FY 1984 Planned Program: Developments discussed in the FY 1983 planned program will continue, with emphasis dependent upon the results obtained in FY 1982 and FY 1983. Delayed programs in high temperature adhesives and sealants will be initiated to address operational problems; as will new construction techniques in strategic reentry vehicle nosetip and heatshields.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #06ML
Program Element: #62102F
DOD Mission Area: Engineering Technology (ED), #523

Title: Materials Laboratory Operations
Title: Materials
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project supports activities required to operate the Materials Laboratory and includes the pay and related costs of civilian scientists, engineers and supporting personnel, travel, transportation, rents, communications, utilities, procurement of supplies and equipment, and contractor support services. The Materials Laboratory is responsible for the Air Force exploratory and advanced development programs in the area of materials technology, a portion of the basic research program in materials, and for the Air Force Manufacturing Technology program. The laboratory provides technical suport to current and future system program offices, the Air Force Logistics Command, and the operational commands. It also maintains a quick reaction capability to respond to operational problems involving technology, materials application, and failure analysis.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element as well as all other projects and programs managed by the Materials Laboratory.

(U) WORK PERFORMED BY: The Materials Laboratory, Wright-Patterson Air Force Base, OH, is the organization responsible for management of the projects included under the Materials program.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable.

2. (U) FY 1982 Program: Not applicable.

3. (U) FY 1983 Planned Program: Not applicable.

4. (U) FY 1984 Planned Program: Not applicable.

5. (U) Program to Completion: Not applicable.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E (3600)	14,408	14,734	15,632	15,874	Continuing	Not applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E (3600)	12,702	13,976	14,276		Continuing	Not applicable

Increase in FY 1983 budget due to impact of 1 Oct 81 civilian pay raise.

Project: #2418
Program Element: #62102F
DOD Mission Area: Engineering Technology (ED), #523

Title: Metalilc Structural Materials
Title: Materials
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to develop and apply metallic structural materials and process technology to reduce acquisition and maintenance costs, to improve structural life and reliability and improve performance of Air Force aerospace structural systems. This encompasses the development of metallic materials and processes to give alloys having high toughness/density ratios, better processing and joining techniques, higher use temperatures, and more predictable properties. Nondestructive measurement, evaluation, and inspection techniques are developed to allow greater quality assurance and service life inspection. Systems support in the forms of failure analysis, repair techniques, and inspection is provided to the operational and logistic commands.

(U) RELATED ACTIVITIES: In the area of metallic materials, all Department of Defense services, the Defense Advanced Research Projects Agency, the National Aeronautics and Space Administration and many industrial and academic organizations conduct programs related to the Air Force effort. Coordination is provided by joint agency technical committees, exchange of planning documents, technical symposia and the Department of Defense Materials and Structures Technology Conference. These activities assure that the unique and specialized materials requirements of each service are being met and where development goals are similar, the efforts are complementary.

(U) WORK PERFORMED BY: The Materials Laboratory, Wright-Patterson Air Force Base, OH, is the organization responsible for the management of this program. The ten major contractors for FY 1981 were: Rockwell International, El Segundo, CA; Systems Research Laboratories, Dayton, OH; University of Dayton Research Institute, Dayton, OH; University of Cincinnati, Cincinnati, OH; Universal Technology Corporation, Dayton, OH; Westinghouse Corporation, Pittsburgh, PA; Battelle Memorial Institute, Columbus, OH; Miami University, Oxford, OH; United Technologies, Sunnyvale, CA; and Avco Corporation, Greenwich, CT. In addition to the above, there are 9 other industrial contractors, 5 non-profit contractors and a total of 33 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Superplastic forming and diffusion bonding technologies were developed to reduce the cost of titanium processing to a level which made it usable in aircraft systems. The enabling technology for metal-matrix composites was developed jointly with the Defense Advanced Research Projects Agency. Nondestructive inspection technologies were developed which now serve as the basis for Air Force manufacturing, field maintenance, and depot inspection procedures. Precision metal casting techniques were developed which, when applied to Air Force cruise missile manufacture, have a projected production cost savings of over $150 million.

2. (U) FY 1982 Program: The FY 1982 program will emphasize metal-matrix technology. Improved system performance and life expectancy will be sought by developing new powder metal alloys of aluminum, titanium and nickle based superalloys by rapid solidification rate powder forming techniques. Additional emphasis will be given to reducing the need for high cost, short supply metals such as cobalt and chromium by developing new alloys with little or no such critical strategic materials, and improved metal working techniques to reduce waste. Improved metal working thrusts in nondestructive evaluation technologies will include: improved ultrasonic and eddy current inspection methods, new liquid penetrant inspection processes for use by field inspection facilities, improved ultrasonic signal processing techniques

Project: #2418
Program Element: #62102F
DOD Mission Area: Engineering Technology (ED), #523

Title: Metallic Structural Materials
Title: Materials
Budget Activity: Technology Base, #1

which will increase the reliability of inspection of complex shapes, and the development of inspection techniques for carbon/carbon composite structures.

3. (U) FY 1983 Planned Program: The FY 1983 program will build on the accomplishments of the FY 1982 program and will continue to emphasize metal-matrix composites. Support to the Department of Defense/Tri-Service program in Rapid Solidification Powder Metal Technology will be continued with a goal of reducing the cost of thick titanium airframe structures by 40-60 percent through improved titanium powder metallurgy. The development of nondestructive inspection techniques will be initiated for crack detection in the inner wings with a goal of decreasing current costs of over $150 per fastener to $5 per fastener. Programs to improve technology for field/depot maintenance procedures will continue.

4. (U) FY 1984 Planned Program: Developments discussed in the FY 1983 planned program will continue with changes in emphasis dependent upon results obtained during FY 1982 and FY 1983. Potential areas of emphasis are improved forging technology, rapidly quenched titanium powder, low density aluminum, and highly automated nondestructive inspection techniques.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982	FY 1983	FY 1984	Additional	Total Estimated
RDT&E (3600)	4,900	5,480	5,627	6,630	Continuing	Not applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E (3600)	5,100	5,800	7,900		Continuing	Not applicable

The $2.273 million reduction in FY 1983 will decrease planned support to the Department of Defense Rapid Solidification Powder Metal Technology program and delay programs to reduce manufacturing costs by improving metal removal processes and inspection techniques.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62201F
DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	55,686	55,155	61,219	65,184	Continuing	Not applicable
06FF	Laboratory Operations	28,497	30,133*	31,809	32,358		
2401	Structures and Dynamics	6,369	5,799	7,353	7,915		
2402	Vehicle Equipment	5,179	4,756	5,495	6,228		
2403	Flight Control	6,953	6,342	7,290	8,274		
2404	Aeromechanics	8,688	8,125	9,272	10,409		

*Excludes 1 Oct 81 Civilian Pay Raise (4.8%)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This exploratory development program provides the flight vehicle technologies required for the design and development of future aerospace vehicles (aircraft, missiles, and spacecraft) and for the improvement of current vehicles. It encompasses the technical areas of structures, aerodynamics, aerothermodynamics, flight performance analysis, vehicle dynamics, flight control, crew station design, crew escape and recovery, environmental control, mechanical subsystems, survivability/vulnerability, and technology integration. The program also provides for the operational support and management of the Flight Dynamics Laboratory, Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program represents 7.2 percent real growth over FY 1982. This growth will be used to develop flight vehicle technologies which enhance the capabilities of future aerospace vehicles and improve the capabilities of existing vehicles. New design techniques and criteria are to be developed for structures built of composite materials which consider fatigue and fracture toughness, as well as the usual stress loading, deflection and geometry. Test procedures will be developed for the reliability evaluation of avionics equipment through the use of accelerated environmental testing which will produce results in agreement with actual field experience. Technologies will be explored which offer solutions to the problem of sustaining combat operations off of damaged runways and alternate surfaces. Integrated control concepts will be developed which support alternate penetration tactics which will enhance the survivability of fighter/attack and bomber aircraft. Aerodynamic prediction techniques will be developed and expanded to address new flight vehicle problems such as higher speeds, reentry vehicles, weapons bay and weapons release problems, and new configurations designed for low observability.

Program Element: #62201F
DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT	52,300	56,100	73,000		Continuing	Not applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate
Military Construction	9,700	0	0	2,663

Program Element: #62201F
DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element supports work in many scientific disciplines and technical domains. The Structures and Dynamics area includes the use of metallic, nonmetallic, and composite materials, processes, and techniques for fastening, joining, and bonding; load analysis and testing; fracture and fatigue investigations; aeroelasticity, flutter, vibration, and acoustics. Vehicle Equipment includes landing gear components; pivots and bearings; environmental control systems; survivability/vulnerability; and crew accommodation, protection and escape. The Flight Control area involves flight control systems, control augmentation, all-weather operation, cockpit configuration and displays, and flight and ground simulation. Aeromechanics deals with aerodynamics, agility, aerodynamic heating, aircraft and propulsion system integration, wind tunnel testing, and configuration research. The ultimate objective of all efforts in these areas is to provide the advanced flight vehicle technology which forms the base for developing effective, efficient, and economical weapon systems to perform the Air Force mission. This program element, in addition to being the primary technical base exploratory development effort in flight vehicle technology, provides technical support to other Air Force and DOD agencies and receives partial reimbursement for the services provided.

(U) RELATED ACTIVITIES: This program receives technology inputs from In-House Laboratory Independent Research (PE 61101F), Defense Research Sciences (PE 61102F) and from Materials (PE 62102F), as well as from the products of other national and international research and development activities. In turn, the technology product of this program is applied to Flight Vehicle Technology (PE 63205F), Aerospace Structures & Materials (PE 63211F), Aircraft Nonnuclear Survivability (PE 63246F), Advanced Fighter Technology Integration (PE 63245F), and other advanced development, engineering development, and system development programs. Joint and cooperative projects are conducted with other laboratories, other Air Force organizations, the Army, the Navy, National Aeronautics and Space Administration, and foreign countries. Coordination and avoidance of duplication of effort is accomplished with these agencies, academic institutions, and industry through exchange of information, coordinating and advisory groups, technical reviews and seminars, professional societies and meetings, and in the preparation of formal Department of Defense documents such as Technical Area Descriptions and Technical Reports.

(U) WORK PERFORMED BY: Work under this program is performed in-house by the Flight Dynamics Laboratory and under contracts managed by that laboratory. The laboratory makes use of in-house facilities and other Air Force, Government and industry facilities. The ten major contractors are: Rockwell International, Los Angeles, CA; The Boeing Company, Wichita, KA; General Dynamics, Fort Worth, TX; Systems Control, Inc., Palo Alto, CA; McDonnell Douglas, St. Louis, MO; McDonnell Douglas Astronautics-East, St. Louis, MO; Calspan, Buffalo, NY; Grumman Aerospace, Bethpage, NY; Bunker-Ramo Corporation, Westlake Village, CA; Northrop Corp., Hawthorne, CA. Currently there are 79 total contractors and 226 total contracts; four are overseas contracts.

Program Element: #62201F
DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Significant accomplishments include: (1) development and evaluation of an advanced cyrogenic cooler for forward looking infrared (FLIR) sensor systems which would significantly reduce the operational and support costs, (2) flight test of a closed loop digital flight control system using a multiplex data bus, this capability provides the building block for future systems with increasingly complex capabilities, (3) detailed analysis and evaluation of F-4 aircraft operating on damage-repaired runways led to interim guidance for operation of the fleet and potential modifications to improve fleet capabilities, (4) an advanced head up display was developed for the KC-135 boom operator which offers both improved safety and operational effectiveness in aerial refueling operations, (5) a series of aero configured missiles were evaluated starting from unconstrained aerodynamic configurations and then converged on configurations which considered the design compromises of propulsion integration as well as subsystems packaging and realistic control requirements. A 100% improvement was demonstrated in the vehicle lift-to-drag ratio which directly translates into a doubling of the missile range, (6) Two laminate bird proof canopies for the F-16A were developed and safety of flight qualified. Technology developed, during the improved windshield protection program, provided the new structural concepts, transparency configurations and improved materials required for the F-16A's protection against flight hazards including birdstrikes.

2. (U) FY 1982 Program: Develop, apply and evaluate new unsteady aerodynamic prediction methods and obtain corresponding experimental data in the difficult transonic flow regime. Better prediction not only improves understanding of these phenomena but also allows for improved flight vehicle design. New efforts will be initiated to develop accelerated environmental test techniques which will provide good correlation with field reliability experience. Better correlation leads to correction of design problems early in the equipment life cycle and improved repair and spare parts logistics. Continue the development and maintenance of the Air Force Stability and Control Data Compendium, better known as DATCOM, and its computer implementation, Digital DATCOM. DATCOM is the free world standard for estimating stability and control characteristics of aircraft conceptual designs. DATCOM will be extended to missile configurations. Tests will be conducted to gather data which will verify and validate aerodynamic heating prediction techniques. Currently, only simple shapes such as cones and cylinders can be predicted with confidence. Emphasis will be placed on developing a technical base for maneuvering reentry vehicles, space-based radar, high altitude optics, and high energy lasers.

3. (U) FY 1983 Planned Program: Develop and demonstrate efficient large aircraft composite design concepts which exhibit minimum weight and volume, meet the required structural and low signature performance, and have high potential for producibility, repairability and durability at acceptable cost. Design, develop and fabricate a laboratory system to apply dynamic loads through the landing gear to aircraft (up to F-111 size) and evaluate their capability to operate from bombdamaged, repaired, unrepaired or semi-repaired fields. Improve current air-to-surface visual simulation capability of the LAMARS flight simulator required for advanced fighter flight control and weapons systems integration. Improve and provide more responsive test model development and comprehensive test data for experimental aerodynamic research and development programs. Expand current computational programs to support design evaluations and concept optimizations for boost-glide/lifting entry vehicles for advanced military space capability. Reduced funding will constrain the rate of technology growth in structures, dynamics, vehicle equipment, flight controls, crew systems and

aeromechanics. The development of programs such as the Alternate Aircraft Take-off System (AATS), fuel efficient airplane electric actuation systems, and cabin environmental control systems will be curtailed.

4. (U) FY 1984 Planned Program: Evaluate and demonstrate the capability of an active control system to suppress wing/store flutter on a modern fighter. The goal is to demonstrate a 30 percent speed improvement in flight for several wing/store configurations. Design, develop, and demonstrate on an aircraft a landing gear system providing for rough/soft field operation. A final design for the landing gear system will be developed based on previous demonstrated technology. Develop and flight demonstrate a distributed multi-microprocessor based flight control system that will establish a proven technical baseline for integrated digital flight controls. Develop and explore advanced strategic aircraft options featuring highly survivable system integration concepts and enhanced performance. Vehicle concepts for strategic applications including penetration, reconnaissance, intercept, and airlift will be identified.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #06FF
Program Element: #62201F
DOD Mission Area: Engineering Technology (ED), #523

Title: Flight Dynamics Laboratory Operations
Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the support activities required to operate the Flight Dynamics Laboratory, Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH. The mission of the laboratory is to plan and execute the USAF exploratory development, advanced development and selected research and engineering development programs in aerospace flight vehicles. The laboratory also provides technical support within its mission areas to other Air Force organizations, the Army, the Navy, other Department of Defense agencies, National Aeronautics and Space Administration, and other government agencies. This project covers pay and benefits of civilian scientists and engineers and supporting personnel, travel, transportation, rents, communications, utilities costs, procurement of supplies and equipment, and contractor support services.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element, as well as all other projects and activities managed or conducted by Flight Dynamics Laboratory. Other programs supported include Program Element (PE) 63205F, Flight Vehicle Technology; PE 63211F, Aerospace Structures and Materials; PE 63244F, Aircraft Nonnuclear Survivability; PE 63245F, Advanced Fighter Technology Integration; PE 64212F, Aircraft Equipment Development; and PE 63428F, Space Surveillance Technology.

(U) WORK PERFORMED BY: The Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH is responsible for management of this project and other projects included under the Aerospace Flight Dynamics program.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	28,497	30,133*	31,809	32,358	Continuing	Not Applicable

*Excludes Oct 81 Civilian Pay Raise

2. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E Funds	27,600**	29,900	30,600		Continuing	Not Applicable

**Did not include 1 Oct 80 Civilian Pay Raise

Project: #2401
Program Element: #62201F
DOD Mission Area: Engineering Technology (ED), #523

Title: Structures and Dynamics
Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The purpose of this project is to develop and demonstrate structural mechanics and vehicle dynamics technology which will result in low cost, low weight, high performance structures with assured design life for flight vehicles. The project includes three major goals: (1) Effective application of advanced materials to aircraft, missiles and space vehicles. (2) Generating new basic structural and dynamic criteria, techniques and concepts that will facilitate the design and development of weapon systems (3) Maintaining the technical capability and unique facilities to attain the preceding goals and providing the expertise and audit capability required for structures and dynamics technical support to other organizations.

(U) RELATED ACTIVITIES: This project receives inputs from Defense Research Sciences (PE 61102F), from Materials (PE 62102F), as well as from the products of other national and international research and development activities. In turn, the output of this project is applied to Flight Vehicle Technology (PE 63205F), Aerospace Structures and Materials (PE 63211F), other advanced development, engineering development, and system development programs. Joint and cooperative efforts are conducted with other Air Force Systems Command Laboratories, other Air Force organizations, the Army, the Navy, National Aeronautics and Space Administration, and foreign countries. Coordination and avoidance of duplication of effort is accomplished with these agencies, academic institutions, and industry through exchange of information, coordinating and advisory groups, technical reviews and seminars, professional societies and meetings, and in the preparation of formal Department of Defense documents such as Technical Coordinating Papers.

(U) WORK PERFORMED BY: Work under this project is performed in-house by the Flight Dynamics Laboratory, Wright Aeronautical Laboratories, and under contracts managed by that laboratory. Use is made of in-house facilities, such as the Structures Test Facility and the facilities of other Air Force organizations, other government organizations, industry, and foreign countries. The ten major contractors are: Rockwell International, Los Angeles, CA; General Dynamics, Fort Worth, TX; Lockheed Aircraft, Burbank, CA; University of Dayton, Dayton, OH; McDonnell Douglas, St. Louis, MO; Northrop Corporation, Hawthorne, CA; The Boeing Company, Seattle, WA; Anamet Laboratories, Berkely, CA; McDonnell Douglas Astronautics Co-East, St. Louis, MO; Vought Corp, Dallas TX. Currently there are 20 total contractors and 70 total contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Significant recent accomplishments include: (1) issue of the Damage Tolerance Handbook, (2) demonstration of a successful, inexpensive detection technique for Cruise Missiles by measuring acoustic signatures, (3) demonstration in wind tunnel tests of several active control concepts that could raise flutter speed placards by at least 30 percent for fighter configurations with flutter-critical external stores, (4) a full-scale composite deployment module using MX loads, nuclear environment, and reentry vehicle mounting requirements was tested and transferred as a baseline on the MX missile system in full-scale development, and (5) two laminate bird proof canopies for the F-16A were developed and safety of flight qualified. Technology developed during the improved windshield protection program provided the new structural concepts, transparency configurations and improved materials required for the F-16A's protection against flight hazards including birdstrikes.

Project: #2401 Title: Structures and Dynamics
Program Element: #62201F Title: Aerospace Flight Dynamics
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base, #1

2. (U) FY 1982 Planned Program: Develop, apply and evaluate new unsteady aerodynamic prediction methods and obtain corresponding experimental data in the difficult transonic flow regime. Accurate prediction techniques reduce the difficulty, time, and cost of developing new weapons systems. Structural design techniques for composite material structures which consider fatigue and fracture requirements, stress, deflection, geometry, and aerodynamic heating will be developed. This capability is required nationally to design composite structures and by the Air Force in particular in order to be able to assess contractor predictions and proposals. The dynamic structural response of aerospace vehicles to external excitation causes such phenomenon as flutter, sonic fatigue, and ground taxi loads. Each of these will be explored to better understand the phenomena as they affect future aircraft design.

3. (U) FY 1983 Planned Program: Prediction and design techniques will be developed for flight conditions such as high angle of attack, transonic maneuvering, and low speed flight. Vehicle operation in these areas provide improved combat effectiveness. The verification of composite material structure design tools will be accomplished through ground test and service life tracking. High cost maintenance items identified in the current fleet will be assessed for new technology replacement components. The potential for savings in Air Force Operating and Maintenance funds is significant. Reduced funding will constrain the rate of technology growth in structures and dynamics. Transfer of composites technology into advanced strategic missile structure and the development of improved composite aircraft repair procedures will be curtailed.

4. (U) FY 1984 Planned Program: Evaluate and demonstrate the capability of an active control system to suppress wing/store flutter on a modern fighter. The goal is to demonstrate a 30 percent speed improvement in flight for several wing/store configurations. Support the runway independence major thrust by designing and developing a laboratory system to apply dynamic loads through the landing gear to aircraft.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	6,369	5,799	7,353	7,915	Continuing	Not applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E Funds	5,900	6,200	13,300		Continuing	Not applicable

Project: #2402 | Title: Vehicle Equipment
Program Element: #62201F | Title: Aerospace Flight Dynamics
DOD Mission Area: Engineering Technology (ED), #523 | Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objectives of this project are to acquire the technology base and provide demonstrated technologies in the areas of conventional and alternate flight vehicle takeoff and landing systems, windshields and transparency enclosures, cryogenic cooling, internal environmental control, flight vehicle vulnerability to ballistic threats and natural environment hazards, emergency crew escape, and combined environmental reliability testing. These technology advancements will significantly impact the life cycle cost of subsystems and equipment, increase the probability of flight vehicle and crew member survival, and improve flight vehicle operational capabilities. In addition, the project will demonstrate options for improved subsystem and equipment design and performance, and establish the associated scientific and engineering foundation for these technologies.

(U) RELATED ACTIVITIES: This project receives inputs from Defense Research Sciences (PE 61102F) and from Materials (PE 62102F), as well as from the products of other national and international research and development activities. In turn, the output of this program is applied to Flight Vehicle Technology (PE 63205F), Advanced Fighter Technology Integration (PE 63245F), Aircraft Nonnuclear Survivability (PE 63244F), Aircraft Equipment Development (PE 64212F), and other advanced development, engineering development, and system development programs. Joint and cooperative projects are coordinated with other laboratories, other Air Force organizations, the Army, the Navy, National Aeronautics and Space Administration, and foreign countries. Coordination and avoidance of duplication of effort is accomplished with these agencies, academic institutions, and industry through exchanges of information, coordinating and advisory groups, technical reviews and seminars, professional societies and meetings, and in the preparation of formal Department of Defense documents such as Technical Area Descriptions.

(U) WORK PERFORMED BY: Work under this program is performed in-house by the Flight Dynamics Laboratory and under contracts managed by that laboratory. Use is made of in-house facilities and the facilities of other Air Force organizations, other government organizations, and industry. The current ten major contractors are: The Boeing Company, Seattle, WA; Rovak Corporation, Maitland, FL; Helix Technology Corporation, Waltham, MA; Booz Allen and Hamilton, Bethesda, MD; Textron, Incorporated, Buffalo, NY; University of Dayton, Dayton, OH; National Bureau of Standards, Boulder, CO; McDonnell Douglas Corp., St. Louis, MO; Vought Aeronautics, Dallas, TX; and Science Applications, Inc., LaJolla, CA. Currently there are 27 total contractors and 39 total contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Significant recent accomplishments include: (1) development and evaluation of an advanced cyrogenic cooler for forward looking infrared (FLIR) sensor systems which would significantly reduce the operational and support costs, (2) verification of combined environmental reliability testing (CERT) methodology for on-board avionics systems, accurate correlation with field experience failure rates and types allows early correction of design deficiencies, (3) validation through test, of methodology to predict residual strength of damaged structural components caused by ballistic projectile or fragment impact, (4) feasibility demonstration of a superplastically formed/diffusion bonded (SPF/DB) titanium manufacturing technique applicable to landing gear and similar high load structural components provides high strength components at reduced component weight, and (5) development of a structural integrity assessment program for bird impact resistant transparent crew enclosures.

Project: #2402
Program Element: #62201F
DOD Mission Area: Engineering Technology (ED), #523

Title: Vehicle Equipment
Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

2. (U) FY 1982 Planned Program: The results of Combined Environments Reliability Test (CERT) will be transitioned to military specifications for internally carried avionics. Assessments and preliminary designs of emergency crew escape concepts for high speed manned vehicles will be completed. Current systems provide safe crew escape only up to moderate subsonic speeds. Efforts will continue in the area of conventional landing gear including the development of radial ply tires and active control landing gear struts which will allow aircraft operation on battle damaged and repaired runways and/or unimproved surfaces (soft fields). The development of microprocessor controlled, closed loop environmental control concepts will be initiated, and the characterization of the atmospheric electricity hazard (lightning) will be completed on the basis of extensive ground and in-flight measurements conducted over the past three fiscal years.

3. (U) FY 1983 Planned Program. Cryogenic cooler technology will be extended to provide the low temperatures required for the operation of on-board Josephson Junction Processors. A development effort will be continued to expand the safe ejection envelope through utilization of microprocessor control of the ejection seat thrust vector. Crew survivability will be enhanced by reducing pre-ejection time delays and improved man/seat system stability. Cryogenic cooler component development for air-to-air missile infrared sensors will be completed. Computer aided design techniques which include heat load and environmental control considerations in avionics designs will be completed. The development of assessment methodologies to determine the residual strength of composite structures after projectile or fragment impact will be continued. Development of the Alternate Aircraft Take-off System (AATS) which will permit the launch of fighter type aircraft from battle damaged runways and the development of an environmental control system which will provide the cabin environment as well as avionics cooling during chemical/biological warfare attack will be curtailed.

4. (U) FY 1984 Planned Program: Design, manufacture and laboratory testing of landing gear components for rough/soft field operation will be initiated. The development and performance evaluation of a closed cycle cryogenic cooler capable of providing liquid helium (4.2°K) temperature refrigeration for the environmental support of Josephson Junction superconducting devices will be continued.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) RESOURCES:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	5,179	4,756	5,495	6,228	Continuing	Not applicable

Project: #2402
Program Element: #62201F
DOD Mission Area: Engineering Technology (ED), #523

Title: Vehicle Equipment
Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E Funds	4,700	4,900	9,000	Continuing	Not applicable

Project: #2403
Program Element: #62201F
DOD Mission Area: Engineering Technology (ED), #523

Title: Flight Control
Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The purpose of this project is to develop flight control systems technology which matches the performance and dynamic characteristics of the vehicle, its armament and mission systems with the pilot to obtain maximum capability while assuring safety, survivability and economy. The elements of flight control technology include cockpit display and controls, control logic, aircraft stability and control, control sensors, and actuation subsystems. Included are laboratory, wind tunnel, simulation and/or flight tests necessary to demonstrate the validity of advanced control concepts, devices and techniques. Transition is enhanced by involvement of the using commands wherever possible in the evaluation and validation process. The principal formal means of technology transition is through specifications, handbooks, design guides and criteria, and technical reports.

(U) RELATED ACTIVITIES: This project received inputs from Defense Research Sciences (PE 61102F) and from Avionics (PE 62204F), as well as from the products of other national and international research and development activities. In turn, the output of this program is applied to Flight Vehicle Technology (PE 63205F), Advanced Fighter Technology Integration (PE 63245F), Digital Avionics Information System (DAIS) (PE 63243F), other advanced development, engineering development, and system development programs. Joint and cooperative projects are conducted with other laboratories, other Air Force organizations, the Army, the Navy, National Aeronautics and Space Administration, Federal Aviation Agency, and foreign countries. Coordination and avoidance of duplication of effort is accomplished with these agencies, academic institutions, and industry through exchange of information, coordinating and advisory groups, technical reviews and seminars, professional societies and meetings, and in the preparation of formal Department of Defense documents such as Technical Area Descriptions.

(U) WORK PERFORMED BY: Work under this program is performed in-house by the Flight Dynamics Laboratory and under contracts managed by that laboratory. Use is made of in-house facilities and the facilities of other Air Force organizations, other Government organizations and industry. The ten major contractors are: Systems Control Inc., Palo Alto, CA; General Dynamics Corporation, Ft. Worth, TX; Calspan Corporation, Buffalo, NY; Lear Siegler, Inc., Oklahoma City, OK; Electronic Associates, Inc., Long Branch, NJ; Dynamic Controls Inc., Dayton, OH; McDonnell Douglas, St. Louis, MO; Systems Technologies Inc., Hawthorne, CA; Hughes Aircraft Co., Culver City, CA; and Northrop Corp., Hawthorne, CA. Currently there are 33 total contractors and 58 total contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Recent significant accomplishments include: (1) flight control simulations were performed in-house in support of the Advanced Fighter Technology Integration (AFTI) and Integrated Flight Fire Control (IFFC) advanced development programs, aircraft accident investigations, and tanker refueling systems acquisition, (2) flight tests were accomplished on digital flight control system components including the first flight of a digital multiplex data bus closed loop flight control system using both twisted shielded pair and a fiber optic transmission line. These were tested in simulated lightning environments prior to flight demonstrating that these systems can be designed to minimize their susceptability to atmospheric electrical hazards, (3) a flat panel multi-mode matrix display was demonstrated; this technology may eventually replace bulky cathode ray tube displays, (4) a high

Project: #2403
Program Element: #62201F
DOD Mission Area: Engineering Technology (ED), #523

Title: Flight Control
Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

frequency hydraulic actuator for use in a flutter control system completed wind tunnel test demonstrating the capabilities of a new simulation tool which will aid in future investigations of active flutter control technology. Also demonstrated was a new blending of control laws and computer driven gunsite reticles which were superior to the standard system.

2. (U) FY 1982 Planned Program: Simulations will be initiated to develop integrated control concepts which support alternate penetration tactics such as high speed dash, terrain following, terrain masking, evasive maneuvering and lethal countermeasures. A radar warning simulation system will be installed in the flight control simulator. Mission systems management techniques will be explored; these are the cockpit hardware and supporting technologies required to provide the flight crew with essential mission data, systems status required for effective operations. Continue the development and maintenance of DATCOM, the free world standard for estimating stability and control characteristics of aircraft conceptual designs. Work will be done to extend DATCOM to missile configurations. Pursue integrated tactical contract studies, speech technology development and pictorial format displays.

3. (U) FY 1983 Planned Program: The multifunction flight reference system is continuing as a major emphasis and is expected to flight demonstrate two strap down, skewed, ring laser gyro assemblies in an F-15 during FY 1983 and FY 1984. Studies will be initiated to develop criteria for space transportation system crew stations. Distributed processing digital flight control system to improve reliability, supportability and vehicle survivability will be flight tested on the Digital Tactical Aircraft Control (DIGITAC) program. Newly emerging digital architecture will be applied to flight control systems to improve reliability, supportability and vehicle survivability. The flying qualities specification will be expanded to include large aircraft such as bombers, missile carriers, and transports in the million pound plus class. Develop a set of validated design criteria for the low-speed, power-lift flight phases for Short Takeoff and Landing (STOL) vehicles. Develop terrain following/terrain avoidance algorithims that increase aircraft survivability and mission effectiveness. Reduced funding will constrain the rate of technology growth in flight controls and crew systems. Development of Short Takeoff and Landing (STOL) fighter displays for approach and landing on battle damaged runways and the development of fuel efficient airplane electric actuation systems will be curtailed.

4. (U) FY 1984 Planned Program: Complete multifunction flight reference system and transition to the Integrated Inertial Reference Assembly program. Conduct design, test, and evaluation of innovative electric actuation concepts and systems using current and advanced state-of-the-art techniques; conduct experiments for new mechanizations to improve control power management efficiency with no penalty to aircraft performance and increased actuation system reliability, maintainability and supportability. Continue flat panel display development.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2403 Title: Flight Control
Program Element: #62201F Title: Aerospace Flight Dynamics
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base, #1

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	6,953	6,342	7,290	8,274	Continuing	Not applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
RDT&E Funds	6,200	6,600	10,900		Continuing	Not applicable

Project: #2404 | Title: Aeromechanics
Program Element: #62201F | Title: Aerospace Flight Dynamics
DOD Mission Area: Engineering Technology (ED), #523 | Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to initiate and conduct technology programs in the areas of aerodynamics, aerothermodynamics, performance analysis, configuration research, technology assessment and integration, and wind tunnel and flight experiments. These technology programs are directed toward improved mission capability, reduced development risk, and reduced development and operation cost. Fundamental technology base efforts include test and prediction techniques, design criteria, wind tunnel simulation, and flight test correlation.

(U) RELATED ACTIVITIES: This project receives inputs from Defense Research Sciences (PE 61102F) and from Materials (PE 62102F), as well as from the products of other national and international research and development activities. In turn, the output of this program is applied to Flight Vehicle Technology (PE 63205F), Advanced Fighter Technology Integration (PE 63245F), and other advanced development, engineering development, and system development programs. Joint and cooperative projects are conducted with other laboratories, other Air Force organizations, the Army, the Navy, National Aeronautics and Space Administration, and foreign countries. Coordination and avoidance of duplication of effort is accomplished with these agencies, academic institutions, and industry through exchange of information, coordinating and advisory groups, technical reviews and seminars, professional societies and meetings, and in the preparation of formal Department of Defense documents such as Technical Area Descriptions.

(U) WORK PERFORMED BY: Work under this program is performed in-house by the Flight Dynamics Laboratory and under contracts managed by that laboratory. Use is made of in-house facilities and the facilities of other Air Force organizations, other government organizations, and industry. The ten major contractors are: The Boeing Company, Seattle, WA; Rockwell International, Los Angeles, CA; McDonnell Douglas Astronautics - East, St. Louis, MO; McDonnell Douglas Corporation, St. Louis, MO; Grumman Aerospace, Bethpage, NY; General Dynamics, Ft. Worth, TX; Northrop Corporation, Hawthorne, CA; General Dynamics, San Diego, CA; and Vought Aeronautics, Dallas, TX. Currently there are 33 total contractors and 71 total contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Computer simulations of self-excited unsteady aerodynamic phenomena have demonstrated a new and powerful analytic tool. Conventional aerodynamic prediction techniques have been expanded to include carriage and separation of conventional and advanced weapons. A significant inlet flow distortion problem on the Air Launched Cruise Missile was identified analytically. An independent analysis of the Space Shuttle uncovered design deficiencies which were later confirmed by wind tunnel tests. An in-house technology assessment was completed on the technology requirements for a Vertical/Short Takeoff and Landing (V/STOL) aircraft. Life cycle cost prediction techniques applicable to conceptual designs have been developed. A series of missiles were evaluated starting from unconstrained aerodynamic configurations and then converged on configurations which considered the design compromises of propulsion integration as well as subsystems packaging and realistic control requirements. A 100 percent improvement was demonstrated in the vehicle lift-to-drag ratio which directly translates into a doubling of the missile range. Advanced fighter configurations were developed emphasizing supersonic persistance, maneuverability, and STOL. The results indicated that high aerodynamic efficiency and STOL capability can be achieved with little penalty in take-off gross weight.

Project: #2404
Program Element: #62201F
DOD Mission Area: Engineering Technology (ED), #523

Title: Aeromechanics
Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

2. (U) FY 1982 Planned Program: An effort to study volumetrically efficient advanced missile vehicle aerodynamics will be expanded to include innovative configurations of maneuvering reentry vehicles and lifting orbiter vehicles. The results will be assembled in a design guide. Prediction techniques will be explored for air launched highly maneuverable missile aerodynamics. Tests will be conducted to gather data which will verify and validate numerical techniques for calculating flow fields and aerodynamic heating. Studies will be initiated to assess technical problems integrating advanced and current weapons with reduced ra signature and configuration shaping. The in-house aerodynamic experimental facilities will continue to be emphasized and will concentrate on clean affordable flow visualization facilities such as a water tunnel and a smoke tunnel. Advanced strategic aircraft configurations will be investigated for vehicles with increased range, payload, survivability and reduced life cycle cost. Technologies will be explored which offer solutions to the problem of sustaining combat operations off of damaged runways and alternate surfaces.

(U) FY 1983 Planned Program: New efforts will be initiated to define critical technologies for multi-purpose fighter-interceptor configurations. Wind tunnel and radar cross section tests are planned to verify aerodynamic, stability, performance and detectability characteristics of advanced Short Takeoff and Landing (STOL) fighter and strategic aircraft configurations, including weapons contributions. The effect of observables on aerodynamically configured missiles will be assessed. Continue the assessment of flight vehicle concepts for effectiveness of standoff ballistic glide and cruise weapons. Continued refinement of aerodynamic and functional performance prediction techniques which are efficient users of computer time and resources will be emphasized. An effort to correlate actual flight data, wind tunnel test results and analytic predictions will be completed. Aircraft and missile performance prediction techniques will be integrated to allow aircraft/missile performance trade-offs which will maximize weapon system performance.

4. (U) FY 1984 Planned Program: Develop and explore strategic aircraft options featuring highly survivable system integration concepts and enhanced performance. Vehicle concepts for strategic applications including penetration, reconnaissance, intercept, and airlift will be identified. Establish design criteria for high performance conformal inlet and exhaust nozzle concepts in highly integrated airframe-propulsion installations. Aeromechanic technologies for key aerospace problems such as non-catalytic heating effects will be assessed for improved confidence and reduced costs.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2404 Title: Aeromechanics
Program Element: #62201F Title: Aerospace Flight Dynamics
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base, #1

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	8,688	8,125	9,272	10,409	Continuing	Not applicable

8. (U) Comparison with FY 1981 Descriptive Summary:

RDT&E Funds	7,900	8,500	9,200

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62202F
DOD Mission Area: Environmental and Life Sciences (ED) #522

Title: Aerospace Biotechnology
Budget Activity: Technology Base #1

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	34,740	35,959	41,718	44,777	Continuing	Not Applicable
06MD	Aerospace Medical Division Laboratory Operations	18,286	18,738*	20,209	20,666		
2729	Chemical Defense	793	681	3,100	2,800		
6302	Occupational and Environmental Toxic Hazards in Air Force Operations	3,135	2,890	3,000	4,017		
6770	Biotechnology Studies in Advanced Systems	112	100	600	520		
6893	Manned Weapon Systems Effectiveness	2,063	2,465	1,800	2,200		
7184	Man-Machine Integration Technology	3,118	3,640	4,250	4,450		
7231	Safety and Aircrew Effectiveness in Mechanical Forces Environments	2,101	2,485	2,500	3,017		
7755	Aerospace Medicine	860	710	900	900		
7757	Radiation Hazards in Aerospace Operations	3,201	2,950	3,860	4,207		
7930	Advanced Crew Technology	1,071	1,300	1,499	2,000		

*Excludes 1 Oct 81 Civilian Pay Raise (4.8 percent)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Biotechnology is the core Air Force technology base program which enhances effectiveness of weapon systems and air operations through optimizing the human component. The program includes investigations into the protection of man in hazardous environments and man-machine integration technology for system design and operation. The program funds the operational support and management for the research and development activities performed by the Aerospace Medical Division, Brooks AFB TX. This includes the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB OH, and the USAF School of Aerospace Medicine, Brooks AFB TX.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program represents 13.3 percent real growth over FY 1982. This growth is reflected in the following major new thrusts: investigation of chemical warfare effects on human performance in Air Force specific missions; development of strength/stamina criteria for Air Force job performance; computer analysis of disease prediction in aircrew personnel; quantification of laser exposure effects on aircrew performance; development of specifications for advanced life support ensembles; improvements in design of cockpit displays and controls to decrease pilot workload; and development of voice communication jamming and antijamming methods.

Program Element: 62202F
DOD Mission Area: Environmental and Life Sciences (ED) #522

Title: Aerospace Biotechnology
Budget Activity: Technology Base #1

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY ($ in thousands):

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	35,600	40,700	48,200		Continuing	Not Applicable
Military Construction		5,800	750			

(U) OTHER APPROPRIATION FUNDS:

Military Construction		5,600	750			

Program Element: 62202F
DOD Mission Area: Environmental and Life Sciences (ED) #522

Title: Aerospace Biotechnology
Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Biotechnology is the integrated Air Force program to optimize the role of the human operator in the design, development, and operation of increasingly complex and technologically sophisticated weapon systems. The four key thrusts of the biotechnology program are: (1) to improve the performance of the human component of Weapon System/operations by refining crew selection and maintenance, crew protection, and man-machine integration; (2) to improve safety and environmental protection from radiation, chemicals, and noise; (3) to establish threat characterization and countermeasures effectiveness against Soviet weapon systems; and, (4) to develop chemical defense measures for air base operations, casualty care and evacuation, and personal protective equipment. The products of this program are applied primarily to corollary hardware development programs in the mission areas of: strategic offense and defense; tactical air superiority; tactical interdiction; command, control, and communications; and intelligence. Several key factors drive the increasing investment in this program. These include: reliance on more technology rich hardware systems to counter the numerical superiority of threat systems; the requirement to reduce life cycle costs of weapon systems; the national environmental concern with lifetime effects of exposure to various forms of radiation and chemicals; and, the need to retain operationally experienced aircrews. This program element provides technical support to other Air Force and DOD agency programs and receives partial reimbursement for the services provided.

(U) RELATED ACTIVITIES: The Biotechnology Program is formally coordinated with the other Services, Government agencies, industry, the university community and selected foreign governments through numerous communications, conferences and agreements. These include topical reviews, the Electromagnetic Radiation Management Advisory Council, Training and Personnel Technology Conferences, Annual Conference on Environmental Toxicology, Triservice Aeromedical Research Panel, and several Joint Technology Coordinating Group working bodies. In April 1981, an Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee consisting of Research, Development, Test and Evaluation (RDT&E) representatives of the US Army, Air Force and Navy, was established to coordinate programs of mutual benefit, exchange information and accomplish biomedical RDT&E. The Commander, Aerospace Medical Division, is an active participant on this committee and meets regularly to review the Triservice aeromedical programs. The program is also coordinated on an international basis through the Air Standardization Coordinating Committee, and several North Atlantic Treaty Organization groups including the Defense Research Group, Advisory Group for Aerospace Research and Development, and the Military Agency for Standardization. In addition, bilateral efforts have been established with friendly nations, particularly with the United Kingdom, in the area of chemical defense for aircrews. Within the Department of Defense, joint efforts have been established with the Army Aeromedical Laboratory and the Naval Medical Research Institute. Efforts responsive to Air Force Systems Command are specifically coordinated with the responsible Air Force product division, systems program office, or Air Force laboratory. Liaison is maintained with the Air Force operational commands. Support to the Air Force Surgeon General is provided on a continuing basis.

(U) WORK PERFORMED BY: The Biotechnology Program is conducted by the Aerospace Medical Division through its two laboratories: the United States Air Force School of Aerospace Medicine, Brooks Air Force Base TX, and the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB OH. The in-house portion of the program is centered on unique, complex, man-rated experimental facilities which are generally not available in the aerospace industry or academic institutions. The contract portion of the program complements the in-house efforts. The 10 major contractors

Program Element: 62202F   Title: Aerospace Biotechnology
DOD Mission Area: Environmental and Life Sciences (ED) #522   Budget Activity: Technology Base #1

in FY 1982 are: Systems Research Laboratories, Inc, Dayton OH; University of California, Irvine, CA; Southeast Center for Electrical Engineering Education Operation Office, St. Cloud, FL; Texas A&M Research Foundation, College Station, TX; University of Washington, Seattle, WA; McDonnell-Douglas Corporation, St. Louis, MO; Technology Incorporated, San Antonio, TX; System Development Corporation, Santa Monica, CA; Raytheon Service Company, Burlington, MA; MacAulay-Brown, Inc., Dayton, OH. There are an additional 61 contracts conducted by 52 contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Among the products of this program are the following: Completed a human engineering evaluation and recommended problem solutions for the NORAD Missile Warning Center and Command Post; developed new Air Force strength standards for enlisted personnel selection; completed noise studies of the barrier noise supressor (Hush House) with the F-4, F-15, F-16, F-105, F-106, F-111F and T-38 to establish noise assessment methods for use by Major Air Commands; developed and evaluated a novel audio jamming signal which will be incorporated into a major Air Force audio communications jamming program; developed a method to measure cognitive processing workload for use in determining pilot workload capacity in advanced fighter aircraft; completed extensive environmental toxicology assessment of exhaust products from the Titan III and Space Shuttle, completed assessment of trichlorethylene criteria for potable water supplies, resulting in savings of over $250 thousand per year at Wurtsmith AFB, Michigan; completed an extensive toxicology study on high energy cruise missile fuel component, RJ-5, that established exposure limits for humans; performed 637 aeromedical evaluations on medically grounded aircrew members, and recommended 513 of these for return to flying status, resulting in an estimated savings of $300 million in replacement costs; completed study of biofeedback techniques to reduce airsickness, resulting in 75% of pilot trainees previously washed out for airsickness now flying; completed study to determine intensity of reradiated light produced by pulsed Deuterium Fluoride laser radiation impacting windscreen/canopy material and applied information to predicting associated visual loss. Completed time-dependent performance loss assessment associated with acute exposure to lethal level of ionizing radiation. Completed revision of Radiofrequency Radiation exposure standards (AFOSH STD 161-9). The Onboard Oxygen Generation System utilizing molecular sieve technology was completed for single seat aircraft and transitioned to Advanced Development.

2. (U) FY 1982 Program: The $3.0 million Congressional reduction in FY 1982 has effected the following contract actions: delay until 1983 the start of work on shelters for field medical care in chemical warfare environments; delay the development of a chemical simulant to test chemical defense protective clothing; cancel development of a program aimed at reducing aircraft accidents caused by human factors--accidents which cost $400 million per year in damaged or lost aircraft and trained pilots; delay development of workload metrics essential for the design of next generation aircraft cockpits; cancel work for evaluation of enemy antiaircraft systems; and, cancel efforts to identify the characteristics of the exceptional flyer in order to determine the best match of aircrews to aircraft type. The major new FY 1982 efforts include determination of human performance capability in a chemical warfare environment; crew station design and configuration for enhanced strategic penetration and weapons delivery capability; development of aircrew eye glasses acceptable for combat use; determination of laser effects on pilot vision and mission performance; and development of a solid state oxygen sensor for operational aircraft. Military construction for FY 1982 includes the

addition and alteration of the Biotechnology Laboratory at the Air Force Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base OH. This project provides modernized facilities to support the development of displays, controls and standards for strategic and tactical crew stations.

3. (U) FY 1983 Planned Program: The impact of the $6.2 million reduction in FY 1983 on an urgently needed chemical defense program was largely accommodated through deferrals and rescoping of other programs within this program element (see paragraph 5, "Program to Completion"). Adjustments made for management efficiency within the approved FY 1983 program element funds include the consolidation of all efforts related to chemical defense into one project, 2729, which is reflected in the large increase for this project. Chemical defense work begun in late 1981 will focus on the areas of protective garments vs crew performance; cockpit detector and filter development; patient decontamination and casualty evacuation. Toxicology studies will be undertaken on composite materials/epoxies and chemical warfare agent simulants. Other efforts will be pursued in human information processing and system control; human physical variability in systems design; strength/stamina for Air Force job standards; aircrew communications effectiveness in noise jamming environments; use of contact lenses by aircrew personnel; and particle beam/laser bio-hazards. FY 1983 military construction funds will provide a Quarantine Support Facility to the United States Air Force School of Aerospace Medicine, Brooks Air Force Base TX. It will provide space for R&D animal quarantine to rid animals of disease and stabilize animals before initiation of controlled research.

4. (U) FY 1984 Planned Program: New thrusts will include efforts to: assess side effects of chemical warfare antidotes; evaluate aeromedical communications and telemetry in a chemical defense environment; conduct toxicology evaluations of advanced missile fuels; quantify laser ground-to-air systems effects on aircrew performance; develop design criteria for voice activated control systems; develop new concepts for biodynamics escape/protection technology; and evaluate bioeffects of long term low level exposure to radio frequency radiation.

5. (U) Program to Completion: This is a continuing program; however, in addition to program deferrals and cancellations resulting from an FY 1982 Congressional reduction of $3.0 million, the $6.2 million reduction for FY 1983 will result in the deferral of the following development efforts: hydrazine dosimeters used for personnel in missile silos and ground hydrazine power units; military-unique biotechnology requirements for manned space missions; methods to reduce spatial disorientation in high-altitude and night formation flight; and, developments in man-machine integration technology and robotics to reduce mission workload. Programs reduced in scope for FY 1983 include: directed energy bioeffects; pilot workload measurement technology; advanced controls and display technology for command post and warning center designs, and toxicology of Air Force synthetic fuels.

Program Element: 62202F
DOD Mission Area: Environmental and Life Sciences (ED) #522

Title: Aerospace Biotechnology
Budget Activity: Technology Base #1

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Descriptive Summary; Not applicable.

Project: 06MD Title: Aerospace Medical Division Laboratory Operations
Program Element: #62202F Title: Aerospace Biotechnology
DOD Mission Area: Environmental and Life Sciences (ED) #522 Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides the resources to conduct the in-house research and development activities of the Aerospace Medical Division at Brooks Air Force Base TX and its research and development laboratories. The project provides for the pay and related costs of civilian physicians, scientists, engineers and support personnel as well as for travel, transportation, rents, communications, utilities, laboratory supplies and unique equipment and other related costs needed to conduct biotechnology research and development. The program, managed by the Aerospace Medical Division, is one of research and exploratory development in biotechnology. The research and development efforts are designed to specifically define human limits with regard to adaptability, survivability, and performance capabilities within the Air Force operational environment. These coordinated efforts form the basis for: (a) designing more effective weapon systems which capitalize on and enhance man's abilities; (b) developing realistic trade-off options in system design and mission planning to increase overall effectiveness and achieve economy of operations; (c) assuring maximum protection and survivability of aircrews, consistent with mission requirements; and, (d) establishing realistic criteria for selection and care of military personnel to maintain a strong and viable Air Force fully responsive to operational requirements and national goals.

(U) RELATED ACTIVITIES: This project accounts for about 51 percent of the funds of the exploratory development program which is predominantly conducted by specialized scientific teams using complex, unique research facilities and devices. Related activities are discussed in the Descriptive Summary for the overall program element.

(U) WORK PERFORMED BY: The Aerospace Medical Division has overall program responsibility and delegates project management to the United States Air Force School of Aerospace Medicine, Brooks Air Force Base TX, and the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Adjusted for comparability with FY 83 manpower transferred to Program Element 65898F, Management Headquarters (R&D).

2. (U) FY 1982 Program: Adjusted for comparability with FY 83 manpower transferred to Program Element 65898F, Management Headquarters (R&D).

3. (U) FY 1983 Planned Program: Not applicable.

4. (U) FY 1984 Planned Program: Not applicable.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: 06MD Title: Aerospace Medical Division Laboratory Operations
Program Element: #62202F Title: Aerospace Biotechnology
DOD Mission Area: Environmental and Life Sciences (ED) #522 Budget Activity: Technology Base #1

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Program to Completion
RDT&E	18,286	18,738*	20,209	20,666	Continuing	Not Applicable

*Excludes 1 Oct 81 Civilian Pay Raise (4.8 percent)

8. (U) Comparison with FY 1982 Budget Date:

RDT&E	18,596	19,659	20,147		Continuing	Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62203F
DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Propulsion
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	51,173	53,918	58,645	60,547	Continuing	Not Applicable
06PP	Laboratory Operations	15,378	15,681*	16,681	16,982	Continuing	Not Applicable
3012	Ramjet Technology	6,295	5,863	6,461	7,403		
3048	Fuels, Lubes & Fire Prot	5,952	7,754	8,582	8,203		
3066	Turbine Engine Technology	15,955	16,269	17,346	18,485		
3145	Aerospace Power Technology	7,553	8,351	9,575	9,474		

* Excludes 1 Oct 81 civilian pay raise (4.8%)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element develops the propulsion and power technology in support of current and future aerospace vehicles and weapons systems. Exploratory development and component/subsystem evaluations are conducted in the technical areas of turbine engines, ramjet engines, fuels, lubrication, and fire protection technology as well as aerospace power generation, distribution and control technology. The program also provides for the operation and management of the Aero Propulsion Laboratory at Wright-Patterson Air Force Base OH.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program represents 3.1% real growth over FY 1982. This growth is reflected in increased emphasis in turbine engine components, ducted rockets, alternate fuels and space power systems. The major emphasis for FY 1983 will be in the following areas. Programs will be initiated for the development of compressors and turbines for high-bleed/high horsepower extraction for short and/or vertical take-off and landings. Efforts will continue on survivable aerospace power systems which will operate in the multi-threat environment. Tests will be completed to determine the effect of alternate fuels on fuels systems and turbine engine combustors. Programs will be undertaken to validate the variable cycle engine control system logic. Major emphasis in the Ramjet area will be on ducted rocket and solid fueled ramjets for tactical missile applications.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	51,900	55,000	72,000		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #62203F Title: Aerospace Propulsion
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Both contractual and in-house efforts will be accomplished. The turbine engine programs are geared to development and test of engine components and subsystems for timely inclusion in core gas generators and system responsive advanced development programs. The ramjet programs are designed toward making major technology thrusts in solid fueled ducted rockets and low cost ramjet propulsion systems for tactical missiles while continuing support of strategic air launched missiles. Aerospace power programs are geared toward advancing electrical, thermal, hydraulic, and mechanical power for USAF space systems, reentry vehicles, manned aircraft, missiles, munitions, and special high power systems. The area of fire protection concentrates on timely developments of effective fire prevention, detection, containment and suppression technology with minimum penalty to the prime mission. Aircraft and missile fuels and lubrication technology explores advancement of knowledge in combustion and lubrication phenomena in modern air breathing systems with a goal of improving efficiency and durability. To minimize cost and maximize availability of jet fuels, major projects in specification variability testing and alternate fuels will continue to receive increasing emphasis. This program element, in addition to being the primary technical base exploratory development effort in aerospace propulsion and power, provides technical support to other Air Force and DOD agency programs and receives partial reimbursement for the services provided. In the case of basic research accomplished by the laboratory, full reimbursement is provided by PE 61102F, Defense Research Sciences. The project break reflects the best estimate considering these anticipated reimbursements, but may require adjustment to the degree that reimbursements are actually earned.

(U) RELATED ACTIVITIES: This program receives information and technology from PE 61102F, Defense Research Sciences. It interacts with other exploratory development program elements and feeds PE 63202F, Aircraft Propulsion Subsystem Integration; PE 63211F, Aerospace Structural Materials; PE 63215F, Aviation Turbine Fuels Technology: PE 63216F, Advanced Turbine Engine Gas Generator; PE 63302F, Advanced Missile Propulsion; and others. Coordination with Army, Navy, National Aeronautics and Space Administration, Department of Energy, Department of Transportation, Environmental Protection Agency, industry and academia is accomplished by joint projects, information exchanges and standing committees, such as the Interagency Advanced Power Group and the National Aeronautics and Space Administration/Air Force semi-annual meetings.

(U) WORK PERFORMED BY: Work is managed and performed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. Other Air Force organizations involved are the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH; the Space Division, Los Angeles, CA; and Armament Division, Eglin Air Force Base, FL. There are 86 contractors with 190 contracts. The ten major contractors for the program in FY 1981 were: Pratt and Whitney Aircraft, East Hartford, CT and West Palm Beach, FL; Garrett Corp., Los Angeles, CA and Phoenix, AZ; General Electric Co., Evendale, OH and Lynn MA; Rockwell International Corp., Canoga Park, CA; Research Triangle Institute, Res Triangle Park, NC; Boeing Co., Seattle, WA; UOP, Inc., Des Plaris, IL; Detroit Diesel Allison Div., Indianapolis, IN; Marquardt Co., Van Nuys, CA; and United Technologies Corp., Sunnyvale CA.

Program Element: #62203F
DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Propulsion
Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Significant accomplishments included the demonstration of the advanced "high throughflow" compressor concept; extensive testing to validate the high-temperature durability and maintainability of the shingle and Lamilloy^R combustor liners; development of a high-pressure, single-stage centrifugal compressor; and the adoption by industry of a validated three-dimensional stress analysis to improve turbine blade mechanical reliability. Representative accomplishments in energy conversion included fabrication and demonstration of a multi-bandgap solar cell which shows a significant increase in efficiency over any currently used device, successful test of reserve lithium primary batteries for possible electrically driven remotely piloted vehicle applications, and developmen of a very high heat flux heat pipe system for use in thermal management on future high power spacecraft. Processing studies have confirmed technical and economic feasibility of jet fuels from domestic shale oil sources. Significant advancements in development of analytical and optical techniques for characterization of fuel and lubricant properties, performance of combustor modelling studies, and engine oil condition and wear analysis have been made and operationally implemented. Significant accomplishments have been achieved in ducted rockets, solid fuel ramjets, and high temperature-high performance ramjet combustors. Freejet testing of solid fuel ramjets and direct connect testing of ducted rockets have been accomplished. The Compressor Research Facility became operational.

2. (U) FY 1982 Program: Turbine engine programs will develop an advanced high-temperature augmentor for Joint Technology Demonstrator Engine evaluation in PE 63202F, and a low-cost, light-weight shingle liner concept. In-house testing of both contemporary and advanced compressor systems in the Compressor Research Facility will commence in FY 1982. New efforts include initiation of development of inductive energy storage for spacecraft, analysis of pulse power system requirements and power processing techniques for spacecraft applications. Advanced inverters, advanced motors and motor controls and advanced generator control units will be developed. A nonflammable hydraulic brake system for aircraft will be demonstrated. Alternate fuels programs will determine fuel property effects on combustors and fuel systems. A portable wear metal analyzer will be developed for field use. Two candidate On-Board Inert Gas Generator Systems (OBIGGS) will be ground tested. Multi-year programs initiated earlier will continue. Advanced variable fuel flow ducted rocket engine development offering thirty percent performance improvement will be initiated. Split fuel grain, reduced drag inlet, and non-ejectable port cover developments to support variable flow ducted rocket tactical missiles will be initiated.

3. (U) FY 1983 Planned Program: New component development programs are planned in both compressors and turbines for high-bleed/high-horsepower extraction requirements for short takeoff and/or vertical/short takeoff and landing system application. Previously described multi-year efforts will continue. New programs will demonstrate advanced aircraft auxiliary power systems, survivable power systems in a multi-threat environment, spacecraft thermal management, high power switch technology, and power conditioning for electronic warfare systems. Tests will be completed to determine fuel property effects on fuel systems and combustors. Feasibility for reprocessing synthetic MIL-L-7808 engine oils will be demonstrated. Fuel and lube property characterization, combustion diagnostics and fire and explosion hazard analyses efforts will continue. The emphasis on ducted rocket and solid fueled ramjet development

for tactical missile applications will continue. A program to develop and demonstrate an advanced solid fuel ramjet engine will be started. The cost difference from the FY 1982 Descriptive Summary will cause the elimination or delay of several new efforts in all areas and are described in the individual project summaries.

4. (U) FY 1984 Planned Program: Turbine engine programs will emphasize critical component developments supporting high-bleed propulsion system technology needs. A high-pressure-ratio, axi-centrifugal compressor will be developed. A light-weight, low-cost segmented combustor liner will be demonstrated. An integrated aircraft/propulsion control system will be demonstrated. Multi-year efforts previously described will continue. New programs will demonstrate high power density, longer life, survivable power systems including high energy spacecraft batteries, advanced electrical power control systems, advanced actuators, and advanced ground power systems. New efforts include development of processes to produce aviation turbine fuels from coal syncrude. Solid ramjet fuels and an engine mounted lubricant condition and wear metal monitoring system will be developed. An improved aircraft dry bay fire protection capability will be developed. Reduced signature combustor and advanced fuel controls for liquid fuel ramjet engines will be started for strategic missile applications.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #06PP
Program Element: #62203F
DOD Mission Area: Engineering Technology (ED) #523

Title: Aero Propulsion Laboratory Operation
Title: Aerospace Propulsion
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the support activities required to operate the Aero Propulsion Laboratory's exploratory and advanced development programs. The Laboratory provides technical support to current and future systems programs and undertakes operational support projects in its mission areas. The project provides for the pay and related costs for civilian employees, travel, transportation, rents, communications and utilities costs, and procurement of supplies.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element, as well as all other projects and programs managed by the Aero Propulsion Laboratory, such as PE 63202F, Advanced Propulsion Subsystem Integration; PE 63215F, Aviation Turbine Fuels Technology; PE 63216F, Advanced Turbine Engine Gas Generator; and others. Direct costs incurred by supported advanced development programs are reimbursed by those programs to this project.

(U) WORK PERFORMED BY: The Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH, is the organization responsible for management of the projects included under the program element.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable.

2. (U) FY 1982 Program: Not applicable.

3. (U) FY 1983 Planned Program: Not applicable.

4. (U) FY 1984 Planned Program: Not applicable.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Estimate to Completion	Total Estimated Costs
RDT&E	15,378	15,681	16,681	16,982	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: ($ in thousands)

RDT&E	14,185	15,727	16,093		Continuing	Not Applicable

Changes reflected in the FY 1983 program are due to the 1 October 1981 civilian pay raise.

Project: #3012 Title: Ramjet Technology
Program Element: #62203F Title: Aerospace Propulsion
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops ramjet component and engine technology to improve performance and reduce costs of tactical and strategic air-launched missiles. Ramjet propulsion concepts being evaluated include: variable fuel flow ducted rockets for tactical air-to-air missiles, boron fueled solid fuel ramjets, and high payoff components for liquid fuel ramjets for long range strategic missiles. These efforts include component development of inlets, gas generators, combustors, nozzles, fuel controls, and engine technology demonstrators. Emphasis is on solid fueled ducted rockets and solid fuel ramjets for tactical missile applications.

(U) RELATED ACTIVITIES: This program is closely coordinated and includes jointly funded efforts with: the Navy for solid fuel ramjets and boron fueled ducted rockets; the Air Force Rocket Propulsion Laboratory for hydrocarbon fueled ducted rockets; the Materials Laboratory for engine structures; and the Armament Division for tactical application studies. Ramjet technology supports PE 63302F, Advanced Missile Propulsion. This program focuses on the propulsion requirements of the Armanent Division at Eglin Air Force Base, FL and the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. Program coordination is maintained through meetings, conferences and the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Interagency Propulsion Committee.

(U) WORK PERFORMED BY: This project's in-house and contractual efforts are managed and performed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. The contractors in FY 1981 were: The Marquardt Co., Van Nuys, CA; Chemical Systems Division of United Technologies Corporation, Sunnyvale, CA; McDonnell Douglas, St. Louis, MO; Atlantic Research Corporation, Alexandria, VA; Hercules, McGregor, TX; Martin-Marietta Corporation, Orlando, FL; Boeing Aerospace Co., Seattle, WA; and Dynamics Research Corporation, Wilmington, MA. These contractors were involved in 32 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Significant accomplishments have been achieved in ducted rockets, solid fuel ramjets, and high temperature-high performance ramjet combustors. Freejet tests of solid fuel ramjets and direct connect tests of ducted rockets were made. Gas generators for variable fuel flow ducted rockets were developed. Freejet testing of advanced liquid fueled ramjet engines for strategic application was completed. Component development for advanced cruise missile variable geometry inlets and nozzles was initiated. Programs to evaluate advanced fuels and combustion instability were initiated.

2. (U) FY 1982 Program: Advanced variable fuel flow ducted rocket engine development offering thirty percent performance improvement will be initiated. Split fuel grain, reduced drag inlet, and non-ejectable port cover developments to support variable flow ducted rocket tactical missiles will be initiated. Solid fuel ramjet performance will be enlarged by initiation of bypass control and thrust flexibility programs. Investigation of swirl combustion and short carbon-carbon nozzles for strategic missiles will be initiated. Other on-going programs will be continued.

Project: #3012
Program Element: #62203F
DOD Mission Area: Engineering Technology (ED), #523

Title: Ramjet Technology
Title: Aerospace Propulsion
Budget Activity: Technology Base, #1

3. (U) FY 1983 Planned Program: The major emphasis on ducted rocket and solid fueled ramjet development for tactical missile applications will continue. A program to develop and demonstrate an advanced solid fuel ramjet engine will be started. New programs to develop advanced cruise missile combustor structures and advanced inlets will be undertaken. A new series of inlet, fuel system and combustor technology efforts will be initiated in support of a very high altitude defensive missile mission. Other multi-year on-going efforts will be continued.

4. (U) FY 1984 Planned Program: Programs described above and others will continue. Reduced signature combustor and advanced fuel controls for liquid fuel ramjet engines will be started for strategic missile applications. Advanced ducted rocket inlet, combustor, insulation, and nozzle demonstrations will be undertaken. Alternate solid fuel ramjet fuels and components will be initiated.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	6,295	5,863	6,461	7,403	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: ($ in thousands)

RDT&E	5,830	5,552	8,440		Continuing	Not Applicable

The decrease from the FY 1982 Descriptive Summary will cause a delay in initiating development of a liquid fueled ramjet engine for strategic missile application.

Project: #3048 Title: Fuels, Lubrication & Fire Protection Technology
Program Element: #62203F Title: Aerospace Propulsion
DOD Mission Area: Engineering Technology (AD), #553 Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Efforts under this project are oriented toward providing improved and economically available fuels, fuel management technology, lubricants and lubrication techniques, bearing and gear technology, and fire protection methods and techniques which will satisfy the stringent requirements of present and future aircraft and air-breathing missile systems. Approaches to meet the objectives of this project include investigation of processing techniques and understanding the constituents and characteristics of jet fuels produced from domestic resources (oil shale, tar sands and coal); development of fuels and lubricants with improved high temperature properties; development of high energy density fuels; development of analytical techniques for fuel (including combustion properties) and lubricant characterization; development of advanced bearing concepts including solid and gas lubricated configurations; and development of advanced on-board fire and explosion prevention, detection and suppression techniques.

(U) RELATED ACTIVITIES: This project provides technology for PE 62102F, Materials; PE 63202F, Aircraft Propulsion Subsystem Integration; PE 63215F, Aviation Turbine Fuels Technology; PE 63216F, Advanced Turbine Engine Gas Generator, and PE 63246F, Aircraft Subsystems Technology. Coordination with the Army, Navy, DARPA, National Aeronautics and Space Administration, Federal Aviation Administration, Defense Fuel Supply Center, the Fuels and Lubricants Standardization efforts of the North Atlantic Treaty Organization and the Department of Energy is accomplished by a broad spectrum of interactions and exchanges.

(U) WORK PERFORMED BY: The work is managed and performed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. There were 26 contractors and 35 contracts. The ten major contractors for FY 1981 were: The Boeing Company, Seattle, WA; UOP, Inc., Des Plaines, IL; Ashland Oil Co., Ashland, KY; AiResearch Manufacturing Co., Phoenix, AZ; Canadian Commercial Corp., Ottawa, Canada; Monsanto Research Corp., Dayton OH; University of Dayton, Dayton, OH; Exxon Research and Engineering, Linden, NJ; General Electric, Cincinnati, OH; and United Technologies Corp., East Hartford, CT.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The technology developed under this project has led to the qualification of Department of Defense fuels and lubricants such as JP-4, JP-5, JP-7, JP-8, JP-9, JP-10, RJ-6 and MIL-L-7808 (A thru H). Processing studies have confirmed technical and economic feasibility of jet fuels from domestic shale oil sources. Significant advances in the development of analytical and optical techniques for characterization of fuel and lubricant properties were made. Combustor modelling studies and engine oil condition and wear metal analysis have been made. Carbon slurry fuel formulation and combustion investigations, corrosion resistant engine bearing development and solid lubricated ceramic bearing development were initiated. Aircraft fire protection activities have led to improved fire detection and extinguishing systems for engines. Inerting and explosion suppression systems were developed.

Project: #3048 Title: Fuels, Lubrication & Fire Protection Techology
Program Element: #62203F Title: Aerospace Propulsion
DOD Mission Area: Engineering Technology (AD), #553 Budget Activity: Technology Base, #1

2. (U) FY 1982 Program: New efforts include additional alternate fuels programs to determine fuel property effects on combustors and fuel systems, tapered roller bearing development, and extensive ground testing of two candidate On-Board Inert Gas Generator Systems (OBIGGS). Multi-year programs initiated earlier will continue. Development of a portable wear metal analyzer for field use will be completed.

3. (U) FY 1983 Program: Tests will be completed to determine fuel property effects on fuel systems and combustors. Feasibility for reprocessing synthetic MIL-L-7808 engine oils will be demonstrated. Analysis and ground evaluation of an On-Board Inert Gas Generator System will be completed. New efforts include development of boron slurry fuels and fuel systems, a new technique for measuring lubricant load capacity and high speed air oil seals. Fuel system design techniques for minimizing electrostatic hazards will be investigated. Fuel and lube property characterization, combustion diagnostics and fire and explosion hazard analyses efforts will continue.

4. (U) FY 1984 Program: Efforts will continue to define and refine specifications for shale derived fuels and a new lubricant specification for advanced high temperature engine systems. New efforts will be initiated to develop processes to produce aviation turbine fuels from coal syncrude. Solid ramjet fuels development will continue. An engine mounted lubricant condition and wear metal monitoring system will be developed. Aircraft dry bay fire protection capabilities will be improved.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,992	7,754	8,582	8,203	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: ($ in thousands)

RDT&E	7,718	7,948	9,847		Continuing	Not Applicable

The decrease from the FY 1982 Descriptive Summary will cause a delay in initiating new efforts in fire protection suppression.

Project: #3066 Title: Turbine Engine Technology
Program Element: #62203F Title: Aerospace Propulsion
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops technology to increase operational reliability, cycle flexibility and performance and reduce fuel consumption, weight, acquisition and operational costs. Analytical and experimental efforts address fans and compressors, high temperature combustors, turbines and seals, controls, diagnostics, mechanical design techniques and environmental considerations. The project considers the total propulsion system (inlet, engine, nozzle) and its integration into a weapon system.

(U) RELATED ACTIVITIES: This project is coordinated with the Army, Navy, National Aeronautics and Space Administration, Department of Energy, and the Department of Transportation in meetings, inter-service committees and headquarters staff coordination. Component advancements are integrated into PE 63202F, Advanced Propulsion Subsystem Integration; and PE 63216F, Advanced Turbine Engine Gas Generator. Jointly funded programs with the Navy, National Aeronautics and Space Administration and the Materials Laboratory are developing advanced turbine engine component technology for future applications.

(U) WORK PERFORMED BY: Work is managed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. There are 14 contractors with 65 contracts. The ten major contractors in FY 1981 were: Cadre Corporation, Doraville, GA; Pratt and Whitney Aircraft, Division of United Technologies Corporation, East Hartford CT and West Palm Beach, FL; Garrett Corporation, Los Angeles, CA and Phoenix AZ; General Electric Company, Evendale, OH and Lynn, MA; Detroit Diesel Allison Division of General Motors, Indianapolis, IN; Calspan Corporation, Buffalo, NY; McDonnell Douglas Corporation, St. Louis, MO; Systems Control, Inc., Palo Alto, CA; Battelle Laboratories, Columbus, OH; and Rolls Royce, Ltd., Atlanta, GA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: An advanced high-through-flow compressor was demonstrated. Extensive testing validated the high-temperature durability and maintainability of the shingle and Lamilloy[R] combustor liners. A high-pressure, single stage centrifugal compressor was developed. Industry adopted a validated three-dimensional stress analysis to improve turbine blade mechanical reliability. A single stage, mixed-flow compressor with both axial and centrifugal flow characteristics was demonstrated. An augmentor stability analysis procedure was applied to an advanced augmentor design. Three-dimensional, low-aspect ratio turbine aerodynamics was successfully applied to an advanced turbine and resulted in a new high in turbine efficiency. Development emphasis since 1979 has been directed toward achievement of improved component structural durability and life through development and application of improved aeromechanical design and analysis methods, test methodologies, design criteria and performance prediction techniques. The Compressor Research Facility became operational.

Project: #3066
Program Element: #62203F
DOD Mission Area: Engineering Technology (ED), #523

Title: Turbine Engine Technology
Title: Aerospace Propulsion
Budget Activity: Technology Base, #1

2. (U) FY 1982 Program: In-house testing of both contemporary and advanced compressor systems in the Compressor Research Facility will commence in FY 82. An advanced high-temperature augmentor and a low-cost, light-weight shingle liner will be developed. Carbon-carbon composite structures will be applied to turbine components. Effort will continue on structural durability and life prediction improvements. Development of multivariate control logic will be initiated. Critical component technology for a high bleed propulsion system will be defined.

3. (U) FY 1983 Planned Program: New component development programs are planned in both compressors and turbines for high-bleed/high-horsepower extraction for short takeoff and/or vertical/short takeoff and landing system application. Programs to validate variable cycle control system logic, to assess advanced thermal coatings for turbine airfoil applications, and to incorporate aircraft/propulsion usage data into a reliable regression analysis models are also planned. The attachment of high performance blades will be investigated. Structural analysis and instrumentation development will continue.

4. (U) FY 1984 Planned Program: Turbine engine programs will emphasize critical component developments supporting high-bleed propulsion system technology needs. A high-pressure-ratio, axi-centrifugal compression system will be developed. A light-weight, low-cost segmented combustor liner will be demonstrated. Composite materials will be applied to critical attachment and interface regions. Realistic test procedures for accurate turbine durability assessment during the engine development process will be defined. Other new initiatives include advanced component development and design tools for small turbine engines and the development of an integrated diagnostic/control system.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	15,955	16,269	17,346	18,485	Continuing	Not Appliable

8. (U) Comparison with FY 1982 Descriptive Summary: ($ in thousands)

RDT&E	16,568	17,190	24,700		Continuing	Not Applicable

The decrease from the FY 1982 Descriptive Summary will cause a one-year delay in the start of critical component developments supporting the high-speed propulsion system and the delay of a number of small engine component developments.

Project: #3145
Program Element: #62203F
DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Power Technology
Title: Aerospace Propulsion
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project includes the development of solar power, fuel cells, batteries, hydraulics and power conversion, conditioning and transmission for both space and non-space applications. These analytical and experimental efforts form a balanced, broad base in power subsystem technology responsive to anticipated needs of aeronautical, missile, space and electronic systems including special ground power needs. General goals are increased power output, decreased weight and volume, decreased vulnerability, increased life and reliability, increased tolerance to environments, and provision of effective options in technology and capabilities for future systems application in the conceptual phase. The Aero Propulsion Laboratory provides a single point of technical management for these programs within the Air Force. A strong technological base has been established for these efforts by extensive work in prior fiscal years. This program emphasizes chosen options for specific power subsystem technologies to provide improved capabilities for near-term applications and more advanced technology for long-term Air Force power demands.

(U) RELATED ACTIVITIES: The Army, Navy, Department of Transportation, Department of Energy, and National Aeronautics and Space Administration have exploratory development programs in areas related to thiss project to support their respective and unique requirements for systems and supporting subsystems. Coordination is maintained at all levels through symposia, meetings, professional associations and the Interagency Advanced Power Group. This program receives inputs and provides technology for PE 61102F, Defense Research Sciences; PE 62102F, Materials; and PE 63401F, Space Vehicle Subsystems.

(U) WORK PERFORMED BY: Work is managed and performed by the Aero Propulsion Laboratory at Wright-Patterson Air Force Base, OH. Other Air Force organizations involved are the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH, and the Space Division, El Segundo, CA; Ballistic Missile Office, San Bernadino, CA; and the Air Force Engineering and Services Center, Tyndall Air Force Base, FL. There are 38 contractors with 58 contracts. The ten major contractors are: Rockwell International Corp., Canoga Park, CA; Research Triangle Institute, Research Triangle Park, NC; The Boeing Company, Seattle, WA; McDonnell Douglas Corp., St. Louis, MO; General Electric Co., Schnectady, NY; University of Dayton, Dayton, OH; San Jose State University Foundation, San Jose, CA; Southeastern Center for Electrical Engineering Education, St. Cloud, FL; The Garrett Corporation, Torrance, CA; and Eagle-Picher Industries, Inc., Joplin, MO.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Representative accomplishments in energy conversion included fabrication and demonstration of a multi-bandgap solar cell which shows a significant increase in efficiency over any currently used device. Reserve lithium primary batteries for possible electrically driven remotely piloted vehicle applications were tested. A very high heat flux heat pipe system for use in thermal management on future high power spacecraft was developed. Advances in the electrical system area have included development and demonstration of a 60KVA permanent magnet aircraft generator which is much simpler and more reliable than conventional devices. Repeated energizing of a niobium tin superconducting coil was demonstrated. Prototype hybrid power controllers were

Project: #3145
Program Element: #62203F
DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Power Technology
Title: Aerospace Propulsion
Budget Activity: Technology Base, #1

demonstrated at high ampere levels for use with large motor and electrical bus contractors. In-house testing validated the feasibility for use of a nonflammable hydraulic fluid in a system at 8000 psi. Analysis showed the system could give significant weight savings while eliminating costly aircraft hydraulic fires.

2. (U) FY 1982 Program: Major efforts include the development of inductive energy storage for spacecraft, analysis of pulse power system requirements and power processing techniques for spacecraft applications. Advanced inverters, advanced motors and motor controls and advanced generator control units will be developed. A nonflammable hydraulic brake system for aircraft will be demonstrated.

3. (U) FY 1983 Planned Program: Previously described multi-year efforts will continue. New programs will demonstrate advanced aircraft auxiliary power systems and survivable power systems in a multi-threat environment. Spacecraft thermal management systems will be developed. High power switch technology, and power conditioning for electronic warfare systems will be developed.

4. (U) FY 1984 Planned Program: Multi-year efforts previously described will continue. New programs will demonstrate high power density, longer life, survivable power systems, including high energy spacecraft batteries. Advanced electrical power control systems, advanced actuators, and advanced ground power systems will be developed.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	7,553	8,351	9,575	9,474	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: ($ in thousands)

RDT&E	7,599	8,583	12 920		Continuing	Not Applicable

The decrease from the FY 1982 Descriptive Summary will cause a delay in initiating efforts to demonstrate high power density, survivable power systems and advanced ground power systems.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62204F — Title: Aerospace Avionics

DOD Mission Area: Electronics and Physical Sciences (ED), #5[illegible] — Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	57,730	61,523	67,652	71,500	Continuing	Not Applicable
06AA	Air Force Avionics Laboratory Operations	24,470	25,152*	26,729	27,113		
2000	Active Electronic Countermeasures	3,284	4,000	4,300	6,150		
2001	Electro-Optical Technology	2,901	3,150	3,900	3,100		
2002	Microwave Technology	5,704	6,350	6,470	6,500		
2003	Avionics System Design Technology	3,550	4,150	3,915	4,200		
2004	Technology for Reconnaissance and Targeting Avionics	2,126	2,300	3,055	3,300		
6095	Inertial Reference and Guidance Technology	2,204	1,950	2,808	3,400		
6096	Microelectronics Technology	3,812	3,871	4,200	3,700		
7622	All-Weather Reconnaissance/Strike Avionics	3,373	3,950	4,950	7,050		
7629	Fire Control Avionics	2,120	2,150	2,475	2,500		
7633	Passive Electronic Countermeasures	3,034	3,400	3,675	3,000		
7662	Avionics Data Transmission and Reception	1,152	1,100	1,175	1,487		

* Excludes 1 Oct 1981 civilian pay raise (4.8%)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is the primary source of new concepts, feasibility demonstrations, and technology evaluation for the full spectrum of Air Force avionic system needs. Mission areas addressed include target detection and classification, fire control and weapon guidance, navigation, communication, jamming and deception of hostile defenses, system design and integration, and the crucial supporting technology of devices, circuits, and materials. Avionics advances have the potential to multiply weapon system effectiveness. Modern technology has also begun to yield enhanced reliability and reduced life cycle costs. The program also supports the operation and management of the Avionics Laboratory of the Air Force Wright Aeronautical Laboratories at Wright-Patterson Air Force Base, OH.

Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Aerospace Avionics
Budget Activity: Technology Base, #1

BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program represents 5.3% real growth over FY 1982. This growth is reflected in increased opportunities for new starts which will exploit new concepts in electronic warfare, avionic sensors, system integration techniques, and advanced devices and which have been deferred due to funding constraints in FY 1982 and earlier years. The program advances avionics hardware and software capabilities at the component, subsystem and system levels. In FY 1983, major emphasis will be placed on: technology improvements for synthetic aperture radars and forward-looking infrared sensors to improve resolution and allow automatic target acquisition and classification;

device, circuit, and system demonstrations for high reliability solid state phased array radars; inertial navigation components with improved accuracy and reduced cost; and improved devices for optical, microwave, and digital systems.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
RDT&E	56,700	64,600	76,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION NEEDS:

Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Aerospace Avionics
Budget Activity: Technology Base, #1

DETAILED BACKGROUND AND DESCRIPTION: Rapid advances in electronics and in the basic concepts and techniques of avionics are now being exploited to achieve major advances in the capability and support burden of military aircraft. Examples of radically new approaches to avionics systems include extensive use of embedded computers, compact solid state sources of microwave and optical energy, and architectural integration to achieve enhanced overall performance along with extended reliability and easier maintenance. The payoffs in combat aircraft include increased probability of target detection and destruction, improved survivability in the face of hostile defenses, reduced aircrew workload, and reduced life-cycle costs. This program is the primary vehicle for developing, evaluating, and demonstrating at the exploratory level the technology which will be essential to the avionics systems which will enter full scale development in the late 1980s and 1990s. The program includes the following eleven research and development projects:
Active Electronic Countermeasures: The objectives of this project are to

Electro-Optical Technology: This project develops lasers, detectors, and optical signal processing techniques for a wide range of detection, tracking, guidance, and defensive systems. Work includes tunable lasers for broad bandwidth coverage, advanced imaging infrared arrays and signal processors, components for laser radars, and integrated optical systems for compact, inexpensive signal processing. This basic component development leads to enhanced performance, increased reliability, and reduced size and cost in applications ranging from sensors for automatic target classification to optical gyroscopes.
Microwave Technology: This project develops solid state and thermionic sources, amplification and signal processing components, and circuit and system concepts at frequencies below 300 gigahertz. Emphasis includes extension of components and system technology into the millimeter wave region along with efforts to improve reliability and reduce hardware costs in the more familiar microwave frequencies. System uses for this technology include replacement of microwave tubes with solid state power devices, radar and electronic warfare systems, communication transmitters and receivers and compact, integrated microwave front ends.
Avionic System Design Technology: The objectives of this project include both advanced methods of designing, integrating and validating avionics systems and the facilities to simulate and evaluate such systems. The increasing use of embedded computers has created urgent needs for software support, while the high cost of testing places a premium on simulation techniques. This work produces both short term payoffs through improved design and acquisition of avionics software and longer term results as the basis for future integrated systems. In both cases, there is direct return on investment in the form of reduced life cycle costs, improved reliability, and easier upgrading of avionics suites.
Technology for Reconnaissance and Targeting Avionics: The objective of this project is to provide the basis for major advances in electro-optical and infrared systems for real-time reconnaissance, automated target classification and aircraft navigation and defense. Efforts include techniques for target pattern recognition, advanced sensors and signal processors, and extension of existing forward-looking infrared systems to higher resolution and multiple functions. This work is essential to support both tactical and strategic aircraft able to cope with high densities of targets and defenses and to achieve multiple kills per sortie against a numerically superior enemy.
Inertial Reference and Guidance Technology: The objectives of this project are to improve the accuracy of inertial navigation systems as needed for cruise missile and tactical strike weapons and to develop low cost, mass-produced

Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Aerospace Avionics
Budget Activity: Technology Base, #1

components for high volume applications such as tactical missiles and transport aircraft. The work includes ultra high precision accelerators and gyroscopes, low cost molded thermoplastic inertial components, and mathematical techniques for error compensation. This work is essential both to permit advanced strategic and tactical weapon systems to be built and to address the unacceptably high cost of present moderate-performance inertial navigation systems.
Microelectronics Technology: This project exploits selected solid state device and circuit technologies to achieve advances in information processing capacity, reliability, and radiation hardness. Work includes both advanced devices and materials, such as large scale gallium arsenide integrated circuits, and basic problems of packaging, testing, and design techniques needed to reduce cost and improve reliability in existing technology. The project is structured to complement developments in industry and other government laboratories by pursuing technologies not supported elsewhere. System payoffs include ultra fast front end data processors for real time surveillance systems; reduced size, weight, and cost of conventional microelectronic components; and tremendous expansion of data storage capacity in avionics systems.
All-Weather Reconnaissance/Strike Avionics: The objective of this project is to develop new techniques and systems for aircraft radars, including synthetic aperture radar for imaging and techniques for automatic target classification. This work complements the electro-optical sensor project in addressing the full spectrum of detection/classification sensors. Work includes an in-house signal processing laboratory, a unique flying testbed for synthetic aperture radar testing, and new counter-countermeasures to allow radar to defeat enemy electronic defenses. The project is essential to support next-generation penetrating attack aircraft, air superiority fighters, and covert (stealthy) operations which require minimized emissions to reduce detectability.
Fire Control Avionics: This project develops new techniques for delivery of air-to-air and air-to-ground munitions through integration of sensors, new fire control algorithms, and automation. Areas of work include expanded envelopes for missile and gun firing, automated battle management, and improved standardization and interoperability. Mission payoffs include higher weapon kill probability, multiple target attack, and improved survivability through firing range extension and evasive maneuvers. The effort is integrated with advanced sensor work under other projects.
Passive Electronic Countermeasures: The objective of this project is to increase aircraft survival by

Avionic Data Transmission and Reception: The objectives of this project are to develop improved methods for rapid information transmission to and from aircraft. Required capabilities include real-time transmission of imagery from reconnaissance platforms and secure, jam-resistant communications. This work includes signal processing techniques such as frequency agility, image compression for reduced data rates, and demonstration of jam-resistant hardware. The mission payoff includes the ability of the battle commander to receive intelligence in near-real-time and the ability of aircraft to communicate and coordinate activities in the presence of sophisticated enemy jamming.

Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Aerospace Avionics
Budget Activity: Technology Base, #1

(U) RELATED ACTIVITIES: Since this program is a broad technology base effort, technology transfer takes place between a large number of related program elements. The most significant of these, to or from which a significant number of efforts are transitioned, include: Defense Research Sciences, 61101E; Defense Research Sciences, 61102F; Materials, 62102F; Strategic Technology, 62301E; Command, Control, and Communications, 62702F; Advanced Avionics for Aircraft, 63203F; Reconnaissance Sensors/Processing Technology, 63208F; Space Vehicle Subsystems, 63401F; Advanced Space Communications, 63431F; Very High Speed Integrated Circuits, 63452F; Conventional Weapons, 63601F; Electronic Warfare Technology, 63718F; Advanced Communications Technology, 63727F; Air-to-Air Identification of Non-Cooperative Targets, 63742F; Electro-Optical Warfare 63743F; and Counter-Countermeasures Advanced Development, 63750F. Tri-Service and interagency coordination is continually accomplished. All electron device work is coordinated through the Advisory Group on Electron Devices which advises the Office of the Undersecretary of Defense for Research and Engineering. All work on fiber optics components and systems applications is coordinated through the Tri-Service Fiber Optics Coordinating Group. Developments in thermal imaging and image processing are coordinated through the Night Vision Technology Panel under the Joint Deputies for Laboratories Committee which, in turn, is under the Joint Logistic Commanders. Many areas of work are coordinated through the Air Force/National Aeronautics and Space Administration Interdependency Working Groups on Space and Aeronautics. Radiation hardening activities are coordinated through the Radiation Hardened Electronics Technology Coordinating Group. Work on flares and related devices is coordinated through the Tri-Service Pyrotechnics Coordinating Group. Infrared sensor developments are coordinated through the Joint Technical Coordinating Group on Thermal Imaging Sensors. Sensitive technology developments are controlled through the Coordinating Committee (COCOM) to prevent disclosure to hostile nations. The Laboratory participates in a Joint Air Force/Navy Radar Working Group, a Tri-Service Airborne Displays Working Group, and a Tri-Service Background and Targeting agreement originated by the Air Force Armament Laboratory. In the area of standardization, the Laboratory is active in the Bubble Memory Standardization Subcommittee of the Joint Electronic Devices Engineering Council and in national standards activities coordinated by the Society of Automative Engineers, especially in the area of aircraft data multiplexing systems. This extensive coordination activity ensures timely dissemination of progress to qualified parties and avoids wasteful duplication of efforts. Key program elements involved in this coordination include: Aircraft Avionics, 62202A; Electronic and Electron Devices, 62705A; Aircraft Avionics Equipment, 63702A; Night Vision Investigations, 62709A; Night Vision Advanced Development, 63710A; Electron Device Technology, 62762N; Avionics, 63203N; and Countermeasures Technology, 62734N.

(U) WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, manages the work performed under this program. Specialized facilities operated by the Avionics Laboratory in support of this program include: The Electronic Warfare Anechoic Chamber, Electronic Defense Evaluator, Dynamic Electromagnetic Environment Simulator, Dynamic Analyzer, Computer-Aided Design Facility, Mobile Evaluation Laboratory, Reference System Software and Evaluation Laboratory, 100-inch Collimater, Laser Research Laboratory, Radar Reflectivity Measurement Facility, Targeting Systems Characterization Facility, Global Positioning System Evaluation Facility, Ring Laser Gyro Laboratory, Communications Systems Evaluation Laboratory, Microelectronics Laboratory, Avionics Simulation and Integration Laboratory, and Radar Signal Processing Laboratory. The ten major contractors were: Hughes Aircraft Corp., Malibu, CA; Environmental Research Institute of Michigan, Ann Arbor, MI; Texas Instruments, Dallas, TX; Raytheon Corp., Bedford, MA; Systems Research Labs, Dayton, OH; Northrop Corp., Rolling Meadows, IL; Goodyear Aerospace Corp., Litchfield Park, AZ; Systron Corp., Dayton, OH; Honeywell Inc., Minneapolis, MN; and Westinghouse Electric Corp., Baltimore, MD. There were 100 other contractors. The total number of contracts was 256.

Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Aerospace Avionics
Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Active Electronic Countermeasures project highlights include the following.

Electro-Optical Technology highlights include the first growth of large, high quality crystals for tunable solid state lasers, demonstration of solid state laser pumping diodes to permit all-solid-state high power laser systems, and advances in chemical and carbon dioxide lasers for optical tracking and countermeasure systems. In addition, improved charge-coupled device sensor arrays and integrated optical spectrum analyzers were demonstrated establishing the feasibility of real-time imaging, tracking, and signal sorting systems.
Microwave Technology project advances were made in the state-of-the-art of solid state components, including field effect transistors and avalanche diodes. Among the achievements were higher power, extension of frequency coverage to millimeter wavelengths, efficiency improvements sufficient to make system applications feasible, and fundamental reliability improvements.

Detectors, mixers, and other components were extended in frequency and improved in noise performance.
Avionic System Design Technology project highlights include completion of major portions of the software design environment for new embedded computer languages and issue to dozens of qualified defense users. Military standards for computers, data transfer busses and software languages were developed or improved, and their employment in systems was supported with data and design expertise. Essential preparatory work was initiated to support the PAVE PILLAR integrated avionics program which begins in FY 1982.
Technology for Reconnaissance and Targeting Avionics achievements include completion of the Real Time Three Dimensional Target Classifier program and Phase 1 of the Forward Looking Active Classification Technology program. These results establish the feasibility of automated targeting to permit rapid, multiple-kill strikes by low level penetrating attack aircraft. In addition, new detector and signal processor concepts for forward-looking infrared sensors were demonstrated which prove that resolution, field of view, and navigational precision can be improved by factors of two to ten over current technology.
Inertial Reference and Guidance Technology progress included initiation of brassboard demonstrations of high precision ring laser gyroscopes for advanced cruise missiles. A unique in-house testing facility for key components of such systems was established. This capability is being used by other Services and industry to solve materials and fabrication problems limiting the accuracy of optical gyroscopes. The feasibility of molded inertial navigation components costing one third or less the price of conventional units has been proven, and test data on a variety of models has confirmed their operational suitability. Development of techniques for mathematically correcting gravitational errors was begun to eliminate this limit on ultra high precision inertial navigation for strategic weapon systems.
Microelectronics Technology highlights include the following. Basic demonstrations of radically new high speed, low power integrated circuits, based on gallium arsenide and silicon metal-semiconductor field effect transistors, have proven feasibility of these components for real-time processing of the enormous data rates produced by surveillance sensors, electronic warfare pulse sorters, and similar systems. Design was begun on magnetic bubble memory with sub-

Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Aerospace Avionics
Budget Activity: Technology Base, #1

stantially greater capacity than is currently available to permit onboard storage of terrain data, reconnaissance imagery, etc. Chip demonstrations of complex signal and image processing schemes have established the feasibility of a new class of real-time processors.
All Weather Reconnaissance/Strike Avionics project highlights include the world's first successful demonstration of bistatic, imaging synthetic aperture radar, a breakthrough which is essential to covert penetration of defenses by tactical attack aircraft. In addition, new methods were developed for extracting target signatures from synthetic aperture radar data which prove the feasibility of automated targeting with such sensors. Progress was also substantial on such advanced radar techniques as spread spectrum counter-countermeasures and ultrahigh resolution imaging.
Fire Control Avionics progress included completion of flight tests on an advanced electro-optical fire control system, a multiple reference gunsight, and a relative velocity gunnery system. These results prove that air-to-air and air-to-ground weapon delivery profiles can be greatly expanded to increase probability of kill, allow more effective evasive maneuvering, and permit successful engagement in a wider range of encounter geometries. Other work on expanding missile launch envelopes and on coupling fire control to flight controls will allow next generation aircraft to fly more survivable sortie profiles and to attack more targets per pass.
Passive Electronic Countermeasures highlights include the following.

Avionics Data Transmission and Reception project progress included completion of technology development for the HAVE QUICK jam-resistant airborne communication system and successful demonstration of a new interference suppression filter which solves a major operational problem with aircraft radios. This will be used by both Air Force and Navy aircraft. Another effort successfully demonstrated jam-resistant hardware for transmitting data to and from guided weapons whch is essential for stand-off range attack of defended targets.

2. FY 1982 Program: Active Electronic Countermeasures highlights include

Electro-Optical Technology highlights include completion of the development of the optical frequency doubling crystal known as "KTP" and initiation of follow-on work in infrared lasing materials, all with the goal of producing a broadband tuning capability for optical sources used in targeting and jamming applications. Efforts will be initiated on improved detectors for optical countermeasures systems, imaging sensors, and tracking systems. A broadband chemical laser will be completed and evaluated as a source for defensive systems against optically guided weapons.
Microwave Technology highlights include initiation of a multi-year program to reduce costs, enhance reliability, and establish qualified industrial sources of gallium arsenide field effect transistors which have become key components

Program Element: #62204F Title: Aerospace Avionics
DOD Mission Area: Electronics and Physical Sciences (ED), #521 Budget Activity: Technology Base, #1

in a wide range of microwave systems. Expanded approaches to thermionic power generation in the millimeter wave region and to extremely broadband microwave amplifiers will be started. Solid state sources and associated receiver components for the 100 to 300 gigahertz region will enter development. Work will continue on circuit and manufacturing techniques to reduce the cost of microwave systems such as monolithic modular phased array radars and satellite communication sets.
Avionic System Design Technology highlights include initiation of hardware and software development for an electronic terrain map system for effective, real-time cockpit navigation displays. The capabilities of the avionic simulation facility will be enhanced to support the Avionics Laboratory thrust in integrated avionics. Work will continue on software support tools for embedded computers, feasibility models for high level programming languages, and application of avionics standards. This will result in reduced life-cycle costs and enhanced supportability in next-generation avionics suites.
Technology for Reconnaissance and Targeting Avionics project highlights include completion of data analysis under the forward looking active classification technology project which establishes techniques for automated targeting with infrared sensors. The first phase of a laser radar technology development program will begin, aimed at developing a new generation of infrared acquisition and tracking systems. Work will begin on a multiband staring sensor for improved target detection in adverse weather, smoke, or dust. A study of forward looking infrared sensor fields of view and target identification will complete and feed into a variety of advanced development efforts to provide high resolution, automated targeting sensors for increased tactical strike effectiveness.
Inertial Reference and Technology project highlights include initiation of a real-time gravity compensation demonstration. This is essential to remove an error source which prevents current inertial navigation systems from achieving the accuracy needed by advanced cruise missiles and other strategic airframes. Work will continue on low cost molded technology to extend the cost savings from single sensors to complete inertial navigation units. A multifunction navigation radio development will begin. A study to establish methods of achieving ultrahigh accuracy inertial systems will be completed, and the results will be carried into advanced development.
Microelectronics Technology project highlights include initiation of a large scale integration effort for linear circuits to extend the technology of digital microelectronics into areas of analog signal processing. Work will continue on extended temperature range magnetic bubble memories and on nonvolatile high speed memories, both of which are crucial to the implementation of advanced aircraft and space electronic systems. Development will also continue on high speed analog-to-digital converters and on gallium arsenide integrated circuits, both of which have high potential payoff in high data rate systems such as real time space surveillance.
All-Weather Reconnaissance/Strike Avionics project highlights include the start of development of

The flying testbed for synthetic aperture radars which has evolved in previous years will be upgraded to support crucial demonstrations of bistatic and high resolution operation needed to validate planned avionics suites for next-generation combat aircraft. Work will continue on automatic target classification and in-house signal processing facilities.
Fire Control Avionics project highlights include completion of studies on visual-range identification-friend-or-foe techniques and fire control for advanced air-to-ground weapons. The results of these analyses are needed to support both advanced development projects and planning for next-generation avionics. Also scheduled for completion is the electro-optical threat sensor effort which has been jointly conducted by the Air Force Avionics and Weapons Laboratories and the Army Missile Command to address common needs for ways to counter optical tracking and weapon guidance systems. Work will begin on a sensor blending scheme to couple aircraft sensors and flight controls for extremely low

Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #522

Title: Aerospace Avionics
Budget Activity: Technology Base, #1

level penetration of enemy defenses and on new techniques and software for battle management, including multiple target attack.
Passive Electronic Countermeasures project highlights include

Avionic Data Transmission and Reception project highlights include initiation of an adaptive interference cancellation development to address problems of incompatibility and self-jamming being experienced with current radio equipment. Another new effort will pursue design of a laser-based airborne optical communication system for secure, high capacity information transmission. Work will continue on spread spectrum and frequency hopping techniques needed for secure data links and communications networks.

3. FY 1983 Planned Program: The Active Electronic Countermeasures project will

The Electro-Optical Technology project will complete a gallium-aluminum-arsenide optical sensor array for high sensitive imaging systems. Work will begin on halide chemical lasers and on improved mercury-cadmium-telluride hybrid focal plane arrays, both of which have high potential for advanced targeting and guidance systems, and a bistable optical element for extremely high speed signal processing will be demonstrated.
The Microwave Technology project will select the most promising solid state and thermionic sources of millimeter wave power explored in previous years and begin intensive development to meet the needs of detection, tracking, guidance, and countermeasures systems. Work will continue on improved microwave diodes and transistors and on monolithic microwave integrated circuits which can greatly reduce costs in radar and communications systems.
The Avionics System Design Technology project will begin development of simulation facilities for the avionics suite of the unconstrained tactical fighter and on a fiber optic multiplexing system to provide the high data rates needed in integrated avionics architectures. Work will complete on an effort to advance head-up display technology to the performance level needed by the next tactical fighter. Work will continue on design of fault- and damage-tolerant avionics configurations.
The Technology for Reconnaissance and Targeting Avionics project will complete the initial phases of a laser sensor development and begin testing under simulated flight conditions. An effort wil begin which builds on previous optical sensor and target classification work to complete the technology development in time to support full scale development of the next combat aircraft generation. Work will continue on advanced, multi-band infrared sensors.
The Inertial Reference and Guidance Technology project will begin flight test of the gravity error correction techniques developed in FY 1981 and 1982. Work will begin on a prototype demonstration of high precision, optical gyroscope-based inertial navigation unit and on signal processing methods to increase satellite positioning system receiver accuracy to levels needed both for covert tactical strike missions and for precision strategic weapon system navigation.
The Microelectronics Technology thrust will begin an effort to demonstrate complex signal processing integrated circuits based on silicon metal-semiconductor transistors which eliminate the most radiation-vulnerable problem of present

Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Aerospace Avionics
Budget Activity: Technology Base, #1

technology. Work will continue to extend high speed gallium arsenide integrated circuits to higher levels of complexity to develop design, packaging, and testing methods required by complex microelectronic components; and to perfect real-time image processing components for tactical targeting systems.
The All-Weather Reconnaissance/Strike Avionics project will complete demonstration of an automatic classifier able to distinguish tracked from wheeled vehicles. The upgraded synthetic aperture radar flying test bed will be used to collect data needed for design of the COVERT STRIKE attack aircraft. Assessment of

The Fire Control Avionics project will begin design of fire control systems identified by the Air Force Armament Division as needed for weapon delivery in the next generation of tactical attack aircraft. Work will continue on weapon delivery methods which are compatible with stealth requirements, and on software and modelling studies to develop expanded and more effective fire control profiles.
The Passive Electronic Countermeasures project will

The Avionics Data Transmission and Reception project will demonstrate in brassboard form an agile transversal filter which will be a key factor in implementing communication links which are secure against interception and jamming. Work will begin on systems exploiting advanced microelectronic components to improve performance and reliability while reducing size and power consumption. Efforts on implementing signal processing and data link control software in higher order languages to reduce costs and improve long-term supportability will begin. The reduction in the FY 1983 RDT&E request from the previous Descriptive Summary defers new starts in most of the projects described above.

4. FY 1984 Planned Program: The Active Electronic Countermeasures project will

The Electro-Optical Technology project will initiate development of a high power tunable laser for the 0.5 to 0.9 micrometer wavelength band and of precision optical components for ultrahigh accuracy inertial navigation components. Demonstration of high speed switching using bistable optical devices will be completed.
The Microwave Technology project will exploit the best results of earlier millimeter wave device studies to begin development of high power solid state sources for detection, tracking, and countermeasures applications. Work will continue on circuit techniques for cost reduction in solid state phased array radars.
The Avionic System Design Technology project will complete development of a graphics generator brassboard and fiber optic multiplexing scheme for advanced cockpit displays as part of an integrated avionics suite. Work will continue on software techniques for avionics data processors and on simulation techniques to evaluate new concepts and components.
The Technology for Reconnaissance and Targeting project will begin development of an integrated sensor system which blends radar and infrared signals to enhance target detection and classifcation. Work will continue on techniques for automated target identification, including rooftop and airborne testing against real and decoy targets.
The Inertial Reference and Guidance Technology project will complete development of a high accuracy accelerometer

Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Aerospace Avionics
Budget Activity: Technology Base, #1

brassboard. Work will continue on techniques to correct gravity-induced errors in inertial navigation systems. An effort will be started to develop an advanced ring laser gyroscope to carry inertial navigation accuracy to levels needed by aircraft and missiles.

The Microelectronics Technology project will initiate brassboard demonstrations using complex gallium arsenide signal processing integrated circuits. Work will continue on radiation-hard silicon integrated circuits for large scale signal processing and analog-to-digital conversion applications and on nonvolatile memories.

The All-Weather Reconnaissance/Strike Avionics project will extend previous work on automatic target classification to cover advanced radar modes, including bistatic operation and millimeter wave frequencies. Work will begin on demonstration of techniques for focussing sythetic aperture radar data to obtain maximum resolution and real-time operation.

The Fire Control Avionics project will begin a group of projects, based on the most promising results from previous work, to develop weapon delivery techniques which complement evolving advances in sensors. Examples include coupling of fire control and radar systems for air-to-air combat and techniques for exploiting synthetic aperture radar imagery for targeting of precision air-to-ground munitions.

The Passive Electronic Countermeasures project will [

The Avionic Data Transmission and Reception project will complete and test a millimeter wave data link breadboard. Results of the adaptive interference rejection effort will be evaluated, and the preferred approach will be transitioned to advanced development. Work will continue on methods of encoding data transmission for jam-and-interception-resistant communications.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

Project: #06AA
Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Air Force Avionics Laboratory Operations
Title: Aerospace Avionics
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the support activities required to operate the Air Force Avionics Laboratory, Wright-Patterson Air Force Base OH. The Air Force Avionics Laboratory is responsible for research, exploratory and advanced development programs concerned with navigation and guidance, weapon delivery and fire control, reconnaissance and aerospace surveillance, aerospaceborne communications, electronic countermeasures, avionic systems architecture and integration, and electronic and electro-optical device technology. The laboratory provides technical support to current and future systems programs and undertakes operational support projects in its mission areas. This project provides for the pay and related costs of civilian scientists, engineers, and support personnel; travel; transportation of equipment; rental equipment; communications and utilities cost; procurement of supplies and equipment; duplication and reproduction services; and contractor support services for maintenance and modification of facilities.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element as well as other projects and programs managed by the Air Force Avionics Laboratory including: Advanced Avionics for Aircraft, 63203F; Reconnaissance Sensors/Processing Technology, 63208F; Very High Speed Integrated Circuits; 63452F; Electronic Warfare Technology, 63718F; Advanced Communications Technology, 63727F; Air-to-Air Identification of Non-Cooperative Targets, 63742F; Electro-Optical Warfare, 63743F; Counter-Countermeasures Advanced Development, 63750F; and Advanced System Integration Demonstrations, 63253F.

(U) WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson Air Force Base OH, is responsible for the management of the projects under this program element.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: This support program has played a crucial role in providing the technical staff, facilities, and related activities without which the research and development activities of the Avionics Laboratory would be impossible.

2. (U) FY 1982 Program: Improvements will be made to several in-house facilities, including the electronic warfare simulation laboratory and the avionics system assessment and integration laboratory. Support for the civilian staff of the Avionics Laboratory and for supporting activities will continue.

3. (U) FY 1983 Planned Program: An orderly program to upgrade the facilities and equipment of the Avionics Laboratory will continue. Support for the civilian staff and for supporting activities will also continue.

4. (U) FY 1984 Planned Program: Facility upgrade activities will continue. Support for the civilian staff and for supporting activities will also continue.

Project: #06AA
Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Air Force Avionics Laboratory Operations
Title: Aerospace Avionics
Budget Activity: Technology Base, #1

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	24,470	25,152	26,729	27,113	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Budget Data:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	23,285	25,446	25,852	Continuing	Not Applicable

Changes are reflected in the FY 1982 and FY 1983 program due to the additive cost of the 1 Oct 1981 civilian pay raise and revised estimates of reimbursement for support provided to other programs and agencies.

Project: #2002
Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Microwave Technology
Title: Aerospace Avionics
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Microwave components are the heart of all radar, electronic countermeasures, and communications systems. When these components fail, aircraft and missile radars can't find targets, aircraft radars can't do terrain following and terrain avoidance, electronic countermeasures can't detect and jam threats, and communications break down. This project develops the technology to improve airborne microwave device and subassembly performance, improve their reliability, and decrease their costs. The scope of activity extends from critical microwave device development through selected equipment feasibility demonstrations of microwave sources, circuits, antennas, radomes, and sensor techniques. Some of the current needs being addressed follow. Solid state microwave power sources and detection devices with higher power output, lower noise, better efficiency, higher frequency of operation, and wider bandwidth are required for replacement of low and medium power microwave tubes in aircraft and missile radars, electronic countermeasures receivers and transmitter front ends, and aerospaceborne communications sets. High power microwave tubes need longer life, higher power, lower cost and wider bandwidth for electronic countermeasures and aircraft multifunction radar applications. All solid state phased arrays are being developed to completely replace tubes in aircraft and multifunction radars, increasing radar performance and reliability. The millimeter wave technology base is being actively developed for missile terminal guidance, countermeasures, and spaceborne communications applications. Microwave solid state components and microwave integrated circuits will be pursued with the goal of maturing the technology for standardization, proven reliability, and widespread industrial availability for lower cost.

(U) RELATED ACTIVITIES: The Army, Navy, Defense Advanced Research Projects Agency, and National Aeronautics and Space Administration have exploratory development programs in microwave technology. These programs support their specific requirements and complement the work in this project. The DOD Advisory Group on Electron Devices coordinates each effort in this project. The Microwave Working Group of the Advisory Group on Electron Devices considers in detail the efforts of the above agencies and the Air Force in microwave technology. Efforts are examined for technical merit and to prevent duplication of effort. Several current areas under this project are coordinated under the Air Force/National Aeronautics and Space Administration Interdependency Working Group. In addition, symposia and informal contacts among government workers within these agencies further insured full coordination of the efforts. Related activities include: Advanced Avionics for Aircraft, 63203F; Electronic Warfare Technology, 63718F; Advanced Attack Weapons, 63609F; and Advanced Space Communications Technology, 63431F.

(U) WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH is the organization responsible for the management of this project. In-house facilities available to support this project include a near field antenna and radome measurement facility and a microwave technology laboratory for device, circuit, and microwave subassembly design, fabrication, test, and evaluation. The ten largest contractors for FY 1981 were: Hughes Aircraft Company, Torrance, CA; Raytheon Company, Bedford MA; Northrop Corporation, Rolling Meadows IL; Varian Associates, Beverly MA; L.N.R. Communications, Inc., Hauppage NY; Texas Instruments, Inc., Dallas TX; The University of Michigan, Ann Arbor MI; TRW Systems Group, Redondo Beach CA; Georgia Institute of Technology, Atlanta GA; and TRW, Inc., Redondo Beach CA. There were 14 other contractors. The total number of contracts was 42.

Project: #2002
Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Microwave Technology
Title: Aerospace Avionics
Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Substantial progress has been made in the power, efficiency, reliability and frequency coverage available from gallium arsenide solid state devices. Powers and efficiencies sufficient to allow replacement of vacuum tubes in low to medium power applications such as missile seekers and satellite transmitters have been demonstrated. Examples include a power combiner producing 390 watts peak power from multiple diodes and a field effect transistor yielding 6 watts, both at X-band. The move to solid state allows systems to be smaller and less power consuming while eliminating high voltage power supplies and lifetime-limiting wearout mechanisms of tubes. Progress has also been rapid in low power devices for receiver and signal processor applications. Examples include low noise field effect transistors at frequencies up to 33 gigahertz and monolithic gallium arsenide integrated circuits which offer the same performance as older solid state circuitry but in much smaller space and at one-quarter or less the cost. Much of this technology has evolved in support of a solid state active aperture phased array radar which is expected to be the basis for new aircraft radars starting in the late 1980s, and which critically depends on this device and circuit work to achieve required performance and cost. At high power levels where solid state sources do not yet exist, work has continued on thermionic (tube) devices. Radically new tube concepts have been evolved for power generation in the millimeter wave frequencies where urgent requirements have been identified for detection and countermeasures systems. Progress has also been made on tube components and manufacturing techniques to extend lifetime and performance while lowering cost. Examples include completion of a crossed-field amplifier for a multimode radar system and a new meanderline coupled cavity circuit for a millimeter wave electronic countermeasures transmitter at 45 gigahertz. Other work has advanced the technology of mixers, circulators, antennas, and other key components of microwave systems to lower noise figures, broader bandwidths, and higher efficiencies. The sum of this effort is a broad improvement in the many technical areas needed to make advanced microwave systems practical and affordable.

2. (U) FY 1982 Program: Work on both gallium arsenide and silicon solid state sources and amplifiers will continue. Efforts will begin to develop field effect transistors capable of 8 watts at 10 gigahertz and 30 watts at 4 gigahertz and on avalanche diodes to produce high power at frequencies from 10 to 94 gigahertz. A major effort in solid state circuits will begin in support of a full-scale solid state phased array radar demonstration. Advanced fabrication techniques for solid state millimeter wave sources will be investigated. Work will continue on extremely broadband tubes for electronic countermeasures systems including helix tubes for the 20 to 40 gigahertz band and coupled cavity tubes at 40 to 60 gigahertz. Peniotron and gyro-travelling wave tube devices demonstrated in previous years will be emphasized for millimeter wave power generation. Also in the millimeter wave region, both active and passive receive components will be investigated, principally for countermeasures applications. These include an integrated 94 gigahertz transceiver which will demonstrate the ability to package sophisticated signal processing capabilities in very small volumes with the potential for low cost batch fabrication. Work will continue on cathodes, interaction circuits, and other tube components to increase both lifetime and performance. Efforts will also be initiated or continued on high speed tuning components, low noise mixers, and detectors for electronic warfare, radar, and communication system applications.

Project: #2002
Program Element: #62204F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Microwave Technology
Title: Aerospace Avionics
Budget Activity: Technology Base, #1

3. (U) FY 1983 Planned Program: High power avalanche diodes will be demonstrated at 10 and 20 gigahertz for both communication and electronic countermeasures transmitters. Work will continue to extend solid state power capability at frequencies up to 300 gigahertz. Initial demonstrations of millimeter wave countermeasures tubes at 20 to 40 and 40 to 60 gigahertz and of a 1 kilowatt travelling wave tube at 8 to 18 gigahertz will occur. An effort will begin to develop a long shelf life radar tube for missile applications. Solid state sources and power combining circuit will continue to develop with the goal of replacing tubes in radar, communication, and countermeasure systems. One specific goal is a transistor power combiner producing 100 watts at 10 gigahertz. Work will continue on components and measurement techniques vital to the design and construction of a variety of millimeter wave systems. Work on the 94 gigahertz integrated transceiver will continue. New efforts will pursue microwave/optical techniques for high speed and broad bandwidth in receivers, a 5 to 20 gigahertz solid state transmit/receive array for radar and countermeasures systems, and a phased array satellite communication antenna.

4. (U) FY 1984 Planned Program: The 94 gigahertz integrated transceiver will be completed and tested. Efforts will continue to raise power levels and efficiencies of solid state sources at a variety of system application frequencies up to 300 gigahertz, emphasizing the millimeter wave bands at 35 and 94 gigahertz. Previous years' work on millimeter wave tubes will be exploited in one or more new efforts to advance the technology to the degree needed for radar and countermeasures systems. Work will continue on monolithic gallium arsenide integrated circuits for cost reduction in phased array radars and communication systems. Device and circuit tasks in support of the full scale solid state phased array demonstration will also continue.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,704	6,350	6,470	6,500	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
RDT&E	5,700	6,700	8,300		Continuing	Not Applicable

Reduced funding in this project in FY 1983 compared to the FY 1982 Descriptive Summary reflects a drop in total funding for Program Element 62204F and will result in reduced scope or deferred start for a number of planned efforts, particularly in the area of high power solid state sources.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62205F
DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Training and Simulation Technology
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	12,942	13,964	18,545	18,271	Continuing	Not Applicable
06HT	Laboratory Support	5,524	5,029*	5,766	5,895		
1121	Technical/Team Performance Training	1,044	1,345	1,855	1,966		
1123	Flying Training Development	659	927	1,400	1,400		
1192	Advanced Simulator for Pilot Training	4,694	4,697	6,024	5,405		
1710	Weapon Systems Logistics & Combat Maintenance	996	1,633	2,300	2,405		
6114	Simulation Techniques for Air Force Training	25	333	1,200	1,200		

* Excludes 1 Oct 1981 Civilian Pay Raise (4.8%)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will improve operational readiness through more effective training and increased weapon system supportability. It consists of efforts grouped under the following three catagories: TRAINING DEVICES AND SIMULATION, EDUCATION AND TRAINING, and HUMAN FACTORS. Significant opportunities exist for improving flying and technical training effectiveness with flight and maintenance simulators. A major research thrust is under way using the Advanced Simulator for Pilot Training, a large field-of-view visual flight simulator. This simulator is used to conduct research to develop innovative methods for flight simulator training in general and to develop innovative techniques for training tactics used in air-to-ground, and air-to-air combat. Improved flight simulator hardware is being developed to support these training research requirements. Another major research effort investigates techniques for making maintenance training more cost effective by developing and evaluating maintenance training simulators. These devices permit the simulation of malfunctions and allow hands-on maintenance training and trouble-shooting to take place without tying up or damaging expensive operational hardware. A second major research thrust concerns the logistics support of weapon systems and improvements that can be made by determining the interactions between the human elements of logistics and the associated characteristics of weapon systems. A unified data base for each emerging weapon system will be designed to replace the multiple logistics data bases currently used. This will allow designers highly consistent and accurate information for use in design trade-off studies. Also very critical work will be done in the area of crew, group, team and unit performance and training. This will concentrate on Command and Control (C^2) systems used in the NATO environment. The support of the Air Force Human Resources Laboratory, Brooks Air Force Base TX, is partially funded by this program element. The Research and Development efforts are coupled directly with the major command training programs, with programs conducted by the Aeronautical Systems Division and with Army and Navy programs.

Program Element: #62205F
DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Training and Simulation Technology
Budget Activity: Technology Base, #1

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program represents 33.2% real growth over FY 1982. This growth is based upon a conscious decision to increase needed research in flight simulation and training, command and control team training and logistics research efforts. The Advanced Simulator for Pilot Training (ASPT) requires specifically increased funding in FY 1983 in order to replace worn out visual display hardware. More detailed information about the FY 1983 increased funding requirements is presented under the FY 1983 Planned Program section and also the Project 1192 section. This program includes the exploratory development of simulator helmet-mounted display technology, improved moving target generation capability in the Advanced Simulator for Pilot Training (ASPT) at Williams AFB AZ, ASPT visual display refurbishment, and greatly expanded training effectiveness research for flight simulator specifications. Successful results of these projects will be transferred to both advanced development simulation demonstration programs and directly to MAJCOM (TAC, SAC, MAC, ATC) training operations. The goal of all these efforts will be increased combat readiness through more effective combat mission training. An equally important aspect of the program involves research to improve weapon system supportability, maintenance, and logistics. Specific efforts include analysis of factors to improve wartime maintenance, evaluation and development of prototype maintenance simulators, development of a triservice computer-based instructional system, integration of logistic support factors into early weapon system design, and improvement of command and control team training and performance. Again, many successful results are transferred directly to MAJCOM (AFLC, etc.) users.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	12,500	16,200	18,500		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #62205F
DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Training and Simulation Technology
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program addresses two of the three principal thrusts of the Air Force Human Resources Laboratory (AFHRL): (1) Air Combat Tactics and Training and (2) Weapon System Logistics, Maintenance, and Technical Training. These thrusts are included in the major categories of TRAINING DEVICES AND SIMULATION, EDUCATION AND TRAINING, and HUMAN FACTORS. The first thrust will help provide, through the use of flight simulators, trained aircrews capable of operating aircraft effectively under both peacetime training conditions and war time combat conditions. The greatest benefit from this thrust will be an expanded combat training capability in which aircrews will be able to rehearse full missions in the simulator under realistic threat and flight conditions that cannot be duplicated with actual aircraft. The second thrust will improve individual and group training, organizational structure and procedures for maintenance, war time planning, and human resource factors in weapon system acquisition. Some of the key research issues involve (1) predicting manpower, personnel and training requirements in time to affect weapon system design, (2) validating planning assumptions used to transition from peacetime to wartime operations, (3) reducing the high error rate of diagnostics in aircraft maintenance, (4) developing a supportable unit level training system, (5) assessing team performance, and (6) assessing the impact of the human element in the design and operation of command and control (C^2) systems. Payoffs from this thrust include (1) decreased life-cycle costs due to the more effective planning and management of the human resources requirements of weapon systems, (2) increased probability of mission success due to improved logistics support: (3) enhanced on-the-job performance of Air Force technicians due to better training on maintenance simulators and (4) improved operation and design of C^2 systems. This program element, in addition to being the primary technology base exploratory effort in Training and Simulation Technology, provides technical support to other Air Force and Department of Defense programs and receives partial reimbursements for the services provided. In the case of basic research accomplished by the Laboratory, full reimbursement is provided by Program Element 61102F, Defense Research Sciences. The project funding reflects the best estimate concerning these anticipated reimbursements, but may require adjustment to the degree that reimbursements are actually earned.

(U) RELATED ACTIVITIES: The majority of the work is directly in support of requirements identified by major commands, Air Staff agencies, and separate operating agencies. Related efforts of the military services are identified in the Training and Personnel Technology Area Description. Related program elements are: 61102F, Defense Research Sciences; 62202F, Aerospace Biotechnology: 63227F, Advanced Simulator Technology; 63751F, Innovations in Education and Training; 64227F, Flight Simulator Development; 62757N, Human Factors and Simulation Technology; 63733N, Training Device Technology; 63720N, Education and Training; 62722A, Manpower, Personnel, and Training; 62727A, Non-System Training Device Technology and 63216A, Synthetic Flight Simulators. The Laboratory has Memoranda of Agreement with the Army Program Manager for Training Devices for visual display light valve projector technology development, and with the F-16 System Program Office for maintenance aids development and resource planning and allocation. Research agreements with the Air Training Command, Tactical Air Command, Air Force Logistics Command, Military Airlift Command, Strategic Air Command, Simulator System Program Office, Naval Training Equipment Center, and National Aeronautics and Space Administration clearly describe work to be accomplished, list necessary support to be provided by the user of the technology, and insure adequate coordination of efforts. The Navy has a liaison office with the Laboratory's Operations Training Division at Williams Air Force Base AZ. In addition, personal contacts, meetings, and formal contacts such as the DoD Technical Advisory Groups provide coordination between specific focal points for research and development efforts. Close coordination within the Air Force user community is also ensured by semiannual research and development coordination meetings between AFHRL, the Aeronautical Systems Division and the major commands (TAC, SAC, MAC, ATC). These meetings were held in April and November in 1981.

Program Element: #62205F
DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Training and Simulation Technology
Budget Activity: Technology Base, #1

(U) WORK PERFORMED BY: The program is managed by the Air Force Human Resources Laboratory (AFHRL), Brooks AFB TX. Two Laboratory divisions support this program element: Logistics and Technical Training, Wright-Patterson Air Force Base OH, and Operations Training, Williams Air Force Base AZ. The Logistics and Technical Training Division is collocated with the Air Force Logistics Command, the Simulator Systems Program Office, and numerous other Air Force Laboratories and System Program offices at Wright-Patterson Air Force Base OH. The Technical Training Branch of this division is collocated with the Air Training Command Technical School at Lowry Air Force Base CO. The Operations Training Division is collocated with Air Training Command and Tactical Air Command pilot training operations at Williams Air Force Base AZ. The Operations Training Division also has convenient access to Tactical Air Command pilot training at Luke and Davis Monthan Air Force Bases AZ. The major contract efforts in FY 1981 were conducted by the following companies: Lear Siegler, Oklahoma City OK; McDonnell-Douglas, St. Louis MO; Systems Engineering Laboratories, Ft. Lauderdale FL; General Electric, Daytona Beach FL; Singer, Binghamton NY; University of Denver, Denver CO; Clemson University, Clemson SC; General Dynamics, Fort Worth TX; Grumman, Bethpage NY; Honeywell, Minneapolis MN; SAI Computer Systems, San Diego, CA; Digital Equipment Corp, Dayton, OH; Applied Science Association, Valencia, PA; and University of Dayton, Dayton OH. The total contract program ($7.455 million) includes 24 contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments:

In the area of EDUCATION AND TRAINING: A preliminary on-the-job training capacity study was completed. This study specified, in objectively measureable terms, the factors which impact a military unit's capacity to conduct on-the-job training without impairing mission requirements. The long range R&D plan concerning team operated ground-based C^2 systems was completed. Measurement and scoring methods for evaluation of the performance of B-52 electronics warfare operations and weapons delivery accuracy were developed for Strategic Air Command. A new high threat environment has been developed for Advanced Simulator for Pilot Training (ASPT) that currently has seven independent Surface-to-Air Missiles (SAM) sites (three SA4's, two SA6's,), nine Antiaircraft Artillery (AAA) sites (ZSU-23), and the capability to provide an air-to-air threat. The environment is totally interactive with either the A-10 or F-16 cockpits and potential targets include a tank formation, communications vehicles, and a Soviet airport. Also, a special function trainer was designed to provide part task training for F-16 weapons control tasks. Micro-computer technology, combined with a color graphic display, resulted in a flexible special function trainer which can be easily reprogrammed to provide training in a number of piloting tasks. By using off-the-shelf micro-computers and color graphic displays, a low cost training device was demonstrated which can provide significant cost savings while offering state-of-the-art part task training. TAC BRAWLER, a value-driven math model of air combat, was used during FY 81 to evaluate the effects of visual system resolution, target contrast, and field of view upon the topography of selected one versus one and two versus one air-to-air engagements. The computer modeling approach has proven to be extremely productive. It addresses the implied impacts of alternative engineering design decisions upon the capability of a flight simulator to support certain types of task performance. The results will have significant impact upon the specifications for simulators used for air combat maneuvering.

In the area of HUMAN FACTORS: Computer programs were developed to predict the interactions among maintenance manpower, spare parts and support equipment. The programs can forecast the impact of various mixes of these factors on aircraft readiness to fly both peacetime and wartime missions. Technology was transitioned to the Air Force Logistics Command for improved Technical Orders, which has the potential to reduce spare parts consumption by up to 10%. An evaluation of

Israeli aircraft combat battle damage repair was completed which provided insight into critical logistics policies, battle damage repair teams, and combat maintenance training.

In the area of SIMULATION AND TRAINING DEVICES: The technology required to link two geographically dispersed flight simulators (the Advanced Simulator for Pilot Training, Williams Air Force Base AZ, and the Simulator for Air-to-Air Combat, Luke Air Force Base AZ) and "fly" the simulators against each other was demonstrated in air-to-air combat. This link is the first step in the simulation of a complete combat scenario using several geographically dispersed flight simulators.

2. (U) FY 1982 Program:

In the area of EDUCATION AND TRAINING: The best methods for obtaining accurate performance data on Tactical Air Command pilots flying Air Combat Maneuvering Range engagements will be determined. This is a long term effort which was started in FY 1981 and it will require close coordination with TAC in the future years. Progress on this effort has been slowed due to the lack of manpower and funding. Preliminary transfer of training studies will be conducted from flight simulator combat mission training in the Advanced Simulator for Pilot Training (ASPT) to aircraft missions at Red Flag . A Tactical Battle Management R&D capability will be established for command and control (C^2) research which will allow the development of team assessment methods and evaluation of critical decision making in C^2 teams and commanders. A computer based instructional system will be developed utilizing 3-dimensional graphics to train Weapons Directors.

In the area of HUMAN FACTORS: Work will continue on a unified data base structure designed to evolve with a weapon system and provide logistics planners an improved capability for considering supportability and human considerations during design trade-off studies. Work will be initiated to reduce the high error of maintenance diagnostics. Work will be completed on maintenance metrics designed to identify the relationship of hardware, environmental, and operational variables with maintenance demand rates. The analysis of Israeli battle damage repair for aircraft will be completed.

In the area of SIMULATION AND TRAINING DEVICES: Advanced computer image generation and projector techniques that utilize high resolution areas for both air-to-air and air-to-surface visual combat will be developed. This will provide more realistic visual scenes in flight simulators, and will improve training effectiveness and aircrew proficiency. The training and cost effectiveness of the F-16 Simulated Aircraft Maintenance Trainers will be evaluated. Development will continue on the functional specifications for a Non-destruction Inspection (NDI) Maintenance Trainer.

3. (U) FY 1983 Planned Program:

In the area of EDUCATION AND TRAINING: The wide spread application of Computer Based Instructional (CBI) techniques is rapidly approaching with the Air Training Command (ATC) Advanced Instructional Delivery and Evaluation System (AIDES) Statement-of-Need (SON) and associated critical shortfalls in instructor personnel. In the CBI environment instructors are being required to perform a wide variety of instructional tasks that were not required in the conventional, group-paced classrooms. This year's research effort will define the new instructor skills required in the non-conventional environment and solve many of the new problems that are being encountered. This result will be an overall increase in Air Force training effectiveness through the cost-effective application of CBI techniques. The development of a 3-dimensional computer graphics training system for Weapons Director training will near completion. Studies of individual pilot characteristics during Air Combat Maneuvering (ACM) using an existing computer model (TAC BRAWLER) and a study of flying skill degradation will be performed. The potential of a helmet-mounted visual display for low cost simulators to portray a high threat environment for realistic combat training and forced decision making under high task loading will be evaluated. Transfer of training studies will continue from the Advanced Simulator for Pilot Training to Red Flag aircraft sorties using simulated hostile threat environments.

In the area of HUMAN FACTORS: The capability will be refined to more accurately analyze, evaluate, and predict the combat readiness of aircraft maintenance organizations. This will improve their ability to specify the personnel, training, management policies and logistics support needed to achieve various degrees of mission readiness . Development will also start on the conceptual design and an experimental prototype for an adaptive trouble shooting system for maintenance. This program will consolidate and apply recent developments in several fields (adaptive learning, artifical intelligence, computerized medical diagnosis, and decision theory) to the development of a computerized, adaptive human-equipment-procedural system for troubleshooting failed or poorly functioning equipment. Another research subarea concerns the optimum structuring and training for command and control team combat decision making. The behavioral and engineering technology required to measure and improve command, and control team performance will be refined. Improved team training procedures and system hardware designs will also be developed.

In the area of SIMULATION AND TRAINING DEVICES: A feasibility study will be conducted on the consolidation of maintenance subsystem trainers into an Integrated Training System (ITS) that will allow simulation training for battle damage repair and malfunctions requiring teams of different specialists. Visual displays for simulation systems that offer reduced size and weight for the large visual fields-of-view required in flight simulators will be developed. The most promising hardware technology will be selected for the development of portable combat readiness training devices which can be taken into the field for training and mission rehearsal.

The increase in funding from the FY 1982 Descriptive Summary is essential for required maintenance and improvements to the Advanced Simulator for Pilot Training (ASPT) at Williams Air Force Base AZ, and more extensive pursuit of answers to urgent Simulator SPO and MAJCOM (TAC, MAC, SAC) questions concerning training effectiveness research hardware requirements for flight simulators. The current cathode-ray tube (CRT) displays on the ASPT are all beyond their life expectancy due to very heavy use for TAC training/research. These CRTs and related display hardware (electronics, plastic optics, etc.) must be replaced at considerable cost in order to keep the ASPT functioning. The simulator training effectiveness research issues will require extensive contract research efforts. In FY 1983 the laboratory will also begin active development of an R&D Strategic Mission Simulator (SMS, B-1B) using spare B-52 Weapon System Trainer (WST) components and a facility (building) which was recently acquired from the Air Training Command. Airborne sensor simulation technology will also be developed and training effectiveness research will be conducted using the B-52 WST Forward Looking Infrared (FLIR) and Digital Radar Landmass (DRLMS) systems and a nonreal-time Airborne Electroptical Sensor Simulation. The laboratory has also developed much more substantial research programs in the Command and Control (C^2) and the Logistics research areas. These research programs are in response to urgent requirements for improvements in tactical forces C^2 team training and to numerous Logistics Needs (LNs) from the major commands. The FY 1983 funding was specifically increased to add support to these critically needed training, simulation, logistics and C^2 R&D programs.

Program Element: #62205F
DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Training and Simulation Technology
Budget Activity: Technology Base, #1

4. (U) FY 1984 Planned Program: The increased research efforts on simulator training effectiveness will continue. The initial phase of strategic mission simulator development will be completed. The improvement of aircrew training will continue by increasing the realism of simulated advanced radar and other sensor system displays, and defining the hardware training effectiveness requirements. The enhancement of pilots' capabilities during hostile engagements will be pursued by developing a program for specialized training in tactical decision making. There will be increased effort on combat tactics system development and visual scene studies to determine the effects of high resolution areas of interest and target insetting on aircrew performance. Development will start on a computerized aircraft battle damage aid for maintenance damage assessors. New methods for reducing diagnostic errors in built-in-test equipment will be tested. A single, weapon system specific, computerized data base of logistics information designed for use by designers and logistic managers will be demonstrated. Development will start on a triservice computer-based instruction system, and decision and training guides for commanders of C^2 systems. Additional research will start on Logistics Needs which could not be addressed in prior years.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

Project #06HT
Program Element: #62205F
DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Laboratory Support
Title: Training and Simulation Technology
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the operation of the Air Force Human Resources Laboratory, Brooks Air Force Base TX, including pay and related costs of civilian scientists and support personnel, travel, transportion, rent, communications, utilities costs, procurement of supplies and equipment, and contractor support services. The laboratory performs research and development in manpower and force management, weapon systems logistics, maintenance and technical training, and air combat tactics and training in support of the immediate or potential needs of Air Force operational systems.

(U) RELATED ACTIVITES: Supports and complements all projects in this program element.

(U) WORK PERFORMED BY: The project is managed by the Air Force Human Resources Laboratory with headquarters at Brooks Air Force Base TX, and divisions at Williams Air Force Base AZ, Wright-Patterson Air Force Base OH and Lowry Air Force Base CO.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Plans and accomplishments are discussed in the overall program element submission.

1. (U) FY 1981 and Prior Accomplishments: Not applicable.

2. (U) FY 1982 Program: Not applicable.

3. (U) FY 1983 Planned Program: Not applicable.

4. (U) FY 1984 Planned Program: Not applicable.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	5,524	5,029	5,766	5,895	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Budget Data:

RDT&E	4,952	5,341	5,453		Continuing	Not Applicable

The increased costs for the FY 1983 Descriptive Summary are due to civilian pay raises and associated inflationary increases in laboratory support items.

Proj: #1192
Program Element: #62205F
DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Advanced Simulator for Pilot Training
Title: Training & Simulation Technology
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the operation and maintenance of the Advanced Simulator for Pilot Training (ASPT). This simulator is the main research device for all of the engineering and training effectiveness research that is conducted under the Air Combat Tactics and Training Research Thrust. Most of the related research that is conducted under Project 1123, Flying Training Development, and Project 6114, Simulation Techniques for Air Force Training, is conducted on the ASPT. This Advanced Simulator for Pilot Training is thus the primary simulation device for implementing, demonstrating, and testing any simulation hardware or training technology advances which are developed under Projects 1123 or 6114. The ASPT is also used for demonstrating and testing engineering and training simulation technology advances which are developed under the related ASD and triservice program elements listed under related activities. For example, carrier landing studies have been conducted in conjunction with the Naval Training Equipment Center (NTEC), PE 63757N, and exploratory miniraster light valve technology has been demonstrated in conjunction with the Army Program Manager for Training Devices (PM TRADE), PE 63216A.

(U) RELATED ACTIVITIES: Covered under the program element.

(U) WORK PERFORMED BY: The program is performed by the Air Force Human Resources Laboratory through the Operations Training Division, Williams Air Force Base, AZ. Major contractors are: Systems Engineering Laboratories, Ft Launderdale FL; General Electric, Daytona Beach FL; Singer, Binghamton NY; Honeywell, Minneapolis MN; and University of Dayton, Dayton OH.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: The plans and accomplishments are discussed in the overall program element with regard to Projects 1123 and 6114 which are supported by this Project.

1. (U) FY 1981 and Prior Accomplishments: Project 1192 provided for the operation and maintenance of the ASPT. This project also provided the main support for converting the original dual cockpit T-37 aircraft (ATC trainer) Advanced Simulator for Undergraduate Pilot Training (ASUPT) into the A-10 and F-16 (TAC aircraft) Advanced Simulator for Pilot Training (ASPT).

2. (U) FY 1982 Program: The operation and maintenance of the ASPT will continue. Demonstrations and training evaluations will be conducted on a single channel prototype dual light valve system for optically inserting miniraster (target) displays into lower resolution background scenes. Demonstration and training effectiveness evaluations will be conducted on a dual mini-cathode-ray-tube helmet mounted display. The simulation support for related research projects will continue. This research will include transfer of training studies from the ASPT to Red Flag aircraft sorties and training effectiveness studies for visual flight simulation.

3. (U) FY 1983 Planned Program: The operation and maintenance of the ASPT will continue. The research simulation support for related research projects will continue, including the Red Flag transfer of training studies and visual flight simulation studies. Research studies will also be conducted to evaluate the potential of using a helmet mounted visual display to adequately portray a high combat threat environment. The current ASPT CRT displays and related display hardware items which are deteriorated and worn out will be replaced. The initial operation and maintenance support of the Strategic Mission Simulator (SMS) will begin.

Proj: #1192 Title: Advanced Simulator for Pilot Training
Program Element: #62205F Title: Training & Simulation Technology
DOD Mission Area: Environmental and Life Sciences (ED), #522 Budget Activity: Technology Base, #1

4. (U) FY 1984 Planned Program: The operation and maintenance of the Advanced Simulator for Pilot Training (ASPT) and the Strategic Mission Simulator (SMS) will continue. The simulation support for related research projects will continue, including transfer of training studies, visual and sensor systems requirements studies, and strategic mission simulation studies.

5. (U) Program to Completion: The operation and maintenance of the ASPT and the SMS will continue. The research simulation support for related research projects will continue.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	4,694	4,697	6,024	5,405	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	3,700	4,550	4,907

The difference between the current and the FY 1982 descriptive summary is due to two requirements. First, it is necessary to replace worn out ASPT visual display system hardware. The current cathode-ray tube (CRT) displays are all beyond their life expectancy due to very heavy use for TAC training/research. These CRT's and related display hardware must be replaced at considerable cost in order to keep the ASPT functioning. In FY 1983 the laboratory will also begin active development of an R&D Strategic Mission Simulator (SMS, B-1B) using spare B-52 Weapon System Trainer (WST) components and a facility (building) which was recently acquired from the Air Training Command. This R&D simulator will be used to conduct research on flight simulator training and hardware requirements for strategic missions, such as those missions which will be flown in the B-1B bomber. Electronic warfare simulation systems and airborne sensor simulation systems, such as ground mapping radars, forward looking infrared (FLIR) systems, and low light level television (LLLTV) systems, will be the primary simulation systems of research interest.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62302F — Title: Rocket Propulsion
DOD Mission Area: Engineering Technology (ED), #523 — Budget Activity: Technology Base #1

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	30,791	34,105	37,072	38,264	Continuing	Not Applicable
06RL	Laboratory Operations	10,610	11,277*	12,061	[illegible]		
3058	Space Propulsion Technology	5,720	6,841	8,024	[illegible]		
3059	Ballistic Missile Propulsion	4,709	3,883	4,789			
3148	Air Launched Missile Propulsion	6,935	6,446	7,303	[illegible]		
5730	Multiple Application Technology	2,817	5,658	4,895	6,245		

* Excludes 1 Oct 81 civilian pay raise (4.8%)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides new concepts and techniques in rocket propulsion technology to improve Air Force ballistic missiles, satellite propulsion, space launch systems, and air launched strategic and tactical missiles. Proven technology for solid propellant motors, liquid rocket engines, electrical thrusters and high payoff advanced propulsion concepts minimize the development risk of advanced Air Force missile systems. This program also provides the operational support and management of the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program represents a 2.8% real growth over FY 1982. This growth is reflected in increased emphasis on liquid engine development for military space vehicle concepts and more energetic ingredients for air launched propellants that provide greater mission applicability. The FY 1982-1983 major technology areas include propulsion options for advanced ballistic missiles to improve payload capability (10-15% throwweight improvement and enhanced missile penetration and survivability through flexible front end propulsion; higher performance satellite thruster technology to reduce propulsion system weight yielding a 15% satellite weight savings; propulsion options for space systems deployment to accommodate near term payload growth capability as well as low acceleraton orbital transfer of large space structures; and performance options for air launched missiles which address the interplay between increased weapons stand-off distance, improved kill probabilities, and lower life cycle costs.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: ($ in thousands):

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	30,750	34,800	44,200		Continuing	N/A

(U) OTHER APPROPRIATION FUNDS:

Military Construction 5,000

Program Element: #62302F Title: Rocket Propulsion
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: New concepts and technologies in rocket propulsion are pursued to improve ballistic missiles, satellite propulsion systems, and air launched strategic and tactical missiles. This includes efforts to develop higher performance propellants; stronger and lighter weight cases and nozzles; less erosive nozzle inserts; advanced thrust vector control and increased service life for solid propellant rockets; high performance and long life electric propulsion systems; front end propulsion with increased payload capability; longer life liquid propellant satellite attitude control systems; improved performance space launch vehicle upper stages. This program element, in addition to being the primary technology base exploratory development effort in rocket propulsion, provides technical support to other Air Force and DOD agency programs and receives partial reimbursement for the services provided.

(U) RELATED ACTIVITIES: Technology base activities are related to National Aeronautics and Space Administration, Navy and Army programs. Coordination is accomplished through the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Interagency Propulsion Committee, and through working level meetings and inter-service committees. This program provides the technology base for PE 63302F, Advanced Missile Propulsion, and PE 63401F, Space Vehicle Subsystems.

(U) WORK PERFORMED BY: Air Force management of this effort and a comprehensive in-house program is provided by the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA. There are eleven active test areas with 35 test positions that include: propellant formulation and small scale mixing capabilities, and sea level and simulated altitude test facilities to test subscale and full scale components. The ten major contractors in FY 1981 were: Thiokol Chemical Corporation, Brigham City, UT and Huntsville, AL; United Technologies (Chemical Systems Division), Sunnyvale, CA; Hercules, Inc., Magna, UT; Aerojet Company, Sacramento, CA; Rockwell International, Canoga Park, CA; Atlantic Research Corporation, Alexandria, VA; McDonnell Douglas Corporation, Huntington Beach, CA; TRW, Inc., Redondo Beach, CA; Fairchild Industries, Farmingdale, NY; and Martin Marietta Corporation, Denver, CO. There are 20 additional contractors with 24% of the total contract value or approximately $4 million.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Propulsion technologies which have made possible the Minuteman, Missile-X, Inertial Upper Stage, and reduced smoke Sidewinder and Maverick weapons systems were developed under this program. A striking example is the accumulation of many small step improvements in ballistic missile propulsion technology beyond the Minuteman vintage which have led to the MX ICBM. This AFRPL-developed technology provides MX more than 1700 pounds payload increase over Minuteman technology which translates into a savings of $12 billion. This was accomplished with an investment of $60 million over fiscal years 1974 to 1982. Other demonstrated technologies include qualification of "reduced smoke" propellants providing a 40% reduced visibility of missile exhaust for world-wide deployment in the improved Sidewinder missile and demonstration of the technological readiness of "minimum smoke" propellant which further reduces the exhaust visibility to 10%. Significant extensions of operational capabilities are realized by the employment of a boost/lift trajectory; the range of the lifting trajectory is roughly double the range of a semi-ballistic trajectory.

Program Element: #62302F | Title: Rocket Propulsion
DOD Mission Area: Engineering Technology (ED) #523 | Budget Activity: Technology Base #1

2. (U) FY 1982 Program: In Space Propulsion Technology, long life mission endurance pulse plasma electric thrust technology will be finalized and readied for an advanced development program. Long burn liquid rocket engine component work will be initiated for use in upper stages operating out of the Space Shuttle program. In Ballistic Missile Propulsion, material behavior understanding will be put into design practices, particularly in the area of carbon/carbon nozzles. Air Launched Missile Propulsion efforts will emphasize propulsion energy management options to increase missile effectiveness. Efforts will again be aimed at reducing or eliminating those missile launch cues that reduce missile effectiveness and improving the ballistic tailorability of minimum smoke propellants using glycidyl azide polymer (GAP) as a key propellant ingredient.

3. (U) FY 1983 Planned Program: In Space Propulsion Technology, long life pulse plasma thruster technology will transition to an advanced development program. Liquid rocket engine component technology for long duration space orbit transfer propulsion systems will continue. In Ballistic Missile Propulsion, carbon/carbon exit cones will be developed with survivability equal to the carbon/carbon nozzles. Work on propulsion components for advanced payload delivery systems will begin. Minimum signature propellant development will continue in the Air Launched Missile Propulsion effort. The feasibility of composite motor cases as used in other applications will be demonstrated for air launched missiles. Booster improvements for ducted rockets will continue as well as a demonstration of improved ducted rocket fuels.

4. (U) FY 1984 Planned Program: In Space Propulsion, the feasibility of propulsion systems for reusable satellites will be demonstrated. Long term space and ground cryogenic propellant storage procedures will be developed. In Ballistic Missile Propulsion, procedures to salvage and reuse composite motor cases will be demonstrated and nuclear radiation effects on reentry vehicle propulsion will be determined. In Air Launched Missile Propulsion, a minimum smoke propellant will be developed and demonstrated in a pulse motor configuration. Metalized propellant technology will be expanded to cover a wider range of burn rates for greater mission application.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not applicable.

Project: #06RL
Program Element: #62302F
DOD Mission Area: Engineering Technology (ED), #523

Title: Laboratory Operations
Title: Rocket Propulsion
Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides funds for the support activities required to conduct exploratory and advanced development programs and to operate the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA. This is one of five projects which make up the exploratory development program for Rocket Propulsion. The project provides technical support to the Space and Aeronautical Systems Divisions of the Air Force Systems Command. The project provides an in-house program covering the following areas: propulsion phenomenology investigations, new concepts feasibility, applications evaluations, and systems support. It provides for the pay and related costs of civilian scientists, engineers and supporting personnel, travel, transportation, rent, communications and utilities costs, procurement of supplies and equipment, and contractor support services.

(U) RELATED ACTIVITIES: This project supports all of the technical projects under this program element as well as all other projects and programs managed by the Air Force Rocket Propulsion Laboratory. Projects under PE 61102F, Defense Research Sciences, PE 63302F, Advanced Missile Propulsion, other advanced development program elements, and major system support reimburse this project for all direct costs.

(U) WORK PERFORMED BY: The Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA is responsible for management of this project.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Plans and accomplishments are discussed in the descriptive summary for the overall program element and individual projects.

1. (U) Program to Completion: This is a continuing program.

2. (U) Resources: ($ in thousands):

FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
10,610	11,277	12,061	12,301	Continuing	Not Applicable

3. (U) Comparison with FY 1982 Destriptive Summary: ($ in thousands)

FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
9,960	10,821	11,096		Continuing	Not Applicable

Changes reflected are primarily due to the civilian pay raises.

Project: #2058
Program Element: #62302F
DOD Mission Area: Engineering Technology (ED), #523

Title: Space Propulsion Technology
Title: Rocket Propulsion
Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops rocket propulsion technology for application to future military satellites and space launch and orbital transfer vehicles. Existing propulsion systems are being improved by extending life, increasing performance and by developing satellite control and repositioning capabilities. New propulsion system concepts are evaluated. Related rocket plume data for the development of sensors to detect and track enemy missiles and satellites is being developed. Plume contamination models are developed to control spacecraft contamination.

(U) RELATED ACTIVITIES: Activities in this project are closely coordinated with NASA and Navy programs through the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Interagency Propulsion Committee, and through working level meetings and inter-service committees. This program provides the technology base for PE 63302F, Advanced Missile Propulsion, and PE 63401F, Space Vehicle Subsystems.

(U) WORK PERFORMED BY: Air Force management of this effort and a comprehensive in-house program is provided by the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA. The major contrators in FY 1981 were: Thiokol Chemical Corporation, Brigham City, UT and Elkton, MD; United Technologies (Chemical Systems Division), Sunnyvale, CA; Aerojet Company, Sacramento, CA; Rockwell International, Canoga Park, CA; Bell Aerospace Company, Buffalo, NY; Martin Marietta, Orlando, FL; Accurex Corporation, Mountain View, CA; TRW, Inc., Redondo Beach, CA; Fairchild Industries, Farmingdale, NY; Grumman Aerospace Corporation, Bethpage, NY; and Calspan Corporation, Buffalo, NY. There is a total of 37 contracts all performed by these contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The high performance space motor propellant was developed and transitioned to an advanced development demonstration in a small inertial upper stage motor size. Successful development of bipropellant thruster/redundant seat valve demonstrated long thruster life and durability for a 20-40% propulsion system weight savings and up to 10 years reliable operation in space. Techniques for identifying thruster failure modes were used to assess failure modes in the Defense Systems Communications Satellite system thruster and to determine life limit of the thruster to prevent loss of the satellite. Monopropellant thruster technology has achieved demonstrated a million pulse life goal without degraded performance; this is a 100% improvement over previous state-of-the-art and equates to 10 years of on-orbit life.

2. (U) FY 1982 Program: Finalize long life mission endurance pulse plasma electric thruster technology and prepare for transition to advanced development demonstration. Continue the development of high performance extended life mono and bipropellant satellite propulsion system thrusters in the 0.1 to 5.0 lb. range. Initiate component development for long-burn liquid rocket engines for upper stages for Space Shuttle use. Complete gas deployed skirt and extendible exit cone efforts to provide high performance options for space launch motors.

Project: #3058
Program Element: #62302F
DOD Mission Area: Engineering Technology (ED), #523

Title: Space Propulsion Technology
Title: Rocket Propulsion
Budget Activity: Technology Base #1

3. (U) FY 1983 Planned Program: Transition the long life pulse plasma electric thruster to advanced development. Continue liquid rocket engine component technology development for long duration space orbit transfer propulsion systems operating from the shuttle. Initiate high performance liquid engine component development to support advanced military space vehicle concepts. Complete development of high performance satellite propulsion bipropellant thrusters.

4. (U) FY 1984 Planned Program: Initiate the development of reinforced elastomeric bladders for satellite system propellant expulsion. Demonstrate the feasibility of propulsion systems for reusable satellite. Transition electrical/thermal augmented hydrazine thruster to an advanced development. Initiate integrated systems demonstration of the long burn propulsion system developed in FY 83. Develop a long term space and ground cryogenic propellant storage for future space systems or upper stages.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in thousands).

FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
5,720	6,841	8,024	8,480	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: ($ in thousands)

6,000	7,000	10,500

Eliminated hardware technology development for a growth option of the first stage propulsion for the space defense booster.

Project: #3148
Program Element: #62302F
DOD Mission Area: Engineering Technology (EC), #523

Title: Air Launched Missile Propulsion
Title: Rocket Propulsion
Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides improvements in rocket propulsion technology for future air-launched weapons. Strategic air-launched missile performance improvements are being pursued through high energy propellants, energy management, and improved thrust vector control. Improved aircraft survivability and a greater missile effectiveness will be provided by eliminating missile launch cues caused by the propulsion system. Tactical rockets with improved standoff range, better accuracy, improved service life and lower cost are being developed.

(U) RELATED ACTIVITIES: Army and Navy programs on improved solid propellants and improved components are well coordinated through the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Interagency Propulsion Committee. The Air Force Armament Division has related efforts in the armament propulsion area. This project will provide a technology base for PE 63302F, Advanced Missile Propulsion.

(U) WORK PERFORMED BY: Air Force management of this project is provided by the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA. The contractors in FY 1981 were: Thiokol Chemical Corporation, Huntsville, AL and Brigham City, UT; Hercules, Inc., Cumberland, MD; Atlantic Research Co., Alexandria, VA; Rockwell International, Canoga Park, CA; McDonnell Douglas, St. Louis, MO; Lockheed, Palo Alto, CA; Martin Marietta, Orlando, FL; Chandler Evans, West Hartford, CT; United Technologies/Chemical Systems Division, Sunnyvale, CA; Stanford Research Institute; Palo Alto, CA; and Aerojet Company, Sacramento, CA. There is a total of 56 contracts, all performed by these contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The first motor case made of kevlar was fabricated and successfully tested for the thermal and mechanical load environment typical of the air-launched missile. High performance MX generation ICBM propellants were adapted for use in air-launched missiles. A low cost booster for the Air Force Wright Aeronautical Laboratories, Flight Dynamics Laboratory miniature Remotely Piloted Vehicle was demonstrated through flight tests. Minimum smoke propellants were demonstrated in motor firings after being subjected to the temperature extremes of the air-launched missile environment.

2. (U) FY 1982 Program: Improve propellants to decrease missile time to target and to reduce infra-red, (IR) ultra violet (UV), and visible signatures. Improve energy management to increase the missile launch acceptability region allowing the pilot a greater area from which to fire. Complete demonstration of composite case fabrication for air launch missiles. Investigate aging characteristics of ramjet insulation and booster propellant bonding.

Project: #3148 Title: Air Launched Missile Propulsion
Program Element: #62302F Title: Rocket Propulsion
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base #1

3. (U) FY 1983 Planned Program: Continue development of minimum signature propellant with a wider burn rate range and energy flexibility. Demonstrate the feasibility of composite rocket motor cases for air-launch missiles. Composite cases as they currently exist for other applications would not withstand the rigors of handling and high moisture exposure typical of the air-launched missile environment. Continue booster improvements for ducted rockets and demonstrate improved ducted rocket fuels. Develop more energetic ingredients for future higher performance propellants.

4. (U) FY 1984 Planned Program: Continue minimum smoke propellant development and demonstrate minimum smoke propellant in a pulse motor configuration. Complete ducted rocket fuel development. Complete pulse motor alternative component concept development. Complete low burn rate metalized propellant and initiate demonstration of high burn rate, longer life metalized propellant. Demonstrate improved ramjet insulation motor.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in thousands).

FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
6,935	6,446	7,303	6,959	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: ($ in thousands)

FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
7,100	8,000	11,000		Continuing	Not Applicable

Decreased level of effort on liquid propulsion technology for air launched missiles.

FY 83 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62601F — Title: Advanced Weapons

DOD Mission Area: Electronic & Physical Sciences (ED), #521 — Budget Activity: Technology Base #1

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	35,193	39,208	44,471	44,691	Continuing	Not Applicable
06WL	Laboratory Operations	12,590	13,300*	15,099	15,333		
1900	Environmental Quality Technology	1,410	1,700	1,700	1,760		
2007	Nuclear Safety	511	600	700	828		
2218	Laser Survivability/Vulnerability Technology	507	500	600	800		
2444	Integrated Computational Center	670	600	500	0		
2673	Civil Engineering Technology	300	500	1,600	700		
3326	Laser Applications	11,817	12,708	13,672	13,700		
5797	Advanced Weapons Concepts	2,749	3,770	4,600	5,300		
8809	Nuclear Vulnerability & Hardening Technology	4,639	5,530	6,000	6,270		

*Excludes 1 Oct 81 Civilian Pay Raise (4.8%)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops the technology base for advanced weapons and their adaption to Air Force systems. Studies and experiments are conducted in laser applications, survivability/vulnerability, advanced weapon concepts, nuclear weapon environment, civil engineering technology, and environmental quality. Operation and maintenance of the Air Force Weapons Laboratory at Kirtland Air Force Base, NM, are also included.

BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program represents 6.0% real growth over FY 1982. This growth is reflected in increased emphasis on advanced particle beam weapon concepts, advanced laser technology, and civil engineering technology for airbase survivability. Continue critical experiments on the radial line electron accelerator, RADLAC II, and other particle accelerators to demonstrate atmospheric propagation and [ ] of one or two high current pulses of high energy electrons. These experiments are key milestones in the Department of Defense program to determine feasibility of advanced particle beam weapons. Continue assessment of hostile nuclear weapons environments and their effects on systems. Continue development of chemical laser and critical beam control concepts.

Program Element: #62601F
DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Advanced Weapons
Budget Activity: Technology Base #1

(U) COMPARISON WITH FY 82 DESCRIPTIVE SUMMARY ($ in thousands):

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	37,410	42,863	48,755		Continuing	Not Applicable
Military Construction		6,800				

(U) OTHER APPROPRIATION FUNDS ($ in thousands):

Military Construction	6,800

Program Element: #62601F Title: Advanced Weapons
DOD Mission Area: Electronic & Physical Sciences (ED), #521 Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Provides the Air Force with a sound technology base for the development of advanced weapons and their adaption to systems. Investigations and experiments are conducted in laser weapon technology, survivability/vulnerability of Air Force systems to high energy laser and nuclear weapon threats, nonconventional weapon concepts, nuclear weapon effects, civil engineering technology and environmental quality technology. Includes operation and maintenance of the Air Force Weapons Laboratory. The technology developed helps prevent technological surprise by other nations. Also provides technical support to other Air Force and Department of Defense agency programs and receives partial reimbursement for services provided. Basic research accomplished by the laboratory is fully reimbursed by Program Element 61102F, Defense Research Sciences. The distribution of project funds reflects the best estimate anticipating reimbursements, but may require adjustment to the degree that reimbursements are actually earned.

(U) RELATED ACTIVITIES: Nuclear weapons effects are closely coordinated with programs funded by the Defense Nuclear Agency Program Element 62715H and the Defense Advanced Research Projects Agency Program Element 62301E. Technology developed through these programs directly supports increased nuclear survivability efforts for Minuteman Missile Program Element 11213F, Advanced Ballistic Reentry Systems Program Element 63311F, and Air Force Systems Survivability (Nuclear Effects) Program Element 64711F. Exploratory laser development supports the Air Force Advanced Radiation Technology Program Element 63605F. Civil and environmental engineering technology efforts directly support the Civil and Environment Engineering Technology Advanced Development Program Element 63723F.

(U) WORK PERFORMED BY: The Air Force Weapons Laboratory at Kirtland Air Force Base, NM, manages the majority of the work performed under this Program Element. The Engineering and Services Laboratory at Tyndall Air Force Base, FL, manages Project 1900, Environmental Quality Technology, and Project 2673, Civil Engineering Technology. Air Force Weapons Laboratory facilities involved in the work include the Impact Facility, Sandia Optical Range, the Laser Laboratory, the SHIVA Electromagnetic Implosion X-Ray Source, the Dipole and TRESTLE electromagnetic pulse simulators and the Civil Engineering Research Facility. Engineering and Services Laboratory facilities include the Environmental Chemistry Research Laboratory. A total of 50 contracts and 37 contractors were involved in this program element in FY 81. The ten contractors that received the greatest amount of FY 81 funds from this program element were: Bell-Aerospace, Buffalo, NY; TRW, Redondo Beach, CA; Dynalectron, Albuquerque, NM; R&D Associates, Marina Del Rey, CA; Systems Development Corp, Santa Monica, CA; Maxwell Labs, San Diego, CA; University of New Mexico, Albuquerque, NM; Questron Corp, La Jolla, CA; Boeing Aerospace, Seattle, WA; and Rockwell International, Canoga Park, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The Air Force Weapons Laboratory has conducted an extensive series of programs to assess and minimize the effects of nuclear weapons on key United States strategic, tactical, and command, control, and communication systems. Emphasis has been placed on better definition of nuclear weapon attack environments; development of simulation concepts and technqiues, specific system assessments, and development of improved technology for increased nuclear survivability. Several high energy laser concepts developed under this program have been transitioned into advanced development. An active program to explore new weapons applications has included studies and experiments in charged and neutral particle beams and high power electromagnetic waves. The environmental quality efforts at the Engineering and Services Laboratory have led to analytical models to characterize and minimize environmental impact of Air Force operations.

Program Element: #62601F Title: Advanced Weapons
DOD Mission Area: Electronic & Physical Sciences (ED), #521 Budget Activity: Technology Base #1

2. FY 1982 Program: Results of nuclear weapons effects research must be transitioned into aerospace system development, acquisition, and operation. To satisfy this requirement, several efforts in this program element are continuing level of effort programs: systems support, which includes assessing nuclear survivability and associated hardening costs for new systems (such as the Medium Range Ballistic Missile, Advanced Maneuverable Reentry Vehicle and the Space-Based Surveillance System) radiation hardened electronics; materials evaluation and nuclear environment definition; and simulator development, with emphasis on the electromagnetic implosion concept (SHIVA). Electromagnetic pulse technology issues will be addressed by a review of experimental electron discharge data and additional interaction studies. Efforts in the High Energy Physics Technology Program will continue to support the Undersecretary of Defense for Research and Engineering particle beam program with studies in beam sensing, pointing and tracking, target signature, lethality, power supply development, and electron beam accelerator development and experiments with the radial line accelerator RADLAC II. Laser technology development efforts will continue to emphasize [ ] laser devices and beam control concepts; particular emphasis will be placed on the oxygen-iodine chemical laser. The study of repetitively pulsed laser effects [ ] will continue. Investigation of advanced adaptive optics concepts and their applications will also continue. The Civil Engineering Technology project will develop rapid concrete cutting methods for incorporation into the advanced technology and engineering development programs for rapid runway repair (RRR) and initiate a survivable airbase structures effort. The Environmental Quality project will analyze the consequences of Air Force jet engines burning alternate fuels.

3. FY 1983 Planned Program: Advanced weapons programs include experiments on the second generation radial line electron accelerator RADLAC II (25 million electron volts, 100,000 amperes), the development of a laboratory oxygen iodine chemical laser device at the [ ] the SHIVA II electromagnetic implosion nuclear weapon x-ray simulator, and nuclear weapon safety assessments. These programs provide the Air Force's only long range technology base enhancements for the nuclear and non-conventional weapons development essential to continued technological superiority. Continued efforts include refinement of understanding of the hostile nuclear weapons environment and its effect on United States systems, specifically the Advanced Intercontinental Ballistic Missile System and other advanced systems. High Energy Laser technology development will continue to emphasize advanced chemical laser concepts, [ ] with the goal of transitioning to advanced development. This work will be paralleled by development of critical beam control components and adaptive optics demonstrations involving advanced tracking and non-linear concepts. An airbase survivability effort will develop airblast, groundshock and fragment environments for MK 82 and 84 weapons. This data will be used to assess structural response of buried and above ground structures. Also investigated will be rapid concrete cutting methods for rapid runway repair. Environmental quality efforts will develop methods for smoke reduction of engine test cells, evaluate effects of Air Force alternate jet fuels on the environment, and assess and minimize environmental impact of Air Force unique operation on surrounding air, water and land resources. A new effort will be technology development of space nuclear power centered on reactor concepts, component structures and safety analysis. Nuclear safety analyses of the cruise missile Airborne Launch Control System, the FB-111D Aircraft, and the B-1B Initial Study will be completed and the results transitioned to the field.

4. FY 1984 Planned Program: The efforts in nuclear weapons effects will continue to emphasize the conversion of available effects data into design criteria which will increase survivability of United States systems. Efforts to understand the life cycle implications and develop criteria, techniques, and procedures which will maintain the hardness throughout the life of the system will also be pursued. Refinement of the nuclear environment and exploration of

the interaction of nuclear effects to understand the impact on United States systems will be continued. Air Force support of the Department of Defense particle beam weapon feasibility study will continue with electron beam propagation studies using RADLAC II. Neutral/charged particle beam studies for endo and exoatmospheric applications will continue. High Energy Laser efforts will be directed to development and scale-up of promising[ ]candidates and the development of optical systems

Environmental quality efforts will continue on effects of alternate jet fuels, smoke reduction, and air and water quality assessment models. Civil engineering efforts will use information gained from prior years on explosive effects to develop scaling laws so that full scale testing is not required to validate new storage concepts and spacing desicions. This effort will directly affect current airbase survivability interests of locating munitions next to aircraft shelters. The thermochemisty of asphalt airfield pavement recycling will be addressed in order to help lower the yearly pavement maintenance costs of $200 million. The space nuclear power effort started in FY 83 will continue.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

Project: #06WL Title: Air Force Weapons Laboratory Operations
Program Element: #62601F Title: Advanced Weapons
DOD Mission Area: Electronic & Physical Sciences (ED), #521 Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the support activities required to operate the Air Force Weapons Laboratory, Kirtland Air Force Base NM. The Air Force Weapons Laboratory is responsible for exploratory, advanced, and engineering development programs associated with nuclear and other nonconventional advanced weapons, including studies of effective delivery techniques and hazards of these weapons. The Laboratory provides technical support to current and future systems programs and undertakes operational support projects in its mission areas. This project provides for the pay and related costs of civilian scientists, engineers, and supporting personnel; travel and other transportation; rent, communications and utilities costs; procurement of supplies and equipment; and contractor support services.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element as well as other projects and programs managed by Air Force Weapons Laboratory, such as: Advanced Radiation Technology Program Element 63605F; System Survivability (Nuclear Effects) Program Element 64711F; Nuclear Effects Simulation Test Facilities Program Element 64747F, Project 1209; Ordnance Development Program Element 64222F, Project 5708; Air Force projects under the Defense Nuclear Agency's Nuclear Weapons Effects Program Element 62715H; Defense Advanced Research Projects Agency Strategic Technology Program Element 62301E; and related nuclear hardness testing and survivability developments.

(U) WORK PERFORMED BY: The Air Force Weapons Laboratory, Kirtland Air Force Base NM, is the organization responsible for management of this project.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) Accomplishments and Future Programs: Accomplishments and future programs for this support project are covered in the Descriptive Summary for the overall program element.

2. (U) Program to Completion: This is a continuing program.

3. (U) Milestones: Not Applicable.

4. (U) Resources ($ in thousands):

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	12,590	13,300	15,099	15,333	Continuing	Not Applicable

5. (U) Comparison with FY 1982 Descriptive Summary ($ in thousands):

RDT&E	12,310	13,333	13,582		Continuing	Not Applicable

Change in FY 83 reflects the additive cost of the transfer of the R&D Fabrication Shops from 1550 ATTW (MAC) to the AFWL and the Oct 81 civilian pay raise.

Project: #3326 Title: Laser Applications
Program Element: #62601F Title: Advanced Weapons
DOD Mission Area: Electronic & Physical Sciences (EP), #52. Budget Activity: Technology Base, #1

DETAILED BACKGROUND AND DESCRIPTION: This project provides exploratory development to establish the technical feasibility and operational practicability of lasers as weapons to fulfill specific Air Force mission requirements. Included in the scope of this project are the study of advanced laser device concepts [redacted] the investigation of aerodynamic effects on airborne laser propagation, including flow control techniques to reduce aero-optical interaction; the analysis and investigation of advanced beam control concepts, including adaptive optics concepts and advanced resonator designs; diagnostic evaluation, modeling, and kinetics study for the hydrogen fluoride/deuterium fluoride chemical laser; the development of repetitively-pulsed deuterium fluoride chemical laser technology; material, component, and fabrication technology development for high energy laser optical components; the investigation of high energy laser effects; and studies and analysis of potential applications of high energy laser systems.

(U) RELATED ACTIVITIES: This project is part of a Department of Defense program which is coordinated by the Undersecretary of Defense for Research and Engineering, Research and Advanced Technology, and which includes work in Defense Advanced Research Projects Agency Program Elements 62301E, Strategic Technology, and 62711E, Experimental Evaluation of Major Innovative Technology; Army Program Element 62307A, Laser Weapon Technology; Navy Program Elements 62735N, High Energy Laser Technology, and 62768N, Directed Energy Technology; and Air Force Program Element 63605F, Advanced Radiation Technology. Coordination with Department of Energy programs is effected by attendance at the Department of Energy technical program reviews, exchange of technical publications, and cooperative efforts at the working level.

(U) WORK PEFORMED BY: This project is managed by the Advanced Radiation Technology Office of the Air Force Weapons Laboratory, Kirtland Air Force Base, NM. A considerable portion of the work is accomplished with participation by the Air Force Materials Laboratory, Air Force Office of Scientific Research, Air Force Space Division, National Bureau of Standards, Naval Weapons Center, Naval Research Laboratory, Army Missile Research and Development Command, and the Department of Energy. A majority of the FY 81 funds from this project that were used on contracts were applied to major contracts with: Bell-Aerospace, Buffalo, NY; TRW, Redondo Beach, CA; Dynalectron, Albuquerque, NM; and RDA, Marina Del Rey, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Chemical laser technology has continued to progress with the demonstration of 100 kilowatts of power from a hydrogen fluoride laser device exhibiting good beam quality. Work with advanced fuels and nozzle bank concepts has identified improved nozzle bank technology and has characterized substitute fuels, particularly nitrogen trifluoride. In addition, significant progress has been made in establishing the data base for kinetic rates and laser performance and in developing computer models for hydrogen fluoride/deuterium fluoride chemical lasers. Technology investigations in new laser concepts have uncovered a number of potential concepts, such as iodine, nitrogen fluoride, and iodine monofluoride. Particularly notable has been the successful demonstration of lasing from a chemically-pumped oxygen-iodine laser at 1.315 micrometers wavelength; laboratory-scale testing demonstrated over 1000 watts, [redacted] Pulsed deuterium fluoride chemical laser research has indicated the [redacted]

Project: #3326
Program Element: #62601F
DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Laser Applications
Title: Advanced Weapons
Budget Activity: Technology Base, #1

In the development of optical components, optical coatings for wavelength selection and high reflectance at carbon dioxide laser wavelengths have been developed and tested critical optical components for shared aperture tracking concepts have been demonstrated at high power; micro-machining techniques for mirror fabrication with the potential for significantly reducing time and cost for fabrication and polishing have been developed; and work has begun on the development of coatings and window materials Progress has been made in the development of computer codes for laser resonator analysis, particularly for cylindrical geometry. Studies have been carried out on the potential applications of adaptive optics concepts, and the conceptual design of a beam control system has been completed. Work has begun on the development of advanced deformable mirror concepts and experiments have been initiated for the study of non-linear adaptive optics techniques. A number of applications studies for high energy lasers have been completed,

2. FY 1982 Program: The investigation of advanced concepts will continue, and supporting efforts in effects/vulnerability, theoretical modeling, and applications analysis will be pursued. Particular emphasis will be placed on the development of the iodine laser system,

Other new laser concepts will be investigated, including laboratory experiments to develop an efficient generator for excited magnesium atoms and the investigation of concepts for an iodine monofluoride chemical laser. Work will continue in the development of the technology base for hydrogen fluoride/deuterium fluoride chemical lasers, including the laboratory evaluation of an optical resonance transfer laser concept, modeling development for advanced nozzle concepts, and kinetic rate measurements.

In the development of optical components, efforts in developing coatings and window materials will continue, and work will begin on the development of advanced deformable mirror concepts. Aerodynamic interaction investigations will concentrate on the quantification of aero-optical effects through wind tunnel testing, the investigation of flow control techniques, and the development of an aerodynamic flow field modeling capability. Laser effects testing will continue complementary theoretical work will investigate damage mechanisms. Optical systems analysis techniques will continue to be improved, and advanced beam control system concepts will be investigated. In particular, high power applications for non-linear adaptive optics will be investigated. Applications analysis will continue, investigating potential applications of high energy laser weapon systems and developing improved engagement models.

Project: #3326 Title: Laser Applications
Program Element: #62601F Title: Advanced Weapons
DOD Mission Area: Electronic & Physical Sciences (ED), #521 Budget Activity: Technology Base, #1

3. FY 1983 Planned Program: The evaluation of advanced laser device concepts will continue as promising candidates are investigated to establish performance and scalability

Building on analysis and laboratory evaluation in FY 82, significant efforts are also possible in the investigation of excited magnesium transfer laser concepts, the iodine monofluoride chemical laser concept, and the nitrogen fluoride chemical laser concept, including laser demonstrations. Aerodynamic investigations will continue in the development of aerodynamic flow field modeling and the evaluation of promising flow control concepts in large scale wind tunnel testing. Work with hydrogen fluoride/deuterium fluoride chemical laser will continue with

the evaluation of the optical resonance transfer laser concept. Beam control system requirements will be considered in greater detail in terms of optical components advanced tracking concepts, improved resonator designs, optimum stabilization/damping methods, and application of adaptive optics techniques. Applications analysis will be used to evaluate technology advances,

4. FY 1984 Planned Program: The emphasis on the laser device and beam control technology

with breadboard demonstrations as subsystems technology becomes available. Supporting work in phenomenology investigations and applications analysis will also continue,

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources ($ in thousands):

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	11,817	12,708	13,672	13,700	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary ($ in thousands):

RDT&E	12,600	14,100	16,973		Continuing	Not Applicable

Change in FY 83 reflects eliminating the repetitively pulsed deuterium fluoride chemical laser effort.

Project: #8809 Title: Nuclear Vulnerability & Hardening Technology
Program Element: #62601F Title: Advanced Weapons
DOD Mission Area: Electronic & Physical Sciences (ED), #521 Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The goal of this project is to provide an effective transfer of technology gained from nuclear weapons effects research into concrete steps to increase the survivability of Air Force systems to nuclear encounters. To effect this transfer, the hardness of Air Force systems as built or conceived will be assessed and support will be provided to assure that hardness levels are included in the system from concept selection through operational use. This life-cycle survivability program will include studies on the phenomenology of special effects, the determination of appropriate hardening levels for the system being acquired, the implementation of hardening techniques through the program office acquiring the system, the assurance that hardening levels established have been reached by verification, and the maintenance of these hardened levels throughout the operational lifetime of the system. This process will be accomplished through five major areas of effort: technology development for system support, materials evaluation and environment definition, development of radiation hardened electronics for advanced Air Force weapons systems, development of the technology required to simulate nuclear weapon x-ray environments, and special studies of technology impacts and applications.

(U) RELATED ACTIVITIES: This project provides essential parts of the technology base in weapon system survivability/vulnerability and for efforts funded by program offices such as Advanced Ballistic Reentry Systems Program Element 63311F; M-X Program Element 64312F; Nuclear Effects Simulation Test Facilities Program Element 64747F, Project 1209; and Systems Survivability (Nuclear Effects) Program Element 64711F. The project is also related to research and development sponsored by the Defense Nuclear Agency, the Air Force Office of Scientific Research, and other military development/operational agencies.

(U) WORK PERFORMED BY: The Air Force Weapons Laboratory, Kirtland Air Force Base, NM, manages this project and performs some of the work in-house. Major contacts supported by FY 82 funds were with: RDA, Marina Del Rey, CA; Maxwell Labs, San Diego, CA; University of New Mexico, Albuquerque, NM; and Questron Corp., La Jolla, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: System program offices were provided the technology support required to establish and conduct survivability/vulnerability programs. Assistance was given to the various survivability/vulnerability reviews of designated Air Force systems. Criteria and/or hardening/survivability recommendations were developed for several current and proposed Air Force systems, including Air Launched Cruise Missile, Advanced Intercontinental Ballistic Missile, EC-135 Global Positioning System, and F-16. Improvements in computer codes to model the responses of aircraft to blast were completed. To improve the capability to perform vulnerability and hardening assessments of reentry vehicles and missile systems, development of a computer analysis system, which includes methodology, material properties and weapons test data, was continued. Materials and environmental development efforts included characterization of new reentry vehicle materials. Materials and hardened electronics support were provided for such systems as Advanced Ballistic Reentry Vehicle, Advanced Intercontinental Ballistic Missile, and Advanced Maneuvering Reentry Vehicles. Radiation hydrodynamics work included theoretical studies to define more complex nuclear-induced environments to support strategic structure design and deep basing studies. Work continued to improve computer codes for shielding calculations and the satellite radiation environment data base. Under the Radiation Hardened Electronics program, hardening and assessment techniques for advanced electronic technologies continued. Techniques for obtaining

Project: #8809 Title: Nuclear Vulnerability & Hardening Technology
Program Element: #62601F Title: Advanced Weapons
DOD Mission Area: Electronic & Physical Sciences (ED), #521 Budget Activity: Technology Base #1

shorter pulses were demonstrated under the SHIVA x-ray simulation program. Investigation of techniques to increase x-ray output continued. Development of techniques for applying new technologies to Air Force missions through the Advanced Intercontinental Ballistic Missile System Technology Requirements Program continued. Plans for a follow-on contract in this area were initiated. EMP technology development continued in support of engineering development programs.

2. (U) FY 1982 Program: Technology support to program offices will continue. Nuclear hardening technology support will be provided for the F-14, FB-111, B-52 OAS, and cruise missiles. Criteria development by the Nuclear Criteria Group Secretariat will continue for designated systems. These are likely to include Medium Range Ballistic Missile, ~~Advanced Maneuverable~~ Reentry Vehicle, the Defense Meteorological Satellite Program, the CX transport and the SpaceBased Surveillance System. SHIVA electromagnetic implosion x-ray source activities will continue with fabrication and power system tests. SHIVA II upgrade will be completed in FY 82. Deep missile basing concepts will be studied. Electromagnetic pulse (EMP) technology issues will be addressed by studies of electron caused EMP environments and effects and incorporation of multiburst and hydrodynamic effects into Air Force Weapons Laboratory Electromagnetic Pulse codes. Reentry vehicle materials support will continue. The Radiation Hardened Electronics hardening and hardness assurance efforts will continue along with initiation of new efforts for such devices as IR sensors, optical components, and signal processors.

3. (U) FY 1983 Planned Program: Technology support to program offices and operational commands will continue. The Nuclear Criteria Group Secretariat will develop criteria for those systems designated by the Nuclear Criteria Group. Tests of the upgraded SHIVA implosion load will begin. Nuclear environments and hardening technology will be assessed for deeply buried systems. A contract to update the design manual for hardened structures will be initiated. Satellite vulnerability assessments will continue. An effort to define electron caused EMP effects on satellite electronics will be completed. Development of computer codes to predict satellite vulnerability will continue. Improved definition of EMP criteria and effects will also be obtained. The efforts initiated in FY 82 under the Radiation Hardened Electronics program will continue. Improvements in structural and thermal environment response codes for aeronautical systems will be initiated. X-ray effects tests on MX missile and reentry system components will be completed at the AFWL Impact Facility.

4. (U) FY 1984 Planned Program: The efforts in nuclear weapons effects will continue to emphasize the conversion of available effects data into design criteria which will increase the survivability of systems. Effort to understand the life cycle implications and develop criteria, techniques, and procedures which will maintain the hardness throughout the life cycle of systems will continue to be pursued. Refinement of nuclear environment predictions to understand the impact on systems will also be continued. A major portion of the updated hardened structures design manual will be completed. Criteria development by the Nuclear Criteria Group Secretariat for those systems designated by the Nuclear Criteria Group will continue. Experiments will continue using the upgraded SHIVA II. Research on the theoretical and experimental methods for predicting x-ray response of advanced reentry material will continue. Hardness assurance efforts for large scale integrated circuits and electro-optical components will continue.

Project: #8809
Program Element: #62601F
DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Nuclear Vulnerability & Hardening Technology
Title: Advanced Weapons
Budget Activity: Technology Base #1

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources ($ in thousands):

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,639	5,530	6,000	6,270	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary ($ in thousands):

RDT&E	5,600	6,330	8,000		Continuing	Not Applicable

Change in FY 1983 reflects stretching out by one year the SHIVA x-ray source program and curtailing in-house x-ray material testing.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62602F
DOD Mission Area: Engineering Technology (ED), #523

Title: Conventional Munitions
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	30,740	32,724	37,416	38,366	Continuing	Not Applicable
06AL	Air Force Armament Laboratory Operations	12,003	12,633*	13,474	13,723		
2068	Guided Weapons Technology & Simulation	7,511	8,397	9,342	8,343		
2502	Munitions Dispensers & Component Technology	4,888	5,19[illegible]	6,600	7,200		
2543	Weapon Evaluation/Effects Methodology	2,652	2,100	2,100	2,600		
2560	Direct Fire Weapons Technology	2,392	2,400	3,100	3,600		
2567	Weapons Carriage and Release Technology	1,294	2,000	2,800	2,900		

* Excludes 1 Oct 1981 civilian pay raise (4.8%)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program establishes the Air Force technology base to support tactical air-to-surface and air-to-air guided weapons development; design and feasibility demonstration of advanced air-delivered munitions, including cluster munitions, warheads, fuzing, and target activated munition technology; and development of new and improved weapon evaluation methodologies and their supporting data bases. Supports advancement of the state-of-the-art in aircraft guns, rockets, ammunition, ancillary support equipment, new propellants and explosives; and development of effective stores management, aircraft/store interfacing techniques supporting system software; and new assessment techniques for predicting behavior of proposed aircraft/weapon configurations and environmental impact assessment. This program also provides funding for the operational support and management of the Air Force Armament Laboratory at Eglin Air Force Base, FL.

Program Element: #62602F
DOD Mission Area: Engineering Technology (ED), #523

Title: Conventional Munitions
Budget Activity: Technology Base, #1

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program represents 10.3% real growth over FY 1982. This growth is reflected in increased emphasis on emitter homing concepts, defeat mechanisms for helicopters, and advanced carriage concepts for future aircraft. This program is the entire Air Force exploratory development capability in aerially delivered non-nuclear munitions and ancillary support equipment for future weapons applications. The program to be pursued in FY 1983 includes six tasks:

(1) AIR FORCE ARMAMENT LABORATORY OPERATIONS: Provides support required to operate the Air Force Armament Laboratory. Includes civilian salaries, supplies, equipment and environmental impact studies.

(2) GUIDED WEAPONS TECHNOLOGY AND SIMULATION: Investigation of advanced optical rotation sensors, micro-optic gyros, and molded inertial technology to support combat air-to-air and air-to-surface missiles will continue. Development of an inhouse digital and optical image processing capability will continue. Target and background signature data base to support terminal homing developments in infrared and millimeter wave will be established. Electronic Countermeasure filters for tactical Global Positioning System (GPS) guidance will be fabricated and tested with the GPS class M receiver. Technology in the areas of shut-down and continuous wave target homing will be advanced. Feasibility breadboards will be fabricated to demonstrate radio frequency techniques applicable to the advanced air-to-air seeker problem for application to beyond visual range passive/active all-weather seeker technology.

(3) MUNITION DISPENSERS AND COMPONENT TECHNOLOGY: Development of technology for modular dispenser systems with selectable linear/area pattern control for guided, unguided, and cruise missile application will continue. Warhead models will be designed and tested for performance. Utility assessments directed to define an optimum defense suppression weapon concept capable of satisfying long-term defense suppression requirements will continue. Kinetic energy penetrator concepts for performance against hardened command and control targets will be designed and tested. Evaluation of weapons concepts to defeat armed helicopter will continue. Fuze sensor technology necessary to build a 99 percent reliability air-to-surface fuze system for impact, impact time delayed, and proximity functioning for general purpose bombs will be completed. A breadboard sensor for performance in tracking individual targets in the presence of multiple targets and clutter will be tested and evaluated. Basic safing and arming devices applicable to all air-delivered weapons will be designed. Feasibility of the standardization avionics integrated fuze subsystem design will be demonstrated.

(4) WEAPON EVALUATION/EFFECTS METHODOLOGY: Continue developing target models for advanced Soviet fighting vehicles Continue development of threat technical descriptions and damage models of advanced Soviet fighter, bomber aircraft and helicopters. Continue development of computerized target description for advanced hardened military and industrial targets. Advanced warheads will be tested against hardened structures and predictive equations for terradynamic effects developed. Computation, verification, and collection of weapons effectiveness indices, weapons characteristics, performance, delivery, accuracy, aircraft carriage options, and target information will continue. A generic power plant target description will be developed. Efforts for determining the effects of chemical agents on airfields will be initiated.

Program Element: #62602F
DOD Mission Area: Engineering Technology (ED), #523

Title: Conventional Munitions
Budget Activity: Technology Base, #1

(5) DIRECT FIRE WEAPONS TECHNOLOGY: Continue the automated computer design program. Update the projectile design and analysis system to include advanced ammunition. Initiate the light gas launcher development. Initiate hypervelocity projectile interior ballistics development. Continue development of high performance explosives including high energy PBX, energetic binders/composites and prepolymer/plasticizers. Continue development of insensitive explosives. Initiate design studies of high velocity gun concepts for future fighter aircraft. Continue development of electronic proximity fuze concept for high velocity ammunition. Complete development of sabot diverter concept for advanced 30mm armor piercing ammunition. Continue development of 30-40mm guided projectile concept. Initiate development of critical light gas gun component technology. Continue electromagnetic gun component development.
(6) WEAPONS CARRIAGE AND RELEASE TECHNOLOGY: Complete development of vertically launched low level weapon delivery technology on F-15 test bed. Continue to evaluate supersonic carriage and release concepts. Continue aircraft/ store aeroelastic and aeroservoelastic program to develop flight clearance data. Develop aircraft store validation station for aircraft/store electrical integration and validation.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	29,500	33,300	39,900		Continuing	Not Applicable
MILITARY CONSTRUCTION			300			
(U) OTHER APPROPRIATION FUNDS:						
MILITARY CONSTRUCTION			340	3,847		

Program Element: #62602F | Title: Conventional Munitions
DOD Mission Area: Engineering Technology (ED), #523 | Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program is directed to providing the technology base for the development of superior non-nuclear air launched weapons to meet long range Air Force and National objectives. The efforts vary from fundamental technology development to sophisticated breadboard hardware. Concepts and techniques are explored and evaluated to identify future needs and requirements which provide a focus for the technology development. Efforts are conducted in the technical areas of: air-to-air and air-to-surface seekers, sensors, autopilots and processing algorithms, warheads, fuzes, submunitions, dispensers, weapons evaluation, target vulnerability assessments, gun mechanisms, ammunition, propellants, explosives, and weapons carriage and release. Successful outputs from these programs are transitioned to appropriate advanced development programs. This program element, in addition to being the only Air Force exploratory development effort in conventional munitions, provides technical support to other Air Force and Department of Defense agency programs and receives partial reimbursement for the services provided. In the case of basic research accomplished by the Armament Laboratory, full reimbursement is provided by Program Element 61102F, Defense Research Sciences. The projects reflect the best estimate considering these anticipated reimbursements, but may require adjustment to the degree that reimbursements are actually earned. This program also includes the funds required for the operation and management of the Air Force Armament Laboratory, Eglin AFB, FL.

(U) RELATED ACTIVITIES: This program supports, through advanced technology efforts and simulation, the following Program Elements: 63601F, Conventional Weapons; 63609F, Advanced Attack Weapons; 64602F, Armament/Ordnance Development; 63370/64416F, Advanced Medium Range Air-to-Air Missiles; 64607F, Wide Area Anti-Armor Munitions; 64604F, Low Altitude Airfield Attack Systems; 64612F, Low Level Laser Guided Bomb; 64614F, Medium Range Air-to-Surface Missile; 64608F, Close Air Support Weapon Systems; 64610F, Air Delivered Land Mines; and 64746F, Expendable Drones. Related Army and Navy advanced technology efforts are coordinated through existing and specially established channels (62332N, Strike Warfare and 62303N, Missile Technology). Technology base efforts are reviewed by the Joint Directors of Laboratories Committee to coordinate related technologies and approaches. The Joint Logistics Commanders and its Joint Technical Coordinating Group for Munitions Development and Munitions Effectiveness provides an additional program coordination channel. There are special coordinating groups such as the Fuze Management Organization, the Under Secretary of Defense for Research and Engineering sponsored Joint Service Guidance and Control Committee, and the Terminally Guided Submunition Group for selected development efforts. These groups are structured to review, on a semi-annual basis, related activities to prevent duplication in related technology programs.

Program Element: #62602F — Title: Conventional Munitions

DOD Mission Area: Engineering Technology (ED), $523 — Budget Activity: Technology Base, #1

(U) WORK PERFORMED BY: This program is managed by the Air Force Armament Laboratory, Eglin Air Force Base, FL. The Air Force Armament Laboratory has the following in-house facilities: Interior Ballistics Facility, Aeroballistics Research Facility, Ballistics Experimentation Facility, Gun Mechanisms Laboratory, Propellant Evaluation Facility, High Explosives Research and Development Facility, Armament Systems Integration Facility, Structural Dynamics Facility, Missile Simulation Laboratory, Radio Frequency Millimeter-wave Laboratory, Special Projects Laboratory, Electro-Mechanical Fuze Laboratory, Sensor/Fuze Data Collection and Analysis Laboratory, Hopkinson Bar Facility, Computer and Graphics Analysis Laboratory, Environmental Research Laboratory, Technical Library and Model Shop. The work is performed by industrial contractors, educational institutions, DOD and DOE by contract and in-house. The ten highest dollar value contractors for FY 1981 were: General Research Corp, Reading, MA; General Dynamics, San Diego, CA; Rockwell International, Canoga Park, CA; Lockheed Missile and Space Co, Inc., Sunnyvale, CA; Orlando Technology, Inc., Orlando, FL; Environmental Research Inst of Michigan, Ann Arbor, MI; Sperry Research Center, Sudbury, MA; Data Tech, Inc., Ft Walton Beach, FL; Systems Control, Inc., Palo Alto, CA; and Dynatics Corp., Huntsville, AL. One hundred and seven contracts were distributed among sixty-one contractors. Forty-eight of the FY 1981 contracts were incrementally funded and/or follow-ons to FY 1980 and prior year contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments:

(1) GUIDED WEAPONS TECHNOLOGY AND SIMULATION The target and background information library system has been expanded. Study contracts were let for Backbreaker system concept for missiles and definition, of a CO2 laser radar sensor design and target detection/classification algorithm development. A NAVSTAR global positioning system antenna was developed to provide isolation against ground based ECM jammers. An extensive program was conducted to collect active 35 and 95 GHz data in the United States and Europe. Programs were started to exploit the antenna retroreflection phenomena to counter the shutdown problem associated with emitting targets.

(2) MUNITIONS DISPENSERS AND COMPONENT TECHNOLOGY: Feasibility of the Bunkered Target Munition to successfully penetrate into deeply buried hardened command and control targets was demonstrated. A self-forging warhead concept was demonstrated to be very lethal against aircraft and is being considered for use in the Advanced Medium Range Air-to-Air Missile. Depleted uranium warhead technology concepts have been successfully demonstrated Concept studies evolved a dispersion mechanism design which shows promise of generating selectable pattern from cluster warheads. Test techniques for evaluation of long-rod penetrators were developed. Target activated munition fuzing concepts demonstrated the use of passively-obtained acoustic and seismic signals. Ground tests of the low altitude altimeter breadboard were completed. Improvements in baseband reflectometry sensor antenna technology and electronic counter-countermeasures technology were made. Design and fabrication of an integrating accelerometer has been completed, and the test and evaluation processes were initiated. A breadboard based on microcomputer technology was fabricated and tested for application to dispenser airborne timers. A dispenser timer/simulator interface was developed.

Program Element: #62602F Title: Conventional Munitions
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base, #1

(3) WEAPON EVALUATION/ METHODOLOGY: A vulnerability model of the SA-8 was developed for use in weapon effectiveness modeling. Target vulnerability analyses of tanks, armored personnel carriers, self-propelled artillery and trucks to self-forging fragments were completed. Flogger "D" aircraft vulnerability to the selfforging fragment warhead was completed. Technical descriptions for the Flogger "F" and Fitter "C" aircraft were developed. Fuze and warhead computer simulation models were developed for the AIM-7M. Development of a target description of a command and control communications center radar installation was initiated. Work continued on developing a three-dimensional six degrees of freedom soil/concrete penetration code. An open end method for computing weapon effectiveness of the wide area antiarmor munition type weapon was developed. A computer simulation of a trainable gun was completed.
(4) DIRECT FIRE WEAPONS TECHNOLOGY: Hazard classification of the GLCM warhead/explosives in support of European siting was successfully completed. An Air Force MIL STD 1751, Safety and Performance Test for Qualification of Explosives, was approved and submitted for publication. A low-cost explosive, ethylenediaminedinitrate/ammonium nitrate (EA), has been identified which offers greater potential as a general purpose explosive fill than TNT. A munition design computer program which predicts mass properties, stress characteristics, barrel deformation, aerodynamic characteristics, trajectory computations and terminal ballistics effects for both missiles and gun launched projectiles was completed. Advanced propellant tests specifically tailored for GAU-8 applications were completed and resulted in increasing the GAU-8 muzzle velocity 60-150 ft/sec, while significantly reducing the potential for muzzle flash. A hydraulic servo mount was developed that can very accurately point an M-61 gun. Concept design for an advanced defensive gun ammunition with proximity fuzing was completed. Studies of preliminary mechanism designs for a gun to fire telescoped ammunition was completed. Studies to identify technology voids and development needs for weaponizing an electromagnetic gun were completed. Completed initial design and testing of a sabot diverter to allow compatible use of advanced 30mm armor piercing ammunition on the A-10 aircraft and 30mm gun pod.
(5) WEAPONS CARRIAGE AND RELEASE TECHNOLOGY: Preliminary design of the low level delivery sled test hardware, and the detailed design of the carriage and release mechanism were completed. Flight tests were conducted in support of development of analytical and test techniques which can be used to predict the effects of aerodynmamic heating on external stores. Developed scale segmented force wind tunnel test model for airloads freestream and interference flowfield testing. The supersonic programmable ejector rack test bed fabrication and assembly was completed. Initiated a program to design and implement a test technique suitable for aircraft compatibility testing.

2. (U) FY 1982 Program:
(1) GUIDED WEAPONS TECHNOLOGY AND SIMULATION: The Backbreaker utility study, algorithm development and guidance sensor studies will be completed. An assessment will be conducted to determine the array of air launched guided weapon technologies which can defeat attack helicopters. Development of an infrared imaging seeker using a focal

Program Element: #62602F Title: Conventional Munitions
DOD Mission Area: Engineering Technology (ED), $523 Budget Activity: Technology Base, #1

plane array will be continued with the seeker being configured with appropriate filters and software to optimize performance against high value fixed targets and mobile armored targets. New hardware/ software and special inter face will be completed to allow simultaneous air-to-air and air-to-surface simulation activities. Evaluation of molded inertial sensors for tactical weapons will be continued. Advanced control theory investigations and advanced seeker algorithm generation will be continued.
(2) MUNITIONS, DISPENSER AND COMPONENT TECHNOLOGY: Continue vulnerability studies of enemy antiair weapon systems and determine an optimum defense suppression weapon concept that will satisfy long term defense suppression requirements. Continue to investigate and optimize the combination of self-forging fragmentation technology with integral incendiary to provide effective submunitions for defeat of diesel fuel targets. Test and evaluate kinetic energy penetrator cluster munition concepts and designs for penetration into buried/hardened command, control, and communications facilities. Evaluate operational weapons systems to defeat armed helicopters. Continue to develop techniques to harden sensors against electronic countermeasures. Continue fuzing concept studies in seismic/acoustic target classification, optical signal processing, and sensitive magnetic measurement. Test functional warhead models against realistic targets. Continue fuze sensor and fuzing system technology. Develop in-line electronic safing and arming devices with a secure communication link and an aircraft/fuze data interface module. Continue development of concept for implementation of avionics integrated fuzing.
(3) WEAPON EVALUATION/EFFECTS METHODOLOGY: Develop target models for the Soviet armored fighting vehicles as well as target models for secondary vehicles. Vulnerability data for mobile SAMs will be generated. Additionally, functional and physical models and computation of effectiveness indices will be developed. Generate computerized models of advanced Soviet aircraft, and develop end game methodology for various fuze and warhead combinations. Generate computerized target descriptions for military and industrial targets. Conduct explosive tests against a buried SAM tunnel. Aircrew weapon delivery data will be adapted to solutions by small computers. Studies in trainable guns will be continued and applied to fighter and long range bomber aircraft. Emphasis on complex targets will be on methodology development and improvement, functional and dimensional descriptions of hard fixed complex targets, and analysis support of all major programs.
(4) DIRECT FIRE WEAPONS TECHNOLOGY: Continue development of concept design sabot diverter for advanced 30mm armor piercing ammunition. Complete development of a barrel flexure concept to provide accurate gun point capability for minimum volume installations. Complete technology assessment and preliminary design studies for weaponization of light gas guns. Initiate critical component development for electromagnetic gun concept. Initiate development of an electronic proximity fuze concept to provide shorter response time and improved terminal effects for high velocity projectiles. Initiate development of concepts for a small 30-40mm guided projectiles. Development and characterization of AFX-108 and AFX-181 explosive systems utilizing energetic binders for increased energy will continue. Work on improved blast explosives will be continued. Work on terminating stable explosives will include interim qualification and demonstration of AFX-201 as a thermally stable booster explosive. Intermolecular explosive ethylenediaminedinitrate/ammonium nitrate (EA) characteristics will be quantified. In the gun propellant area, ingredient stability, oxidizer particle size effects and formulation/ coating techniques will be developed.
(5) WEAPONS CARRIAGE AND RELEASE TECHNOLOGY: Complete detailed design and fabrication of sled test hardware for

demonstration of the low level delivery concept. Conduct static performance and sled track separation tests of the low level delivery concept. Continue to evaluate supersonic carriage and release concepts. Develop a cost effective experimental method for measuring the unsteady aerodynamic pressure distribution of different aircraft stores carriage configurations. Develop and validate an analytical method and a cost effective wind tunnel technique to accurately determine distributed airloads on a store for different aircraft interference flowfields. Develop and validate an analytical method for predicting required bomb rack performance for weapon separation.

3. (U) FY 1983 Planned Program:
(1) GUIDED WEAPONS TECHNOLOGY AND SIMULATION: Investigation of advanced optical rotation sensors, micro-optic gyros, and molded inertial technology will continue. Electronic Countermeasure filters for tactical global positioning system (GPS) for guidance will continue to be tested with the GPS class M receiver. Development of an in-house digital and optical image processing capability will continue. Target and background signature data base to support terminal homing developments in infrared and millimeter wave will be completed. Technology in the areas of shut-down and continuous wave target homing in support of defense suppression seeker development will be advanced. Feasibility breadboards will be fabricated to demonstrate RF techniques applicable to the advanced air-to-air seeker problem for application to beyond visual range passive/ active all-weather seeker technology. (2) MUNITIONS, DISPENSERS AND COMPONENT TECHNOLOGY: Continue development of technology for modular dispenser systems with selectable linear/area pattern control for guided, unguided, and cruise missile application Continue to design, test and evaluate warhead models. Continue assessments to define an optimum defense suppression weapon concept. Continue to design, develop, and test kinetic energy penetrator concepts for defeat of hardened targets. Continue evaluation of weapons concepts to defeat armed helicopters. Continue fuze sensor and fuzing system technology. Complete the fuze sensor technology necessary to build a 99-percent reliable air-to-surface fuze system for impact, impact time delayed, and proximity functioning. Test and evaluate a breadboard sensor for tracking individual targets in the presence of multiple targets and clutter. Basic safing and arming devices applicable to all air-delivered weapons will be designed. Demonstrate the feasibility of the standardized avionic integrated fuze subsystem design.
(3) WEAPON EVALUATION /METHODOLOGY: Continue developing target models for advanced Soviet fighting vehicles. Continue development of threat technical descriptions and damage models of advanced Soviet aircraft/helicopters. Continue development of computerized target descriptions for advanced hardened military and industrial targets. Various advanced warheads will be tested against hardened structures and predictive equations for terradynamic effects will be developed. Computation, verification, and collection of weapons effectiveness indices, weapons characteristics, performance, delivery, accuracy, aircraft carriage options, and target information will continue. A generic power plant target description will be developed. Efforts for determining the effects of chemical agents on airfields will be initiated.
(4) DIRECT FIRE WEAPONS TECHNOLOGY: Continue the automated computer design program to improve the effectiveness of direct fire weapons. Update the projectile design and analysis system to include advanced ammunition. Initiate the light gas gun development to test high velocity air-to-air rounds to defeat fighters. Initiate

Program Element: #62602F Title: Conventional Munitions
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base, #1

hypervelocity projectile interior ballistics development. Continue development of high performance explosive including high energy PBX, energetic binders/composites and prepolymer/plasticizers. Continue development of insensitive explosives. Complete safety qualification of low cost insensitive explosives. Initiate design studies of high velocity gun concepts for future fighter aircraft. Continue development of electronic proximity fuze concept for high velocity ammunition. Complete development of sabot diverter concept for advanced 30mm armor piercing ammunition. Continue development of 30-40mm guided projectile concept to defeat air-to-air targets. Initiate development of critical light gas gun component technology. Continue electromagnetic gun component development.
(5) WEAPONS CARRIAGE AND RELEASE TECHNOLOGY: Complete development of aircraft upper surface low level delivery technology. Continue distributed airloads evaluation for a cost effective way to determine airload in various aircraft flowfields. Continue to evaluate supersonic carriage and release concepts. Continue aircraft/store aeroelastic and aeroservoelastic program to develop flight clearance data. Develop aircraft store validation station for aircraft/store electrical intergation and validation.

4. (U) FY 1984 Planned Program:
(1) GUIDED WEAPONS TECHNOLOGY AND SIMULATION: Initiate fabrication of the infrared target simulator to evaluate current and future seeker systems which defeat fixed high value tactical targets. Development of technology to overcome problems associated with shutdown of emitting targets will continue. Emitter homing technology techniques to improve low frequency antenna performance for missile application will be investigated. Subsystem requirements for tactical missile employing strapdown seeker technology and optimal control techniques will be determined. A program to gather target/background data in the sub-millimeter wave range will be initiated. Work will continue in developing high performance missile digital processors using higher order languages. Molded gyro component technology for missile inertial systems will continue.
(2) MUNITIONS, DISPENSERS AND COMPONENT TECHNOLOGY: Validate a design basis for adanced dispenser technology for cluster munitions against advanced aircraft and cruise missile requirements. Continue to define and develop the technology for advanced dispenser systems uitilizing selectable linear/area pattern control for guided and unguided cruise missile applications. Continue assessments to define optimum defense suppression weapon concepts to defeat emitters in the tactical combat environment. Continue warhead technology development in the following areas: advanced kill mechanisms; warhead physics/ material properties; penetration dynamics; warhead conceptualization/demonstration. Continue fuze sensor and fuzing system technology. Demonstrate air-to-surface fuze systems for impact, impact time delayed, and proximity functioning. Continue testing of breadboard sensor for tracking of individual targets in fields of multiple targets. Evaluate designs for basic safing and arming devices applicable to all air-delivered weapons. Continue feasibility demonstration of the Standardized Avionics Integrated Fuze subsystem design. (3) WEAPON EVALUATION/ EFFECTS METHODOLOGY: Continue generation of vulnerability data and development of methodolgy for evaluating the effectiveness of all types of air delivered weapons.

Program Element: #62602F
DOD Mission Area: Engineering Technology (ED), #523

Title: Conventional Munitions
Budget Authority: Technology Base, #1

Initiate development of technical descriptions of the Fishbed N, a generic cruise missile, and other applicable aircraft. Methods for evaluating the effectiveness of developmental munitions and munition kill mechanisms against future high priority hardened ground targets will be developed. Effectiveness assessment methodology for gun launched guided projectiles will be developed. Efforts to classify and describe generic complex ground targets will continue and the methodology for predicting cratering effects of various munitions will be completed.
(4) DIRECT FIRE WEAPONS TECHNOLOGY: Complete the projectile design and analysis system for advanced ammunition. Complete high velocity gun design studies for future fighter aircraft. Continue aerodynamic studies using light gas launcher technology. Complete hypervelocity projective ballistics. Initiate projectile rotating band function assessment to improve the effectiveness of current and future fighter gun systems. Complete development of high performance explosive. Complete thermal stability evaluation of insensitive explosives. Continue safety, qualification of low cost insensitive explosives. Initiate experimental work on selected gun design concepts for future fighter aircraft. Complete development of electronic proximity fuze concept for high velocity ammunition. Initiate development of fuze concept for hypervelocity ammunition. Complete concept development of 30-40mm guided project. Complete critical component development for electromagnetic and light gas guns and select gun type for continued development. Initiate concept development to defeat armed helicopters in the tactical battlefield.
(5) WEAPONS CARRIAGE AND RELEASE TECHNOLOGY: Continue technology programs to provide advanced carriage and release cocepts, to determine effects of store carriage on aircraft stability and control, and to develop criteria for aircraft/store electrical integration and compatibility.

5. Program to Completion: This is a continuing program.

6. Milestones: Not applicable

7. Resources: Not applicable.

8. Comparison with FY 1982 Descriptive Summary: Not applicable.

Project: #06AL
Program Element: #62602F
DOD Mission Area: Engineering Technology (ED), #523

Title: Air Force Armament Laboratory Operations
Title: Conventional Munitions
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTIONS: This project provides for the support activities required to operate the Air Force Armament Laboratory, Eglin Air Force Base, FL. The Air Force Armament Laboratory is responsible for the exploratory and advanced development of non-nuclear conventional munitions. This project provides funds for the pay of civilian scientists, engineers, and support personnel, travel, transportation, rents, communication and utilities costs, procurement of supplies and equipment, contractor support services, and, environmental impact studies of munition testing at the Armament Division.

(U) RELATED ACTIVITIES: This project provides in-house support to technical projects under this Program Element and to other projects and programs managed by the laboratory. The Air Force Armament Laboratory is also responsible for: PE 63601F, Conventional Weapons; PE 63313F, Missile Subsystems Technology Integration; PE 63363F, Hypervelocity Missile; and provides technical support to PE 63609F, Advanced Attack Weapons. In addition, it provides technical assistance in armament matters to Systems Program Offices, other laboratories, and the Army and Navy as required. (U) WORK PERFORMED BY: The Air Force Armament Laboratory, Eglin Air Force Base, FL, is responsible for the management of projects under this program element.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. Accomplishments and Future Programs: Not Applicable

2. Program to Completion: This is a continuing program.

3. Milestones: Not applicable

4. Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	12,003	12,633	13,474	13,723	Continuing	Not applicable

5. Comparison with FY 1982 Descriptive Summary: ($ in thousands)

RDT&E	11,003	12,001	12,269		Continuing	Not applicable

Project: #2068 Title: Guided Weapons Technology and Simulation
Program Element: #62602F Title: Conventional Munitions
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides the Air Force with a technology base to support tactical air-to-air and air-to-surface guided weapon's development; develop midcourse and terminal guidance techniques/subsystems and demonstrate their feasibility for application to advanced air-to-surface weapons; provide technology required to develop high performance, low cost air-to-air missiles; develop the technology base for aerodynamic efficiency, stability, control and overall flight performance of tactical guided weapons; and provide the Air Force with a capability to evaluate the operational merit and design feasibility of guided weapons in a laboratory environment. The various efforts are directed toward the development of low cost, highly reliable, effective tactical guided weapons which provide maximum tactical flexibility and adverse weather strike capability.

(U) RELATED ACTIVITIES: This program supports Conventional Weapons, PE 63601F; Missile Subsystem Technology Integration, PE 63313F; Advanced Medium Range Air-to-Air Missile, PE 63316F; Advanced Aerial Targets Technology, PE 63232F; and Advanced Attack Weapons, PE 63609F. Guided Weapons Technology efforts are coordinated through the Joint Service Guidance and Control Committee, and the Joint Technical Coordinating Group under auspices of the Joint Logistic Commanders and other formal and informal coordinating groups. The objective of coordination between Services is to maximize technology output through complementary programs.

(U) WORK PERFORMED BY: The Air Force Armament Laboratory, Eglin Air Force Base, FL, manages this program. The work is performed by industrial contractors, DOD and educational institutions on contract and in-house. The ten major contractors in FY 1981 were: General Research Corp, Santa Barbara, CA; General Dynamics, Pomona, CA; Environmental Research Institute of Michigan, Ann Arbor, MI; Systems Control, Inc., Palo Alto, CA; Dynetics Corp, Huntsville, AL; Raytheon, Sudbury, MA; McDonnell Douglas, Huntington Beach, CA; Grumman Aerospace Corp., Bethpage, NY; University of Florida, Gainesville, FL; and Ford Aerospace, Newport Beach, CA. There were a total of forty-two contracts issued in FY 1981 to twenty-six contractors. Of this total, seventeen of the contracts were incrementally funded and/or follow-on to FY 1980 and prior year contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The target and background information library system has been expended. Study contracts were let for Backbreaker system concept and definition, CO2 laser radar sensor design and target detection/classification algorithm development. A NAVSTAR global positioning system antenna was developed to provide isolation against ground based ECM jammers. An extensive program was conducted to collect active 35 and 95 GHz data in the United States and Europe. Several programs were started to exploit the antenna retroreflection phenomena to counter the shutdown problem associated with emitting targets.

Project: #2068
Program Element: #62602F
DOD Mission Area: Engineering Technology (ED), #523

Title: Guided Weapons Technology and Simulation
Title: Conventional Munitions
Budget Authority: Technology Base, #1

2. FY 1982 Program: The Backbreaker utility study, algorithm development and guidance sensor studies will be completed. The Air Force can then determine if the technology effort is needed to improve cruise missile effectiveness in selected operational environments. An assessment will be conducted to determine the array of air launched guided weapon technologies necessary to defeat attack helicopters in the tactical environment. Development of an infrared imaging seeker using a focal plane array will be continued with the seeker being configured with appropriate filters and software to optimize performance against high value fixed targets and mobile armored targets. New hardware/software and special interfaces will be completed to allow simultaneous air-to-air and air-to-surface simulation activities. Evaluation of molded inertial sensors for tactical weapons will be continued. Advanced control theory investigations and advanced seeker algorithm generation will be continued.

3. FY 1983 Planned Program: Investigation of advanced optical rotation sensors, micro-optic gyros, and molded inertial technology will continue. Electronic Countermeasure filters for tactical Global Positioning System (GPS) guidance will be fabricated and tested with the GPS class M receiver Development of an inhouse digital and optical image process capability will continue. Target and background signature data base to support terminal homing developments in infrared and millimeter wave will be established. Technology in the areas of shut-down and continuous wave target homing in support of defense suppression seeker development will be advanced. Feasibility breadboards will be fabricated to demonstrate Radio Frequency techniques applicable to the advanced air-to-air seeker problem for application to beyond visual range passive/active all-weather seeker technology.

4. FY 1984 Planned Program: Initiate fabrication of the infrared target simulator. Development of technology to overcome problems associated with shutdown of emitting targets will continue. Emitter homing technology techniques to improve low frequency antenna performance for missile application will be investigated. Subsystem requirements for tactical missile employing strapdown seeker technology and optimal control techniques will be determined. A program to gather target/background data in the sub-millimeter wave range will be initiated. Work will continue in developing high performance missile digital processors using higher order languages. Molded gyro component technology for missile inertial systems will continue.

5. Program to Completion: This is a continuing program.

6. Milestones: Not applicable

Project: #2068
Program Element: #62602F
DOD Mission Area: Engineering Technology (ED), #523

Title: Guided Weapons Technology and Simulation
Title: Conventional Munitions
Budget Activity: Technology Base, #1

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
7. Resources: ($ in thousands)						
RDT&E	7,511	8,397	9,342	8,343	Continuing	Not applicable
8. Comparison with FY 1982 Descriptive Summary: ($ in thousands)						
RDT&E	8,097	8,406	11,304		Continuing	Not applicable

NOTE: Reduced FY 83 budget and increased civilian pay commmitments influenced the FY 83 estimate compared with FY 82 Descriptive Summary. The following technologies were also reduced; Guided simulation and analysis to support acquiring valid data prior to flight test in air-to-air and air-to-ground sensors. Development of infrared technology for air-to-air and air-to-surface infrared seekers was reduced. Emitter homing technology investments were reduced. Efforts to quantify optimum weapons system integration for air-to-air missiles was reduced.

Project: #2502
Program Element: #62602F
DOD Mission Area: Engineering Technology (ED), #523

Title: Munitions Dispensers & Component Technology
Title: Conventional Munitions
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides a technology base to support design and feasibility demonstraions of advanced air delivered weapons. The objectives are to design, develop and demonstrate the feasibility of new cluster munition dispersal systems, containers, and submunitions (including submunition kill mechanisms), fuzes, stabilization/retardation devices to provide an increase in performance and lethality of air-delivered munitions; to develop, modify and apply computational techniques for predicting the performance of conventional munitions, primarily through the use of hydrodynamic computer programs (hydrocodes); to establish cradle-to-grave fuze technology which will address both air-to-air and air-to-surface weapons and provide a technology base for target activated munition sensor and related target signal processing; and to demonstrate advanced warhead technology.

(U) RELATED ACTIVITIES: This program supports Conventional Weapons, PE 63601F; Hypervelocity Missile, PE63363F; Missile Subsystem Technology Integration, PE 63313F; Advanced Medium Range Air-to-Air Missile, PE 63315F; Advanced Aerial Targets Technology, PE 63232F; and Advanced Attack Weapons, PE 63609F. Bomb, submunition and dispenser technology efforts are coordinated through the Joint Service Guidance and Control Committee and the Joint Technical Coordinating Group under the auspices of the Joint Logistic Commanders and other formal and informal coordinating groups. The objective of coordination between services is to maximize technology output through complementary programs.

(U) WORK PERFORMED BY: The Air Force Armament Laboratory, Eglin AFB, FL, manages this program. The work is performed by industrial contractors, DOD, DOE, and educational institutions on contract, and in-house. The ten major contractors in FY 1981 were: Lockheed, Sunnyvale, CA; Sperry Research Center, Sudbury, MA; General Dynamics Pomona, CA; Honeywell, Hopkins, MN; Orlando Technology, Inc., Orlando, FL; Chamberlain Mgf. Corp., Waterloo, IA; U.S. Steel, Birmingham, AL; Kaiser Aluminum and Chemical Sales, Inc., Oakland, CA; Instrom Corp., Canton, MA; and Motorola, Inc. Scottsdale, AZ. There were twenty contracts issued in FY 1981 to fifteen contractors. Of this total, eight of the contracts were incrementally funded and/or follow-on to FY 1980 and prior year contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Feasibility of the Bunkered Target Munition to successfully penetrate into deeply buried hardened command and control targets was demonstrated. A self-forging warhead concept was demonstrated to be very lethal against aircraft and is being considered for use in the Advanced Medium Range Air-to-Air Missile. Depleted uranium warhead technology conce[illegible] have been successfully demonstrated.

Project: #2502 Title: Guided Weapons Technology and Simulations
Program Element: #62602F Title: Conventional Munitions
DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base, #1

New kill mechanisms that offer potential to reduce Soviet ground forces combat mobility were developed. Concept studies evolved a dispersion mechanism design which shows promise of generating selectable patterns from cluster warheads. Test techniques for evaluation of long-rod penetrators were developed. Target activated munition fuzing concepts were advanced to demonstrate the use of passively-obtained acoustic and seismic signals. Ground tests of the low altitude altimeter breadboard were completed. Improvements in baseband reflectometry sensor antenna technology and electronic counter-countermeasures technology were made. The design and fabrication of the integrating accelerometer has been completed, and the test and evaluation processes were initiated. A breadboard based on microcomputer technology was fabricated and tested for application to dispenser timers. A dispenser timer/simulator interface was developed.

2. FY 1982 Program: Continue vulnerability studies of enemy anti-air weapon systems, and determine an optimum defense suppression weapon concept that will satisfy long term defense suppression requirements. Continue to investigate and optimize the combination of self-forging fragmentation technology with integral incendiary to provide effective submunitions for defeat of diesel fuel targets. Test and evaluate kinetic energy penetrator cluster munition concepts and designs for penetration into buried/hardened command, control, and communications facilities. Evaluate operational weapons systems versus armed helicopters. Continue to develop techniques to harden sensors against electronic countermeasures. Continue fuzing concept studies in seismic/acoustic target classification, optical signal processing, and sensitive magnetic measurement. Test functional warhead models against realistic targets. Continue fuze sensor and fuzing system technology. Develop in-line electronic safing and arming devices with a secure communication link and an aircraft/fuze data interface module. Continue development of concept for implementaiton of avionics integrated fuzing.

3. FY 1983 Planned Program: Continue development of technology for modular dispenser systems with selectable linear/area pattern control for cruise missile applications. This technology could provide for cost effective defeat of armor and airfield targets. Continue to design, test, and evaluate warhead models for air-to-air and air-to-ground missiles. Continue studies to define an optimum defense suppression weapon concept. Continue to design, develop, and test kinetic energy penetrator concepts for defeat of hardened targets. Continue evaluation of weapon concepts versus armed helicopters. Continue fuze sensor and fuzing system technology. Complete the fuze sensor technology necessary to build a 99-percent reliable air-to-surface fuze system for impact, impact time delayed, and proximity functioning. Test and evaluate a breadboard sensor for performance in tracking individual targets in the presence of multiple targets and clutter. Basic safing and arming devices applicable to all air-delivered weapons will be designed. Demonstrate the feasibility of the standardized avionics integrate fuze subsystem design.

Project: #2502
Program Element: #62602F
DOD Mission Area: Engineering Technology (ED), #523

Title: Guided Weapons Technology and Simulation
Title: Conventional Munitions
Budget Activity: Technology Base, #1

4. FY 1984 Planned Program: Develop a design for advanced dispenser technology for advanced aircraft and cruise missiles. Continue to define and develop the technology for advanced dispenser systems utilizing selectable linear/area pattern control for guided and unguided cruise missile applications. Continue studies to define an optimum defense suppression weapon concept. Continue warhead technology development in the following areas: advanced kill mechanisms; warhead physics/material penetration dynamics; warhead conceptualization/demonstration. Continue fuze sensor and fuzing system technology. Demonstrate air-to-surface fuze systems for impact, impact time delayed, and proximity functioning. Continue testing of breadboard sensor for identification and tracking of targets against fields of multiple targets. Evaluate designs for basic safing and arming devices applicable to all air-delivered weapons. Continue feasibility demonstration of the standardized avionics integrated fuze subsystem design.

5. Program to Completion: This is a continuing program.

6. Milestones: Not applicable

7. Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,888	5,194	6,600	7,200	Continuing	Not applicable

8. Comparison with FY 1982 Budget Data: ($ in thousands)

RDT&E	4,500	5,300	6,900		Continuing	Not applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	61,996	65,887	69,840	75,363	Continuing	Not Applicable
06RA	Laboratory Operations	28,293	27,856*	29,472	29,865		
2338	Assurance Techniques for Electronics	4,500	5,631	6,058	7,050		
4506	Surveillance Technology	6,309	6,920	7,300	8,150		
4519	Communications & Control Technology	5,806	4,920	5,300	6,350		
4594	Intelligence Technology	6,071	6,320	6,900	7,650		
4600	Electromagnetic Radiation, Devices & Components	4,807	5,820	6,300	7,150		
5581	Information Sciences Technology	6,210	8,420	8,500	9,148		

* Excludes 1 Oct 81 Civilian Pay Raise (4.8 percent)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides a broad technology base for advancing Air Force mission capabilities in Command, Control and Communications (C^3), a mission requirement which is rapidly increasing its significance because revolutionary advances in electronics and especially in computers permeate C^3 technology, offering more unique opportunities than in any other mission areas to cope with the crucial time compression of modern warfare. Six basic technology areas are pursued: Surveillance; Intelligence; Communications and Control; Information Sciences; Electronic Reliability and Electromagnetic Compatibility; and Electromagnetic Radiation, Devices and Components. The program element also provides for the operation of the Rome Air Development Center (RADC), Griffiss AFB, Rome NY, and the RADC Deputy for Electronic Technology, Hanscom AFB, Bedford, MA.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Emphasis that began in FY 1982 in the area of decision aids will continue to be addressed. The problems attacked will concentrate on the tactical arena, where existing conditions dictate immediacy. Ironically, the benefits of high speed electronics processing capabilities in the tactical system would actually produce negative factors if the human is not given the manipulative tools and computer aids to keep ahead of the battle situation and information flow. Other representative areas of pursuit will include: development of technologies for the spaceborne radar to have available the ability to take the high ground in surveillance, and fiber optics development for tactical communications to provide airlift and survivability advantages.

Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	61,300	67,999	83,029		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Military Construction			900	2,049		

Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The technical explosion in electronics and computers in recent years is making a profound impact on Air Force Command, Control and Communications technology at the exploratory development level. Although advances in electronic devices provide unique opportunities for revolutionary advances they have attendant problems peculiar to military environments not experienced by the commercial sector. The introduction of very large scale integrated circuits will provide densities of hundreds of thousands of transistors on a chip with millions of instructions per second, basically placing the equivalent of large computers on a single chip. Utilization of these "systems" on a chip in military equipment demands determination of their reliability over the range of military requirements. That demands totally new technologies because it is not possible to get inside these "systems" which in the past were combinations of thousands of individual chips to which probes could be attached. One new method this program has produced is the invention of a visual post-mortem technique used on large integrated circuits by viewing them through a liquid crystal which reveals failure points within the circuit. This and special electron microscope methods are the kinds of tools being developed to provide reliable military systems that use integrated circuits. Surveillance technology faces unique challenges in the area of positive identification of target aircraft beyond visual range as friend or foe. This program is pursuing non-cooperative target recognition techniques to meet this challenge. This program element is also providing the low power, low cost, transmit/receive modules, signal processing, and membrane antenna technology necessary for jam resistant space radar systems that are capable of detecting extremely small targets. It is also providing the technology to detect and track extremely low radar cross section, stealthy targets such as high speed, low altitude cruise missiles which conventional radars cannot "see". In communications, as in device technology, the Air Force is investigating the use of fiber optics for specific military applications. By using fiber optics, transmission distances can be increased by a 20-to-one ratio over copper cable with a 10-to-one weight advantage, increasing tactical survivability and airlift capability. The advances in computing and electronics technologies have greatly improved our capability in the area of information gathering and handling. Intelligence information storage requirements have driven technology to pursue methods of high density recording and extremely high speed data access and retrieval to optimize exploitation of this advanced processing capability. To address this problem, this program element has developed wide band recording in high density digital recorders and data transfer rates of 600 million bits per second through the use of a laser recorded digital optical disc. This program is providing technology to determine which decisions within a modern tactical Command and Control system could be assisted by the use of intelligent decision aids, drawing on the advance technologies areas of Artificial Intelligence, Computer Science, and Decision Analysis.

(U) RELATED ACTIVITIES: This program is actively coordinated at tri-service and interagency levels to preclude duplication and to meet overall Department of Defense (DOD) needs. Examples of this coordination are the DOD Advisory Group on Electronic Devices, the Interservice Antenna Group, the Technology Coordinating Paper on Electronics, the DOD Higher Order Language Working group, and the DOD Embedded Computer Research and Development Technology Panel. DOD has fostered closer coordination between the Services during FY 1981 in several technology areas affecting this program, particularly in surveillance and communications areas. For instances, joint reviews of surveillance programs are underway and a Tri-service fiber optics working group has been revitalized. Participation in various North Atlantic Treaty Organization (NATO) panels and working groups and liaison with the European Office of Advanced Research and Development further coordinates program efforts. Work performed is related to electronics efforts at the Air Force Avionics Laboratory,

Program Element: #62702F
DOD Mission Area: Electronics and Physical Sciences (ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

Air Force Weapons Laboratory, Lincoln Laboratory, the Army Electronics Command, Office of Naval Research, National Aeronautics and Space Administration, the Defense Advanced Research Projects Agency and other government agencies. Image exploitation programs are coordinated through a national committee while the Defense Mapping Agency (DMA) coordinates all service programs in mapping and charting. The National Security Agency coordinates all service programs in signals intelligence and the Defense Intelligence Agency coordinates all work in intelligence data handling. Basic research in Program Element 61101F, Defense Research Science, directly feeds into this program. Major advanced development programs assigned to RADC to which direct technology transfers made are: PE 63728F, Advanced Computer Technology; PE 63750F, Counter-Countermeasures Advance Development; PE 63789F, Command, Control and Communications Advanced Development; PE 63747F, PAVE MOVER; PE 63726F, Fiber Optics for C^3I; PE 63259F, Cartographic Applications. Efforts in this program are also transitioned into other program elements such as PE 63208F, Reconnaissance Sensors/Processing Techniques; PE 63431F, Advanced Space Communications; PE 31011G(F), Cryptological Activities; PE 32022F, Scientific and Technical Intelligence; PE 31025F, Intelligence Data Handling Systems; and PE 64750F, Intelligence Equipment. Related non-Air Force programs are: PE 63701B, Mapping and Charting; PE 62725A, Computer and Information Sciences; PE 62705A, Electronics and Electronic Devices; PE 62712N, Surface/Aerospace Target Surveillance; PE 62721N, Command and Control Technology; and PE 62762N, Electronic Device Technology. Technical support is provided to the Electronics System Division, Space Division, the Defense Mapping Agency (DMA), Defense Intelligence Agency (DIA), Defense Communications Agency (DCA), Defense Nuclear Agency (DNA), the Army and Navy.

(U) WORK PERFORMED BY: The in-house activity is performed at the Rome Air Development Center (RADC), Griffiss AFB, NY, at the RADC Deputy for Electronics Technology, Hanscom AFB, MA, and at ten off-base sites located throughout New York and Massachusetts. Ten major contractors in FY 1981 were: Bunker-Ramo Corp., Westlake Village, CA; Pattern Analysis Recognition Inc., Rome, NY; Honeywell Information Systems Inc., McLean, VA; TRW Inc., Redondo Beach, CA; Harris Corp., Rochester, NY; RCA Corp., Camden, NJ; Hughes Aircraft Co., Fullerton, CA; LOGICON, Inc., Woodland Hills, CA; Syracuse Research Corp., Syracuse, NY; Northwestern University, Evanston, IL. There were 153 contractors with 405 contracts in FY 1981.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Reliability qualification of electronic devices for military use has been extended to include 16 bit microprocessors. Technology for the next generation tactical radar to replace the AN/TPS-43 ground radar and to meet the emerging threats has transitioned into advanced development. The three critical areas of spaceborne radar technology, on-board signal processing, transmit/receive modules, and the membrane antenna are meeting or exceeding their design goals. Experimental models of the moduler will meet low power drain, size and weight requirements and the membrane antenna has successfully completed dynamic physical tests for stability and thermal dissipation. Fiber optics for military ground use has seen a successful fabrication of a replacement 26-pair cable for the Air Support Operations Center and a new highly efficient fiber optic multiplexer has been invented. The laser recorded optical disc with 10^{11} bit storage capacity on a disc the size of a phonograph record has proven good enough to do 200 megahertz bandwidth recording for an operational intelligence program. A new semiconductor junction for radiation resistant circuit was invented and is receiving further testing. A new very high level language programming system was delivered which may advance automated computer programming techniques. A special emphasis will begin and continue through Fiscal Year 1985 to meet Air Force needs in computer technology through the year 2000.

Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

2. (U) FY 1982 Program: Device reliability assurance will include 32 bit microprocessor qualification. Phase shift only modules for a possible use in spaceborne radar will be designed and several transmit/receiver modules will be produced as full-up radio frequency (RF) sections of the radar. Fiber optics technology will begin transition into advanced development for the tactical cable and the new multiplexer will continue development. Testing will be completed on the 600 megabit per second tape drive and the optical disc recorder will continue development. A receiver design will be completed for a high frequency ducted mode propagation experiment. Combined analog/digital circuit developments will provide up to a 10,000 fold increase in processing rate over all digital circuits of the same size and weight. Emphasis begun in FY 1981 and continuing for five years in computer technology will focus on automated computer programming via Artificial Intelligence Techniques. Decision aids, specifically for the tactical commander will be pursued, capitalizing on extensive work done in basic research and in the private sector. Development will begin on computer tools to help decision makers reduce data, gain real time flexible information handling, and interact with a volatile tactical environment in making critical decisions. The goal is to provide these commanders with tools derived from emergent advances in computing power for use against the mounting threat of overwhelming information generated by these same advances in computing power, a problem complicated by the instantaneous nature of modern weapon systems technology.

3. (U) FY 1983 Planned Program: Development will begin on combined hardware/software reliability prediction technology and device reliability assurance will include chips of the 60,000 gate per chip complexity. Technology for the next generation E-3A Airborne Warning and Control System (AWACS) surveillance platform will see incorporation of transferable signal processing efforts from the spaceborne radar work. Phase shift only modules will be combined with the radiating membrane for limited testing of a spaceborne radar design configuration. Fiber optics, high frequency, and satellite communications efforts will continue transition into advanced development as various segments reach successful evaluation. Intelligence technology will stress wideband recording with investigations of materials suitable for faster read/write/erase capabilities in laser optical recording. Automatic updating of intelligence data bases from free text of messages will be investigated. An effort will continue at modest level to aid the data production problem faced by the Defense Mapping Agency and impacting Air Force weapons systems relying on this data. Analog/digital signal processors using charge coupled devices and surface acoustic wave devices will be further developed for use in peripheral components needed to operate with very high throughput processors, such as very high speed integrated circuits (VHSIC). Efforts to reduce size and weight of atomic frequency time standards will be pursued to produce standardized, low cost timing and synchronization components on a new scale. Decision aids to provide tools for tactical commanders in target aggregation, battle staff decision making, and force management will be continued. In comparison with the FY 1983 program resources shown in last year's Descriptive Summary, some efforts will not be pursued which were planned at that funding level, or will be drastically reduced or deferred to future years. For instance, extensive testing of large numbers of spaceborne radar modules will not be possible; decision aids efforts will be stretched out and the program will have a longer transition time to field commanders. Accelerating the development of the production processor needed to rapidly produce cartographic, and photogrammetric data that is needed for terrain following weapon systems will not be possible at the level needed for a possible breakthrough.

Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

4. (U) FY 1984 Planned Program: Techniques will begin in quality assessment methods for extremely small, very high speed integrated circuits. Built-in-test and fault detection/isolation technology will transition into advanced development. Various elements in the spaceborne radar technologies will be integrated on small scale for limited evaluation. Fiber optic transceiver devices for standardized use will transition into advanced development. The optical disc recorder will be ready for evaluation for selected intelligence applications. The elements of the high frequency, ducted mode experiment will be complete and are scheduled to start test if the satellite launch schedule remains firm. Decision aids efforts will continue with tactical emphasis and automated programming techniques will be initially evaluated as they are completed.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

Project: #06RA
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Laboratory Operations
Title: Command, Control and Communications
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides the support activities required to operate the Rome Air Development Center (RADC), Griffiss AFB, NY, and the RADC Deputy for Electronic Technology, Hanscom AFB, MA. Support provided includes the pay and related costs of civilian scientists, engineers and supporting personnel, travel, transportation, rents, communications, utility costs, procurement of supplies and equipment, and contractor support services. RADC is responsible for exploratory development and advanced development programs in surveillance, communications and control, intelligence, information sciences, electronic reliability, electromagnetic compatibility, electromagnetic radiation, devices and components. It is also responsible for technology intensive engineering development programs, primarily in the intelligence area. RADC also provides technical support to current and future systems programs. Project formerly 06DM.

(U) RELATED ACTIVITIES: The project supports and complements all the technical projects under this program element and numerous other programs being performed at the Rome Air Development Center.

(U) WORK PERFORMED BY: The Rome Air Development Center, Griffiss AFB NY, is responsible for the management of the projects under this element. Work is performed by that organization and the RADC Deputy for Electronic Technology, Hanscom AFB, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) Accomplishments and Future Programs: Plans and accomplishments were discussed in the Descriptive Summary for the overall Program Element. This project will also provide for upgrade of the administrative processing support systems needed to support and reduce the workload of the laboratory contract managers. This is an experiment in office automation and management information systems scheduled for completion in 1982.

2. (U) Program to Completion: This is a continuing program.

3. (U) Milestones: Not applicable.

4. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	28,293	27,856*	29,472	29,865	Continuing	Not Applicable

* Excludes 1 Oct 81 Civilian Pay Raise (4.8 percent)

Project: #06RA
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Laboratory Operations
Title: Command, Control and Communications
Budget Activity: Technology Base, #1

5. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	26,800*	27,316	27,700		Continuing	Not Applicable

*Excluded Oct 1980 Pay Raise

Project #2338
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Assurance Techniques for Electronics
Title: Command, Control & Communications
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides the Air Force with basic technology in reliability and maintainability (R&M) techniques and in electromagnetic compatibility (EMC). The technologies are essential to Air Force systems dependent on electronics and have assumed paramount importance with the advent of new electronic components such as large scale integrated circuits (LSI). Although one of the chief payoffs is lower systems life cycle costs, the critical factor is systems availability - having the electronics there when needed. The boom of new semiconductor technologies in the last decade has dramatically increased the capability of military electronic systems and has demanded an increased emphasis in ensuring that only those devices qualified to perform over the full range of military stress environments are used in military designs. These devices with their attendant advantages of thousands of gates in a single chip also present unique reliability problems. Functions previously assigned to be implemented by hundreds of discrete chips to which measurement probes could be attached are now integrated into "systems" as a single chip. New evaluation techniques for failure modes and prediction techniques are being developed to keep abreast of these changes. Likewise, in terms of electromagnetic compatibility, the art of preventing systems from interfering electromagnetically with one another has become increasingly difficult with the increased use of LSI devices. These lower powered, densely packed components allow the integration of many more radio frequency emitters in any given platform, but also present unique problems in ensuring that they can function without interference. Not only are these devices susceptible themselves but prediction of their combined effects requires sophisticated techniques beyond those required in the vacuum tube era. The lessons learned in these technologies are transitioned directly to users by the preparation of various military specifications and standards.

(U) RELATED ACTIVITIES: R&M and EMC efforts related to electronic devices are coordinated through the DOD Advisory Group on Electron Devices and Technology Coordination Paper on Electronics. In addition, tri-service panels, and working groups meet on a regularly scheduled basis to discuss and coordinate activities. This project is related to on-going activities at the Air Force Avionics Laboratory, Lincoln Laboratory, Army Electronics Command, and Office of Naval Research. R&M basic research in PE 61102F, Defense Research Science, transitions into this project. The project output transitions directly into various DOD R&M specifications for which RADC is the preparing activity and both R&M and EMC technology is taken directly to system developers through vigorous system technical support activities. The EMC technology also supports the Intrasystem Analysis Program, a sophisticated computerized prediction tool, used to design new weapon systems to be free of electromagnetic interference effects.

(U) WORK PERFORMED BY: The in-house activity is performed at the Rome Air Development Center, Griffiss AFB NY. Ten major contractors in FY 1981 were: General Electric Co., Pittsfield, MA; McDonnell Douglas, St. Louis, MO; IIT Research Institute, Chicago, IL; Syracuse University, Syracuse, NY; IITRI Corp., Chicago, IL; Southeastern Center for Universities, St. Cloud, FL; Integrated Circuit Engineering Co., Scottsdale, AZ; IBM Corp., Manassass, VA; Hughes Aircraft Co., Culver City, CA; Rockwell International, Cedar Rapids, IA.

Project #2338
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Assurance Techniques for Electronics
Title: Command, Control & Communications (C^3)
Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: This project has provided the technology required to improve the operational readiness and mission success of a wide variety of Air Force electronic systems. Product evaluations, electrical characterization and reliability assurance have resulted in significant improvements in the electrical and reliabilty characterization of 16 bit microprocessors, such as the Z-8000 and advanced memories. These device reliability advances were paralleled by equipment system Reliability and Maintainability (R&M) outputs in improved prediction models for bubble memories, traveling wave tubes, and fiber optic assemblies. These studies coupled with system testability rating and design techniques resulted in improvements of R&M prediction design and demonstration technology for C^3 Systems. The transfer of electromagnetic compatibility technology was enhanced in FY 81 through incorporation of improved models and nonaverage power EMC prediction capabilities within the intrasystem EMC analysis program (IEMCAP). The EMC control studies resulted in the development of electronically tunable filters and linear interference cancellation technic[illegible]. An ultra low noise, electronically tuned oscillator was developed in FY 1981. This technology will ultimately be [illegible]ed to develop a 225-to-400 MHZ synthesizer with improved signal-to-noise capabilities. Finally, an experimental model radio was developed which will improve the EMC performance of existing communications systems on Air Force weapons platforms.

2. (U) FY 1982 Program: The Solid State Device reliability task will concentrate on the development of the technology base for assessing, predicting, and specifying the reliability of a variety of components ranging from 16K, dynamic random access memory (RAM) devices to 32 bit microprocessors. Studies will also be conducted on advanced power switching devices and gallium arsenide devices which are seeing increased usage in Air Force systems. Testability techniques will be transferred to developers by inclusion in a reliability design handbook. Electromagnetic compatibility efforts will concentrate on the development of models for analysis and prediction of the performance of complex systems. In wideband EMC problems, new measurement techniques and instrumentation and the investigation of surface sources of intermodulation will be pursued in order to enhance interference control capabilities. These studies will lead to design guides for improved collocation of sensitive electronic communications and surveillance systems.

3. (U) FY 1983 Planned Program: New investigations will begin on the impact of software and hardware on total system reliability. Reliability evaluation of devices will continue at the 60,000 gate per chip level. Further definition will be done of the physical and electrical factors affecting the evaluation of fully integrated analog and digital subsystems. The equipment/system R&M program will upgrade the reliability prediction methodology through development of models for evolving device technology. Failure modes and effects analysis, sneak circuit analysis and thermal evaluation methodology will be developed to aid in improved R&M design and test of equipment. Testing of advanced synthesizers and antenna coupler systems for improved compatibility will be conducted.

4. (U) FY 1984 Planned Program: Investigation of failure mechanisms in devices fabricated at submicron spacings will begin. Also, related efforts will begin in quality assessments of very high speed integrated circuit (VHSIC) and very large scale integrated circuits. Efforts in developing testability standards will continue. A transmitter/receiver with much improved inteference resistance based on the experimental model radio will begin design. Antenna model updates will be incorporated into the electromagnetic compatibility modeling program for use by system developers to reduce interference in collocating emitters on airborne platforms.

Project #2338
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521)

Title: Assurance Techniques for Elec onics
Title: Command, Control & Communications
Budget Activity: Technology Base, #1

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,500	5,631	6,068	7,050	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	4,800	5,725	8,200		Continuing	Not Applicable

If the previously identified funding for FY 1983 is provided additional emphasis will be applied to accelerating the qualification of electronic circuits and to increasing testability improvements in equipment designs.

Project: #4506 Title: Surveillance Technology
Program Element: #62702F Title. Command, Control and Communication
DOD Mission Area: Electronic and Physical Sciences (ED), #521 Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to develop advanced ground, airborne, and space based system and sensor concepts and the associated technology base for application to future Air Force surveillance needs. The major thrusts include development of new surveillance radar, Electronic Counter-Countermeasures, identification, and survivability technologies for both Tactical and Strategic surveillance. Beyond visual range, positive identification is a high priority operational requirement and new technologies are being pursued to solve this problem. New technology is also addressing the problem of detecting and tracking low observable threats, such as cruise missiles. The radar cross sections of these vehicles are so small that conventional radars cannot reliably detect them. Jam resistance, long-lived, space based radar with the capability to detect and track 1990's type threats is based on the signal processing and array antenna techniques in this project. Space systems and mobile tactical systems require extremely high power tubes and that technology is also developed in this project.

(U) RELATED ACTIVITIES: Electron tube and device developments are coordinated through the DOD Advisory Group of Electron Devices and Technology Coordination Papers on Electronics. In addition, triservice panels and working groups such as the Noncooperative Target Recognition Working Group meet on a regularly scheduled basis to discuss and coordinate activities. For example, a workshop on Target Identification was held in Oct 1981. The work undertaken in this project is relat to on-going activities at the Air Force Wright Aeronautical Laboratories, Space Division, Electronic Systems Division, Lincoln Laboratory, Army Electronics Command, Office of Naval Research, NASA, and Defense Advanced Research Projects Agency (DARPA). The electro-optical area builds extensively on technology developments sponsored by the Defense Advanced Research Projects Agency. The technology output of the Surveillance Technology project is transitioned into PE 63750F, Counter-Countermeasures Development, PE 63789F, Command, Control and Communication Advanced Development; and PE 12412F, Distant Early Warning (DEW) Refurbishment.

(U) WORK PERFORMED BY: The in-house activity is performed at the Rome Air Development Center, Griffiss AFB NY. Ten contractors in FY 81 were: Raytheon Co., Wayland, MA; General Research Corp., Santa Barbara, CA; Varian Associates, Palo Alto, CA; General Electric Co., Syracuse, NY; Westinghouse Electric Corp., Baltimore, MD; Decision Science Application, Arlington, VA; Technology Service Corp., Santa Monica, CA; RCA Corp., Moorestown, NJ; Grumman Aerospace Corp., Bethpage, NY; Hazeltine, Greenlawn, NY.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Technology in this project has provided the basis for the advanced development of the Advanced Tactical Radar, the new highly survivable anti-jam radar designed to replace the AN/TPS-43 radars. Spaceborne radar development has seen verification of the design of the Advanced On-board Signal Processor (AOSP) to meet the demands of an air defense mission. The AOSP is the heart of controlling the radar functions in space. Physical tests conducted in the 10 foot x 10 foot section of the radiating phased array membrane have shown it

Project: #4506
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Surveillance Technology
Title: Command, Control and Communication
Budget Activity: Technology Base, #1

will perform in space within the tolerances of warpage, thermal dissipation, etc. The transmit/receive modules for the radar have been determined to meet the power, size, and weight requirements and now must be made to be more producible at the target costs. Simulations of the integrated system verify the design thus far for a shuttle-deployable radar. Initial efforts will begin on the Advance Airborne Surveillance Radar (AASR), the next generation E-3A Airborne Warning and Control System (AWACS). Design for sensors tuned to cruise missile threats have been completed and engagement scenarios have been coupled into the multisensor integrated systems concepts. An experimental traveling wave tube was demonstrated which has twice the previously available peak microwave power over octave (2GHz - 4 HGz) bandwidth, a significant capabilities advance against jamming that offers at least a two-to-one reduction in cost to manufacture over conventional traveling wave tubes.

2. (U) FY 1982 Program: Concept development of integrated radar/communications using the agile beam of an advanced tactical radar will begin. Design developments for decoys to be used with such a radar will begin, to protect it from enemy radiation-seeking missiles. AASR efforts will continue with expansion to consider high flyer conformal array radar. Complete radio frequency (RF) section of the transmit/receive modules will be designed as an entity and a few modules actually produced under the spaceborne radar program. An alternative to the active RF space-fed lens would be a version with low-loss, phase-shift-only modules and the first design iteration for that type module will be completed. Aircraft identification efforts will continue with emphasis on electronic support measures (stray electronic signals which can help identify an unknown when coupled with other data) and bayesian prediction techniques. Cruise missile surveillance sensor concepts will be prepared for use in augmenting the design of the gap filler radars in an upgraded Distant Early Warning (DEW) line, should that option be picked. The sensors would be tuned for a larger cross-section bomber threat but would provide higher reliability with lower power requirements. High power tube technology will demonstrate extended interaction klystron amplifiers operating at 40 percent efficiency and megawatt peak power. Development of 40 to 44 Gigahertz traveling wavetubes (TWTs) at up to 150 watts power will begin.

3. (U) FY 1983 Planned Program: The feasibility for integrated radar/communications will continue to be investigated. The Advanced Airborne Surveillance Radar (AASR) efforts will begin transition at a modest level into advanced development with emphasis on electronic counter-countermeasure (ECCM) and target identification problems. A possible application of the Advanced On-board Signal Processor (AOSP) usage in the AASR platform will be investigated. The AASR is the next generation E-3A Airborne Warning and Control (AWACS) airborne surveillance system which will not require a rotodome and will have the latest state-of-the-art capabilities. The AOSP for spaceborne radar is an array of processing elements called array computer elements (ACE) which are distributed throughout the hundred thousand plus transmit/receive modules and are interconnected by high-speed data busses. An eight ACE model of the AOSP developed in FY 1982 will continue evaluation to validate AOSP operating system and software. Aircraft identification will continue development of fusion concepts and the application of decision aids and artificial intelligence techniques, including new algorithm development efforts. Spaceborne radar phase - shift only modules will be combined with the membrane lens, and RF testing will be performed. Millimeter wave traveling wave tube developments will continue for space communications with emphasis on increased efficiency and lifetimes.

Project: #4506
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Surveillance Technology
Title: Command, Control and Communication
Budget Activity: Technology Base, #1

4. (U) FY 1984 Planned Program: Testing will continue as the AOSP, membrane antenna, and integrated RF components lead to a ground based demonstration in advanced development that will validate this design of a large spaceborne radar. AASR efforts and cruise missile surveillance concepts will continue transition to advanced development. Survivability techniques will progress into the design of the Advanced Tactical Radar (ATR). Evaluation of coupled cavity traveling wave tubes for use in light weight tactical transmitters will be completed and emphasis on space communications tubes will continue.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	6,309	6,920	7,300	8,150	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	6,700	7,558	10,300		Continuing	Not Applicable

Additional testing using large quantities of transmit/receive and phase shift-only modules for the spaceborne radar will not be done without the additional funds, resulting in stretched out, high risk program. Additional emphasis on on tubes for space applications will not be applied.

Project: #4519 Title: Communications and Control Technology
Program Element: #62702F Title: Command, Control and Communication
DOD Mission Area: Electronic and Physical Sciences (ED), #521 Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project addresses communications needs ranging from very low frequencies to optical frequencies. It develops technology for increasing communications data rates, survivability and flexibility. Another example of important technology is in the area of adaptive high frequency communications. The high frequency portion of the energy spectrum is receiving increased attention after a period of long neglect. Adaptive techniques take the "chance" out of high frequency communications connectivity between users, making it a more reliable path. Technology to provide secure voice and data over adaptive high frequency paths is developed in this project. Another example of high payoff technology in this project is in fiber optics technology, especially for tactical users. Although this technology is maturing in the commercial world, the Air Force has specific problems unique to the military world which the telephone companies do not have. The requirements for many tear down and set up sequences which the Air Force demands in using fiber optics in a tactical environment between combat shelters, and the requirement for quick, reliable splicing and are just two examples of problems which are being addressed. The payoffs are increased bandwidth, 10-to-one savings in deployment weight and 20-to-one increase in transmission distance. This project also develops improved satellite communications technologies.

(U) RELATED ACTIVITIES: The work undertaken in this project is related to on-going activities at the Air Force Avionics Laboratory, Lincoln Laboratory, Office of Naval Research, NASA, Defense Advanced Research Projects Agency, the Army Satellite Communications Agency and the Defense Communications Agency. Tri-service working groups and panels, such as the Fiber Optics Coordinating Group, meet to discuss and coordinate activities. Internal Air Force coordination is accomplished at all levels of management to eliminate duplication. The technology output of the Communications and Control Project is transitioned into PE 63789F, Command, Control and Communications Advanced Development; PE 33126F, Long Haul Communications; PE 63431F, Advanced Space Communications; PE 63726F, Fiber Optics Development, and PE 63727F, Communications Advanced Development.

(U) WORK PERFORMED BY: The in-house activity is performed at the Rome Air Development Center, Griffiss AFB, NY, and at small off-base sites in New York state. The ten major contractors in 1981 were: Harris Corp., Rochester, NY, and Melbourne, FL; Hughes Aircraft Co., Fullerton, CA; Syracuse Research Corp., Syracuse, NY; Ohio State University, Columbus, OH; IBM Corp., Owego, NY; ITT Corp., Roanoke, VA; Hazeltine, Greenl n, NY; General Dynamics, San Diego, CA; ITT, Nutley, NJ.

Project: #4519
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Communications and Control Technology
Title: Command, Control and Communication
Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Demonstration models of fiber optic replacements for 26-pair copper cables used in a tactical Air Support Operations Center were fabricated and are ready for test in FY 1982 with a scheduled period of operational use for evaluation prior to advanced development. The feasibility of transmitting very narrowband source-encoded digital voice over High Frequency (HF) links was demonstrated. Various tactical troposcatter (tropo) communications improvement efforts were completed leading to follow-on efforts for more deployable, more survivable tactical systems. Investigations in adaptive processing, interference cancelling phased arrays, and extremely high frequency (EHF) satellite communications for jam resistance, and survivability were completed and follow-on efforts will continue.

2. (U) FY 1982 Program: The fiber optic 26-pair tactical cable replacement efforts will begin transition to advanced development. Efforts on fiber optics standardized "family" of components - transceivers, optic bus interconnects and wavelength division multiplexers will continue. Tactical tropo efforts will focus on completion of a rapidly deployable tropo design to increase mobility and tactical communications response times as tropo is one of the backbone elements in the tactical theater scenario. A phased array, jam resistant tropo antenna, adaptive to increased surviability, will be completed. High frequency, narrowband voice components will begin transition to advanced development. Initial efforts in cost reduction designs of satellite terminals will end and will be coupled with digital processing technology being developed in the laboratory communications experimental facility. A new effort will start in evaluation technology for measuring communications systems vulnerability in a flexible, experimental facility.

3. (U) FY 1983 Planned Program: Fiber optics building block component developments described above will continue, and emphasis on the tactical needs will feed a new start program element for advanced development. The fiber optic bus elements will also be developed to meet future needs of the Flexible Intraconnect program, a highly adaptive common bus for use within, and between, tactical shelters. It will provide low cost, rapidly configurable capabilities that do not now exist. The tactical tropo work will be completed and will enter advanced development, aimed at low cost, low weight models. The satellite communication activity will build on the FY 1982 efforts and an adaptive EHF processor module and a flexible digital modem will be developed. The HF program developments will begin transition on a larger scale into a new advanced development effort for a set of adaptive HF modules (narrowband). There modules are being designed to provide increased jam resistant, connectivity and security to a new adaptive HF basic transceiver development in engineering development. The efforts in HF signal processing efforts for this purpose will end and frequency hopping, narrowband encoded voice efforts will continue. Communications vulnerability analysis efforts will continue.

4. (U) FY 1984 Planned Program: The fiber optic standard transceiver design will transition to advanced development. The bus concept using the transceiver will begin. Wavelength division multiplexing will continue with a possible FY 1985 transition. The HF program will continue efforts in narrowband and will begin to look at some wideband technology efforts for possible passage of high rate data over HF by selected users. The satellite communications work will continue leading to a target FY 1985 breadboard model of a low cost terminal. (Present terminals cost hundreds of thousands of dollars).

Project: #4519
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Communications and Control Technology
Title: Command, Control and Communication
Budget Activity: Technology Base, #1

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimated	FY 1983 Estimated	FY 1984 Estimated	Additional to Completion	Total Estimated Costs
RDT&E	5,806	4,920*	5,300*	6,350	Continuing	Not Applicable

8. (U) Comparison with 1982 Descriptive Summary:

RDT&E	5,500	6,725*	9,500*		Continuing	Not Applicable

*Portion of work previously planned in this project is now being done in Project 5581 starting in FY1982. For the remaining work, additional emphasis on high frequency and satellite communications technology would have been pursued with the higher funding level.

Project: #4594 Title: Intelligence Technology
Program Element: #62702F Title: Command, Control and Communication
DOD Mission Area: Electronic and Physical Sciences (ED), 2521 Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides the technological advances to improve and/or automate techniques to extract maximum useful and timely information in four areas of intelligence exploitation - signal processing imagery exploitation, non-numeric data (words, message text, etc.) processing and advanced targeting and charting. In signal processing, specific objectives are - (1) the development of necessary recording and data handling techniques for the timely processing, storage and dissemination of extremely high data rate, high capacity digital information, (2) the application of automatic speech processing and pattern recognition to specific problems, and (3) the development of techniques to define and implement automatic processing to manipulate, analyze and convert raw telemetry data into intelligence assessments. The objective of non-numeric data processing is to develop and apply automated techniques for the timely processing and dissemination of large amounts of dissimilar intelligence related to decision making. This is accomplished by an evolutionary updating of intelligence data handling capabilities, such as improving real-time access to multisource data bases stored in networks of computers. In imagery exploitation, advanced digital target classification enhancement, and multisensor correlation techniques are developed to increase the quality and timeliness of military intelligence derived from reconnaissance systems. Developmental reconnaissance/surveillance systems are evaluated to determine their capability for providing timely target detection, as well as intelligence. Advanced targeting and charting objectives include the development of new and improved cartographic and photogrammetric methods and equipment for utilizing reconnaissance/mapping imagery in the timely production of tactical and strategic deployable digital and photo data bases in support of future Air Force weapon systems and to provide technology for the Defense Mapping Agency (DMA) to allow them to accelerate production of worldwide digital data bases.

(U) RELATED ACTIVITIES: Imagery exploitation programs are coordinated through the National Exploitation Committee, while the Defense Mapping Agency coordinates all service programs in mapping and charting. The National Security Agency coordinates all service programs in signal intelligence and the Defense Intelligence Agency coordinates all work in data handling. All of the preceding insures that intelligence technology development within the services is not unnecessarily duplicated. The technology output of the Intelligence Technology project is transitioned into PE 63789F, Command, Control and Communications Advanced Development; PE 63747F, Low Visibility Moving Target Acquisition / Strike; PE 63208F, Reconnaissance Sensors/Processing Techniques; PE 31011G(F), Cryptologic Activities; PE 31022F, Scientific and Technical Intelligence; PE 31025F, Intelligence Data Handling Systems; PE 63259F, Cartographic Applications for Tactical and Strategic Systems; PE 63701B, Mapping and Charting; PE 64750F, Intelligence Equipment; and PE 33885F Tactical Cryptologic Programs.

(U) WORK PERFORMED BY: The in-house work is performed at the Rome Air Development Center, Griffiss AFB, NY. The ten major contractors for Fiscal Year 1981 were: RCA Corporation, Camden, NJ; LOGICON Inc., Woodland Hills, CA; Synetics Corporation, Fairfax, VA; INCO, Inc., McLean, VA; GTE Products Corporation, Mountain View, CA; Harris Corporation, Melbourne, FL; Measurement Concept Corporation, Rome, NY; RCA, Camden, NJ; Magnovox Data Systems Inc., Falls Church, VA; Rome Research Corporation, Rome, N

Project: #4594
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Intelligence Technology
Title: Command, Control and Communication
Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In the signal processing area, the wideband digital disk development was successfully extended to accommodate 320 megabits per second data transfer rates with a bit error rate of 1 x 10^{-10}. This capability is a first step in developing a 10^{13} bit high density, rapid access storage and retrieval mechanism for advanced Command, Control and Intelligence systems. Each phonograph record sized disk can store the digital equivalent of a complete set of the Encyclopedia Britannica. In fact, the wideband optical recorder tests have proven the feasibility of recording 200 MHZ bandwidths with adequate fidelity for scientific and technical Electrical Intelligence (ELINT) applications and advanced development for that purpose has begun. In non-numeric data processing, the introspective data base effort has resulted in a procedure for drawing implied assumptions from explicit intelligence data, a conceptual breakthrough involving the combining of mathematical lattice theory with multi-valued logic. Mathematical, logical, and statistical aids for intelligence analysis were developed. These analytical aids are designed to advance the analyst from the state of merely reporting events to describing what the event may mean, and to extrapolate future events. In targeting and charting, strategic and tactical scenario studies have been completed that provide a rational, structured basis for planning the major technical thrusts for an advanced development program. The studies are based on the target set availability in central Europe and evaluated against projected imagery reconnaissance sensors and weapon delivery systems. The conceptual specifications for an all digital point positioning data base for developing precise target locations has been completed. A data processing system was completed that provides a skeletal, minicomputer based, system capable of the complete generation of standard format and content, digital feature analysis data and digital terrain elevation data. In imagery exploitation, a high performance processor system design was developed. This system will provide automatic screening and image exploitation.

2. (U) FY 1982 Program: Initial testing of a 600 megabit per second computer compatible tape drive will be completed and efforts will continue on development of the optical disc, 10^{12} bit recorder configuration consisting of 100 discs of storage with access within 5 seconds to any one bit of data. Concepts and techniques will be developed for imitative and manipulative deception to support tactical exploitation scenarios. A conceptual framework for a 1990's intelligence information system will begin. The targeting and charting task will emphasize exploiting the unique characteristic of advanced sensor imagery technology in strategic and tactical targeting environments. Target location technology will begin transition into advanced development. A special task in support of the Defense Mapping Agency (DMA) data production problem will begin and will continue through FY 1984. A cartographic requirements study will be done to support an FY 1983 new advanced development program to consolidate and standardize Air Force systems demands on DMA data bases.

3. (U) FY 1983 Planned Program: Efforts in the 600 megabit tape drive will aim at producing start/stop/search capability of 2.25 microseconds and a bit error rate of only one bit in 10^8. Experimentation will continue on test and evaluating read/write/erase materials for use on optical disc recorders. Under the non-numeric data handling task, the automatic data base update effort will provide techniques to automatically update a data base from intelligence reporting messages based upon an analysis of message content. Initially, the emphasis will be on the formatted portion of the messages where fields are rigidly defined. In FY 1983, the narrative free text portion of

Project: #4594
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Intelligence Technology
Title: Command, Control and Communication
Budget Activity: Technology Base, #1

the message will be addressed. Tactical target location developments will continue that have the objective of providing the Air Force field elements with a capability to obtain, in near-real-time, very precise geopositional information to support precision all weather weapons delivery. The special effort to improve Defense Mapping Agency (DMA) data production will continue and the cartographic requirement survey done in FY 1982 will begin advanced developments. Mutli-imagery exploitation technique will continue to transition into advanced development and will do two things - get rid of nonstandard, contractor operated ground imagery centers in Europe and provide ground processing speeds in imagery handling consistent with sensor and communications rate increases. Specifically, imagery exploitation will be striving toward automatic target detection and identification of ground targets in digital image data to alert image interpreters in near-real-time. Artificial intelligence and syntactic pattern recognition techniques will be utilized to relate objects (targets) of interest to their surroundings. These same techniques will be utilized to automatically provide a flag for areas of increased activity within specific areas of interest.

4. (U) FY 1984 Planned Program: Wideband recording efforts will continue with additional transitions of equipment to further development and operational use. Non-numeric data handling will continue to find ways for automatic processing of intelligence text to greatly speed up the analysis process. Imagery exploitation will be aimed at reducing the ground processing time and providing target location technology. The special effort for support to the DMA will transition into advanced development, in addition to other tasks done in support of that Agency.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	6,071	6,320	6,900	7,650	Continuing	Not Applicable

8. (U) Comparison with 1982 Descriptive Summary:

RDT&E	5,500	6,725	9,329		Continuing	Not Applicable

Additional efforts to increase the cartographic/photogrammetric data production capability to try to force a break-through would be done at the higher funding level and increased emphasis on intelligence analyst tools and intelligence data handling techniques would be pursued.

Project: #4600
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Electromagnetic Radiation, Devices & Components
Title: Command, Control and Communications
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides the Air Force with a strong technology base and the devices and techniques for exploitation of electromagnetic radiation in command, control and communications (C^3), surveillance, and other related systems. The work conducted falls into two broad categories, electromagnetic radiation and transmission technology and solid state device technology. Principal areas of activity are: antennas and radio frequency components, electromagnetic techniques, propagation, electromagnetic materials for C^3 applications, advanced solid state devices and circuits, optical and electro-optical devices, and technology for radiation hardening. The antenna, components and propagating technologies attack methods of increasing anti-jam capabilities and survivability aspects of strategic and tactical C^3 systems. The fiber optics efforts address very promising techniques for replacing existing cabling systems with low cost, radiation immune, secure, wideband fiber optics links. This project produces the optical device and actual cable technologies and feeds into fiber optics work in Project 4519, Communications and Control Technology. The electromagnetic materials and devices technologies produce faster, cheaper, much smaller component for such critical missions as tactical radar signal processing and time and frequency subsystems. Radiation hardening ensures C^3 mission availabilities in spite of nuclear and space environments.

(U) RELATED ACTIVITIES: Efforts related to electronic devices are coordinated through the DOD Advisory Group on Electron Devices and Technology Coordination Paper on Electronics. Antenna efforts are coordinated through the Interservice Antenna Group. Efforts are also coordinated with North Atlantic Treaty Organization nations through participation in international panels. In addition, tri-service panels and working groups meet regularly to discuss and coordinate activities. The work undertaken in this project is related to on-going activities at the Air Force Avionics Laboratory, Air Force Weapons Laboratory, Air Force Materials Laboratory, Lincoln Laboratory, Army Electronics Command, and Office of Naval Research and the National Bureau of Standards. Basic research in PE 61102F, Defense Research Science, transitions into this project. Project efforts transition into advanced development programs such as PE 63789F, Command, Control and Communications Advanced Development; PE 63750F, Counter-Countermeasures Advanced Development; PE 63431F Advanced Space Communications; PE 33401F Communications Security Development; PE 63742F, Combat Identification Technology; and PE 63452F, Very High Speed Integrated Circuits.

(U) WORK PERFORMED BY: The in-house activity is performed at the RADC Deputy for Electronic Technology, Hanscom AFB, MA, and at off base sites in Massachusetts. Ten major contractors in FY 1981 were: Megapulse, Bedford MA; ARCOM, Waltham MA; Westinghouse, Baltimore MD; Boeing Aerospace, Seattle WA; Hughes Aircraft Corp., Fullerton CA; Northeastern University Boston MA; Southeastern Conference, St Cloud FL; Sigma Tau Standards, Tusculoosa,AL; Galileo Electro-optics, Sturbridge MA; Park Mathematical, Carlisle MA.

Project: #4600
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Electromagnetic Radiation. Devices & Components
Title: Command, Control and Communications
Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Validity of a tent array antenna design to provide hemispherical coverage needed for a new sensor to detect enemy cruise missiles was confirmed to be valid. New antenna feed concepts for the spaceborne radar program have advanced that technology. A frequency synthesizer, designed using Surface Acoustic Wave (SAW) device technology from this project, is being used in the Joint Tactical Information Distribution (JTIDS) system, reducing the size and saving four million dollars. A new experimental wavelength division multiplexer was invented which is a radically different design with much higher efficiency (70%) less bulk, and greater potential reliability than any other known types and is slated for use in the tactical fiber optics program. Quartz, needed for time and frequency standards was produced in house with the lowest contaminating amount of aluminum content ever produced, showing promise of reducing the ageing problem in military quartz oscillators. The life endurance of radiation hardened memories was increased by several orders of magnitude and a new radiation resistant junction field effect transistor was invented, creating the possibility of making certain types of circuits more immune to radiation. It is a Polysilicon Silicon-on-Silicon Field Effect Transistor (POSFET).

2. (U) FY 1982 Program: Antenna nulling efforts for the spaceborne radar antenna design (phased array) will be completed. High frequency ducting in which energy is propagated within ducts in the ionosphere (as opposed to between the earth and the ionosphere) offers unique long range surveillance and communications capabilities. Design for a receiver to be on a satellite for an FY 1984 launch was completed. The experiment will measure the properties of the ducts to determine their mission related utility. Charge-coupled devices (CCDs) allow signal processing normally done digitally to be done in analog fashion, providing some excellent advantages. CCD processing will be developed at the one to 10 MHZ rate in FY 1982. Also, hybrid processing (CCD analog with conventional digital) will be developed that will provide up to 10,000 fold data processing rates over equivalent all digital processors of the same size and weight. Magnetostatic wave devices will produce a time delay device that is less than a cubic inch-size. Technology for time and frequency standards will address techniques to improve the two problems facing quartz clocks: temperature stability and aging due to impurities. A new rubidium beam tube will be developed that will make these atomic standards more rugged for wider usage.

3. (U) FY 1983 Planned Program: Conformal antenna technology and spaceborne radar antenna technology will continue. A ground based transmitter for the HF ducted mode experiment (described above) will begin development. CCD analog process will be extended from rates of 10MHZ produced in FY 1982 up to 50MHZ. The hybrid (analog/digital) capability (described above) with its powerful processing gain, will be scaled up to meet needs in production of peripheral equipment to be used with Very High Speed Integrated Circuit (VHSIC) processors. The extremely small magnetostatic delay device produced in FY 1982 will continue development to be used in steering phased array antennas. The new fiber optic wavelength division multiplexer, with its high efficiency will allow greatly increased bandwidth over fiber systems and efforts to extend this technology into infrared regions will be addressed, allowing greater transmission distances without repeaters. A new technique to allow fast warm-up and increased stability of quartz oscillators will be completed. Atomic clock (rubidium, cesium) investigations will continue, to reduce weight, size and complexity. This technology is needed to provide reliable standards to the users as state-of-the-art devices, and to allow industry to meet the projected production problem these standards will face when Air Force future systems' needs emerge. A radiation resistant circuit using the new POSFET device will be fabricated for future testing.

Project: #4600
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Electromagnetic Radiation, Devices & Components
Title: Command, Control and Communications
Budget Activity: Technology Base, #1

4. (U) FY 1984 Planned Program: The high frequency ducted mode experiment will proceed with a late FY 1984 launch, or early FY 1985 using the transmitter and receiver developed earlier. Charge coupled device, acoustic, and magnetostatic device processing will continue aimed at specific typical processing applications for demonstration. Time and frequency standards technologies will begin transition into a new start advanced development effort to produce a family of standardized, improved, multi-user frequency standards for Air Force systems applications. Testing of the circuit using the POSFET will be completed. Fiber optic components (sources, detectors, multiplexers) will continue transition to advanced development.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,807	5,820	6,300	7,150	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	5,500	6,425	8,600		Continuing	Not Applicable

Additional emphasis could be placed on developing typical replacement circuits for existing operational equipment using the hybrid processing modules (analog/digital) being developed to increase throughput, save space and weight, and increase reliability at the higher funding level of the FY 82 submission.

Project: #5581 | Title: Information Sciences Technology
Program Element: #62702F | Title: Command, Control and Communications
DOD Mission Area: Electronic and Physical Sciences (ED), #521 | Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project was formerly all computer technology oriented but beginning in FY 1982 that portion of Project 4519, Communications and Control Technology, dealing with command and control technologies was moved to this project. Specific items which transitioned into Project 5581 are emitter location work for Command, Control and Communications Countermeasures (C^3CM), information processing and display technique for modular control facilities, command and control experimentation technologies for simulating real world crisis management environments. The remainder of Project 4519 efforts are communications oriented. Project 5581 also retains its computer hardware/software emphasis. It is the Air Force exploratory development effort which provides technologies to solve generic problems experienced in the acquisition and maintenance of computers and associated software which are embedded in Air Force weapon systems. The primary objective is to reduce the costs associated with all phases of computer resource acquisition and support. The drop in prices of computer hardware have made computers a building block of every major system developed for the Air Force. Developing the software has become the most costly item of computer systems and has been rising per line of instruction delivered because of the increased complexity of the software written and rising labor costs. The thrust of this project, therefore, is to develop those technologies which are needed to evolve software development, acquisition, and maintenance into a controllable, disciplined process. This includes developing automated aids for both managers and designers, mathematically rigorous validation techniques for large programs, computer techniques which allow reuse of proven software, and simplified use of high order languages. In addition to the work in software development a major new thrust in this project will be initiated to develop automated decision aids based on our on-going investigation of Artificial Intelligence. These thrusts are sorely needed to transition software engineering technology advance to software developers.

(U) RELATED ACTIVITIES: The work performed under this project is reviewed at the DOD level along with other technology programs in information processing technology. It supports the DOD Defense Computer Resources Technology Plan. Related non-Air Force programs are PE 62701A, Communications Electronics; PE 62725A, Computer Sciences; PE 62721N, Command and Control Technology; PE 63728F, Advanced Computer Technology and PE 64740F, Computer Resource Management Technology, for demonstration and application. Command and Control efforts transition into PE 63789F, Command, Control and Communications (C^3) Advanced Development and PE 63718F, Electronic Warfare Technology.

(U) WORK PERFORMED BY: The in-house work is performed at the Rome Air Development Center (RADC), Griffiss Air Force Base, NY. Ten major contractors in FY 81 were: PAR Technology Corporation, Rome, NY; Honeywell Info Systems Inc., McLean, VA; TRW Inc., Redondo Beach, CA; Computer Corporation of America, Cambridge, MA; Intermetrics Inc., Cambridge, MA; Martin Marietta, Denver, CO; General Electric, Sunnyvale, CA; Decisions and Designs Inc., McLean, VA; Boeing Aerospace Company, Seattle, WA; Northwestern University, Evanston, IL.

Project: #5581
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Information Sciences Technology
Title: Command, Control and Communications
Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In command and control technology, recent operational experience reinforces the fact that in a typical hostile engagement the radio frequency spectrum will be flooded with both friendly and hostile, intentional and unintentional signals. This project provided the technology to locate and identify those signals to be fed to an Air Force offensive capability i.e., a C^3CM force which can then take appropriate countering action against enemy Command, Control and Communications (C^3). In FY 1981, integration of identification technology and emitter location technology into a single systems concept was initiated to provide a capability for location/ recognition of enemy C^3 nodes for C^3CM application. In computer technology, this project has provided the standards, tools, and methods which control software acquisition and the tools necessary to standardize and control high order computer language in the Air Force. Three competitive designs for an Ada programming support environment (APSE) were completed. One of the designs was selected for implementation beginning early in FY 82. An experimental very high level programming system (LOGLISP) was delivered. This language may be extremely valuable in developing automated program techniques via Artificial Intelligence technology. The initial efforts in potential applications of automated Command Control (C^2) Decision Aids in the tactical environment were initiated. A new thrust began to provide the exploratory development work needed to meet the Air Force computer technology needs for the next twenty years in the areas of distributed processing and software production. These needs are among those identified in the Air Force Systems Command Computer Technology Forecast and Weapon System Impact Study (COMTEC-2000) which contains inputs from government, industry, and the academic sector. Additional funds in FY 1981 through FY 1985 have been programmed in this project above the levels previously planned, specifically to satisfy the needs identified in COMTEC-2000.

2. (U) FY 1982 Program: The integration of identification and location technology of emitters into C^3CM will continue as the basic concepts evolve into development models. The Software Requirements Engineering Methodology (SREM) effort which was to begin in FY 1981 was delayed due to funding reductions and will now begin in FY 1982. This effort will provide a tool to improve system requirements linkage to software development. Another effort delayed to FY 1982 is development of a plan for a proof of principal demonstration of Josephson Junction technology (JJT). JJT is a commercially developing processing technology with extremely fast throughput power (nanosecond) usable for large scale computers The Ada environment efforts will continue as will automated programming using artificial intelligence methods. Three efforts in decision aids started in FY 1981 will continue and the first, tri-service workshop for this technology will be held.

3. (U) FY 1983 Planned Program: The effort for identification of critical order communications modes will end and will be ready for transition to advanced development for C^3CM. The ground attack control center (GACC) development study initiated in FY 1982 will continue to provide air-to-surface warfare control elements for use with systems such as PAVE MOVER. A command and control simulation capability will be developed for use in decision aids testing. The SREM effort will be continued for software requirements and a candidate acquisition program will be selected for a demonstration in advanced development in FY 1984 under PE 63728F, Advanced Computer Technology. The Ada support development will also transition to that program. The decision aids effort for battle management will transition into the next phase which

Project: #5581
Program Element: #62702F
DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Information Sciences Technology
Title: Command, Control and Communications
Budget Activity: Technology Base, #1

is to provide tools for senior tactical battle staff members. The target aggregation, decision aid study will begin transition to investigations of specific tactical targeting problem scenarios. The knowledge based decision aids for mission planning will proceed to more sophisticated development of force management tools, also for the tactical arena, as that is where the problem is most immediate.

4. (U) FY 1984 Planned Program: Technology for deceiving, targeting, and exploiting enemy C^3 will continue. The Ground Attack Control Center (GACC) development should transition to advanced development. Automated programming technology will continue. The three efforts in decision aids begun in FY 1983 will continue with scheduled completion in FY 1985 and FY 1986. Further definition of a processor to employ the Josephson Junction technology with its high processing throughput will continue. An effort in computer security will end and will be ready for demonstrations.

5. (U) Program to Completion: This is a continuing program

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	6,210	8,420*	8,500*	9,148	Continuing	Not Applicable

8. (U) Comparison with 1982 Descriptive Summary:

RDT&E	6,500	7,525*	9,400*		Continuing	Not Applicable

Reflects some shift in work from Project 4519 beginning in FY 1982. Increased emphasis could be placed on accelerating decision aids and automated computer programming developments if additional funds were provided at the FY 82 submission level.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62703F
DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Personnel Utilization Technology
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	5,299	5,391	7,194	7,921	Continuing	Not Applicable
06HP	Laboratory Support	4,080	4,111*	4,380	4,468		
7719	Force Acquisition and Distribution System	710	1,000	2,194	2,521		
7734	Force Management System	509	280	620	932		

* Excludes 1 Oct 1981 civilian pay raise (4.8%).

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force requires a continuing supply of quality men and women who can operate and maintain sophisticated weapons and support systems. The identification, acquisition and retention of a quality manpower pool is difficult. The proportion of quality men and women who are adaptable to military life is limited and their recruitment subject to fierce competition from the civilian sector. It is incumbent upon the Air Force, therefore, to ensure that every effort is made to identify individuals who might contribute to the Air Force mission, that they are assigned to jobs which match as nearly as possible their talents and aspirations, and that strenuous efforts be made to retain these individuals. This MANPOWER AND PERSONNEL research program incorporates two complementary and interrelated streams of research designed to address the problems involved in acquiring and maintaining a quality force. Included in the Force Acquisition and Distribution System are efforts to develop testing procedures to identify those individuals capable of being trained for Air Force jobs. Improvements in tests will result in fewer individuals being rejected for military service who could have succeeded. Additional efforts will determine specific aptitude requirements for Air Force jobs and improve the process for matching individuals to jobs. The Force Management System will provide Air Force managers with devices, models, and strategies to improve evaluation of job performance, retention, and individual/unit productivity and establish comprehensive skills management and reenlistment/career assignment programs. Operation and maintenance of the Air Force Human Resources Laboratory (AFHRL), Brooks AFB, TX, is partially funded in this program.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program represents 51.9% real growth over FY 82. This growth is reflected in programs to meet the urgent AF requirements resulting from projected manpower shortages in the outyears. Our effort will (1) develop more precisely the basic skills and literacy requirements needed for AF jobs (2) develop methods to measure AF jobs; (3) develop a training decision system (TDS) to determine the proper mix of where our personnel should be trained: On-the-job or resident school setting. In addition, this program funds efforts designed to: develop

Program Element: #62703F
DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Personnel Utilization Technology
Budget Activity: Technology Base, #1

and evaluate improved personnel selection procedures through the exploration of new testing techniques and the modification and upgrading of existing selection tests; continue the development of techniques for the assignment of pilot trainees to specialized training tracks e.g., Fighter, Attack, Reconnaissance (FAR) or Tanker, Transport, Bomber (TTB); enhance the enlisted Person-Job-Match model and continue development of an officer Person-Job-Match model for classification of all sources of commissioning (e.g., R.O.T.C. and AF Academy) and subsequent assignment model; continue work to identify personnel and occupational factors related to attrition/retention; examine the Air Force retraining program and develop ease of retraining indices; continue research to identify indices of individual/unit productivity; and continue work on the Occupational Data Base.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	5,100	5,500	7,800		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #62703F
DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Personnel Utilization Technology
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element provides for the conduct of MANPOWER AND PERSONNEL research in support of the Air Force personnel system and all Air Force Major Commands. It is the primary vehicle by which critical problems dealing with personnel acquisition, management, and retention are addressed. There are two major subdivisions within this program element: the Force Acquisition and Distribution System and the Force Management System. Within the Force Acquisition and Distribution System, is research dealing with a diverse range of topics -- the common element being that they all deal with the personnel procurement and assignment system. New techniques for personnel testing are developed and evaluated within this area. These efforts are designed to better identify those individuals who have the capacity for effective service within the Air Force, either as officers or as enlisted personnel. The refinement and validation of the Air Force Officer Qualifying Test and the development and validation of new forms of the Armed Services Vocational Aptitude Battery are part of this effort, as are research efforts concerned with the development of new tests of perceptual and psychomotor abilities. Measures of these abilities, which are not typically assessed through conventional paper-and-pencil tests, may be applied to the improved selection of pilot trainees and their subsequent assignment to specialized training tracks. Air Force innovations in this area of testing have been quickly adopted by the other services, especially in the area of pilot selection. In order to properly place individuals in jobs that suit their abilities, it is necessary to have a very complete description of the tasks performed in each job and their relative difficulties. These job/task analyses may then be related to the abilities of incoming personnel. Research in this area will continue with the expectation that the aptitude, education, experience, and physical factors necessary to perform the jobs in the Air Force will be identified and related to ability and demographic characteristics of recruits. This research will lead to an improved Person-Job-Match model with eventual benefits for both the Air Force and its personnel. One way in which improvements in the personnel assignment system might be evaluated is through the productivity of Air Force organizations and of the individuals making up those organizations. Research into the development of indices of individual and organizational productivity is underway to provide such a capability. In addition to providing the means for comparing the productivity of individuals and organizations, it is expected that this area of research may also provide means for the enhancement of productivity. Closely related to all these efforts is the research being conducted within the Force Management System. This area of research deals with the development of techniques for the optimal utilization of the personnel resources of the Air Force and the development of models to allow Air Force management to explore the possible effects of various forces and events occuring both within the Air Force and from the outside upon the structure and effectiveness of the force. One such study deals with the relationship between characteristics of the civilian labor force such as unemployement rate, salary levels, and other economic and social factors and the structure of the enlisted force. Models such as this greatly enhance the capability of Air Force management to make effective planning decisions and contribute to the maintenance of Air Force mission readiness. This program element also provides technical support to other Air Force and DoD agency programs and receives partial reimbursement for the services provided. In the case of basic research accomplished by the laboratory, full reimbursement is provided by Program Element 61102F. The project break reflects the best estimate considering those anticipated reimbursements, but may require adjustment to the degree that reimbursements are actually earned.

Program Element: #62703F
DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Personnel Utilization Technology
Budget Activity: Technology Base, #1

(U) RELATED ACTIVITIES: Interrelationships of service programs are contained in the Training and Personnel Technology Group (TAG). Related PE's are 61102F Defense Research Sciences, 62205F, Training and Simulation Technology; 62717A Manpower, Personnel; 62763N Personnel and Training Technology; 63707N Manpower Control System Development. Efforts by the Air Force directed toward the improvement of the Armed Services Vocational Aptitude Battery and the production of new forms of that test are directed, in part, by a Triservice Steering Committee of General Officers. Similarly, efforts concerned with the development of computer-based testing techniques, for possible eventual implementation at the Armed Forces Examining and Entrance Stations, are coordinated with the other services through a Triservice Steering Committee. Air Force responsibilities in this area lie principally in the development of test items suitable for computer implementation. Close coordination is maintained both at the working level and by laboratory management with other services. Exchange of proposed Statements of Work for contractual efforts, wide dissemination of technical reports, and symposia and meetings attempt to ensure that work conducted within this program element does not duplicate work conducted by the other service laboratories.

(U) WORK PERFORMED BY: This program is managed by the Air Force Human Resources Laboratory (AFHRL), Brooks AFB, TX. Exploratory development is carried out by the Manpower and Personnel Division of the Laboratory. The total contract effort ($1,193K) for FY 1981 was conducted by the following contractors or institutions: University of Dayton, Dayton, OH; McFann Gray & Associates, Monterrey, CA; Kinton Corp., Alexandria, VA; Resource Research Corp., Washington, D.C.; University of Maryland, College Park, MD; Texas A&M Research Foundation, College Station, TX, University of Texas, Austin, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. (U) FY 1981 and Prior Accomplishments: (1) The Air Force Reading Ability Test (AFRAT) was developed to identify individuals, as they enter basic training, who require remedial training. A savings of approximately $1.4M yearly in training costs is realized as the AFRAT enables the Air Force to identify and provide training to trainees who would otherwise be separated for reasons related to their ability to read job-related material; (2) The Enlisted Screening Test (EST) will be used by Air Force recruiters for preliminary evaluation of individuals seeking enlistment to determine their probable level of achievement on the Armed Services Vocational Aptitude Battery. Approximately $2.5M DoD - wide will be saved yearly in meal costs alone (meals given to applicants during the examination process); (3) A revised Air Force Officer Qualifying Test (AFOQT) provides approximately $3.6M yearly savings by eliminating ineligible pilot/navigators who would otherwise have entered costly undergraduate pilot or navigator training; (4) Person-Job-Match (PJM), a computerized system used for the enlisted ranks, matches the best person with the best job and has saved approximately $0.45M per year since 1976 when it replaced the manual system. An initial Officer PJM was delivered in FY 81 for Officer Training School (OTS) candidate selection; (5) The sensitivity analysis and testing of the Integrated Simulation Evaluation Model (manpower prediction model) prototype was completed.

Program Element: #62703F   Title: Personnel Utilization Technology
DOD Mission Area: Environmental and Life Sciences (ED), #522   Budget Activity: Technology Base, #1

2. (U) FY 1982 PROGRAM: The planned research and development programs will continue the work begun earlier on evaluation and revision of the Armed Services Vocational Aptitude Battery and the Air Force Officer Qualifying Test, along with ongoing research in occupational measurement, individual and unit productivity, computer-based testing, and the development of new measures for rated officer selection and classification. During FY 82 a comprehensive battery of tests measuring perceptual/motor and information processing abilities will be implemented and administered to pilot selectees to evaluate the potential of such tests for pilot selection and classification. In addition, performance criteria will be developed and collected for pilots to assess their performance during transition training after Undergraduate Pilot Training, and their performance in an operational setting. These performance measures, along with the traditional pass/fail criterion from training will be used to validate the new tests. This research effort will directly support the Specialized Undergraduate Pilot Training program which is expected to be implemented around 1986. Advanements to the enlisted Person-Job-Match model will be completed (best person with the best job). These improvements will include measures to make the model now sensitive to individual needs and abilities within the scope of Air Force requirements. In addition, the initial design will begin on a wartime scenario oriented Person-Job-Match Model. Work will continue to identify personnel and occupational factors related to attrition/retention and to develop reliable and valid measurement techniques for collecting such information. Research will also be initiated to examine the Air Force retraining program and to develop indices estimating the ease with which an airman could be transferred from one career speciality to another.

3. (U) FY 1983 PLANNED PROGRAM: Research will continue on the refinement and evaluation of the Air Force testing program. New forms of the Air Force Officer Qualifying Test will be developed and evaluated and efforts will continue on the production of new versions of the Armed Services Vocational Aptitude Battery. During FY 83 criterion data will become available against which the validity of the experimental tests for pilot selection developed in the preceeding year may be evaluated. As the analyses of these tests are conducted, revisions to the test battery will be accomplished as tests are modified or deleted from the battery and new tests are introduced. Plans will be formulated for the design of an integrated aircrew test station for experimental tests that are found to be predictive of pilot training and operational performance. As these tests may also have utility for the selection of pilots for the other services, close coordination will be accomplished so as to produce, if possible, a single test device for joint use. Prototype systems will be developed to assess various job performance criteria measures for possible operational use in validating physical and cognitive aptitude requirements. Person-Job-Match modeling will continue with research on officer model development capitalizing on results from research in the enlisted area. Efforts to identify measures of productivity will continue and focus on the identification of those factors, especially those under management control, that act to limit productivity. This research will have broad implications for the development of procedures and techniques for productivity enhancement. The development of models for the use of Air Force management in the projection of force characteristics under varying scenarios will continue and interim products will be delivered as they are available.

Program Element: #62703F Title: Personnel Utilization Technology
DOD Mission Area: Environmental and Life Sciences (ED), #522 Budget Activity: Technology Base, #1

4. (U) FY 1984 PLANNED PROGRAM: The revision of operational tests such as the Air Force Officer Qualifying Test and the Armed Services Vocational Aptitude Battery is a continuing process which requires the development of new forms of the tests and research to identify and evaluate new testing techniques and test content for possible inclusion. Especially in the area of pilot selection, several years may be required to evaluate a new test due to the length of time required for testing of individuals prior to entry into training and then the length of the training and assignment to an operational unit. During FY 84 additional criterion data will become available, particularly performance data from operational units, upon which the tests administered during FY 82 may be evaluated. The development of performance criteria for other Air Force jobs, against which the Air Force selection procedures may be validated, will continue during FY 84. The closely related efforts to identify individual and unit productivity enhancement procedures and limited field trials of those procedures will continue. Examinations of job characteristics and requirements and the relation of those parameters to the characteristics and abilities of successful and unsuccessful job holders will continue building toward the accumulation of a complete description of all Air Force specialties. This data base will then impact upon the Person-Job-Match modeling algorithms to improve assignment/retention. The results from these research efforts will result in a strengthened Force Acquisition and Distribution System and Force Management System.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63103F   Title: Advanced Airborne Radar
DOD Mission Area: Electronic and Physical Sciences (ATD), #551   Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT			3,475	15,330	176,195	195,000
2831	Covert Strike			3,475	15,330	176,195	195,000

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Surface-to-air defenses in the 1990s will be extensive, requiring covert ingress and egress if the aircraft and crew are to survive. This program element funds advanced development of an airborne radar concept which will lower the enemy's ability to detect fighter aircraft operating around and behind the forward edge of the battle area. Develops a bistatic radar system providing a covert/survivable in-weather reconnaissance (recce)/strike capabilit which satisfies Tactical Air Force validated mission requirements for advanced tactical fighter/aircraft.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The major program objective is to develop a covert/survivable in-weather recce/strike capability for the 1990s. The principal technology used is bistatic radar, where the target is illuminated by a radar operating in a sanctuary while the recce/strike aircraft penetrates and tracks the target in a "listen only" mode. This technique allows effective use of stealth technologies, enhances surprise attack, and denies the enemy effective use of high gain jamming. The FY 1983 funding begins initial work to demonstrate bistatic target acquisition and reference system technologies showing concept feasibility. Cost is based on engineering estimates derived from experience on similar advanced development programs.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: This program is an FY 1983 new start.

(U) OTHER APPROPRIATION FUNDS: NONE.

Program Element: #63103F Title: Advanced Airborne Radar
DOD Mission Area: Electronic and Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Enemy surface-to-air defenses against tactical aircraft operating around and behind the forward edge of the battle area is postulated to be so severe in the 1990s that covert ingress and egress is considered essential if the aircraft and crew are to survive. This program element is a new initiative to develop an advanced airborne radar concept which would permit recce/strike aircraft to detect and track ground targets without emitting radar energy, and revealing its position to enemy defenses. The approach is bistatic radar where a transmitter, located in a sanctuary (standoff aircraft or satellite), illuminates the target while the strike aircraft uses the radar returns to detect and strike the target.

(U) This capability would permit effective use of stealth technologies and allow an aircraft to penetrate enemy defenses and carry out precision target location and weapon delivery in a survivable passive/covert manner. This passive operation will reduce the detectability of penetrating aircraft, allow surprise attack, and deny the enemy effective use of high gain (highly directional antennas) jamming. The program objective is to develop an all-weather, day/night, recce/strike capability for the 1990s which will enable operation in and around a dense threat environment. The program consists of four major efforts pursuing key technical areas. Together they will demonstrate feasibility and provide all necessary information for Full Scale Development of a Covert Strike, bistatic radar.

(U) The Bistatic Target Acquisition effort will demonstrate the feasibility of bistatic, covert acquisition and accurate tracking of fixed and mobile surface targets. The Bistatic Radar Reference System Technologies effort will develop and demonstrate precision reference (position, velocity, time) sensors to provide the accurate reference frame required for ultra-high resolution synthetic aperture radar imagery. Full use of the Covert Strike bistatic radar system necessitates early investigation of weapons which will exploit this capability. The Weapon Development Demonstration effort will investigate how advanced weapon concepts such as tactical munitions dispensers with very low radar cross sections can be integrated with the Covert Strike system. The final phase of the program is the Covert Strike Consolidated Demonstration which provides a flight test of the "full-up" Covert Strike system.

(U) RELATED ACTIVITIES: The Covert Strike program builds upon the joint Defense Advanced Research Projects Agency/Air Force Avionics Laboratory Tactical Bistatic Radar Demonstrations and Bistatic Technology Transition efforts previously funded in PE 62204F (Aerospace Avionics). It also draws upon low probability of intercept, automatic target classification and monostatic ultra-high resolution synthetic aperture radar technologies being pursued in PE 63203F (Advanced Aircraft Avionics). The Very High Speed Integrated Circuits technology being pursued under PE 63425F (Very High Speed Integrated Circuits) will be used in the radar signal processor in the final Consolidated Demonstration. Covert Strike will also make use of the blended aerodynamic shape technology (weapon airframe technology) from PE 62601F (Conventional Munition Technology) Inter-Service coordination takes place in the Joint Air Force/Navy Radar Working Group, the Tri-Service Airborne Displays Working Group, and a Tri-Service Background and Targeting Agreement originated by the Air Force Armament Laboratory.

Program Element: #63103F Title: Advanced Airborne Radar
DOD Mission Area: Electronic and Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

(U) WORK PERFORMED BY: The Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright-Patterson AFB, OH, and the Air Force Armament Laboratory, Eglin AFB, FL, will manage work performed under this program. Potential bidders include Hughes Aircraft Corp., Malibu, CA; Westinghouse Defense and Electronics Systems Center, Baltimore, MD; Raytheon Co., Bedford, MA; Texas Instruments, Dallas, TX; Goodyear Aerospace Corp., Litchfield Park, AZ; General Electric Co., Binghamton, NY; Litton Corp., Woodland Hills, CA; and EG&G Co., Salem, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable.

2. (U) FY 1982 Program: Not Applicable.

3. (U) FY 1983 Planned Program: Initiate Bistatic Target Acquisition efforts to demonstrate feasibility of bistatic covert acquisition and accurate tracking of fixed and mobile surface targets. This test system will demonstrate, under limited maneuvering (3 g's or less), an on-board, real-time bistatic capability with high resolution synthetic aperture radar. Initiate Bistatic Reference System Technologies effort to demonstrate precision reference system (position, velocity and time) sensors to provide the accurate reference frame required for ultra-high resolution synthetic aperture radar imagery. Emphasizes development of precision time standards and a feasible approach for maintaining coherent radar operation between the separately located illuminator (transmitter) and aggressor (receiver) aircraft.

4. (U) FY 1984 Planned Program: Complete design and begin hardware fabrication on the Bistatic Target Acquisition and Bistatic Reference System Technologies efforts. Initiate Weapon Development Demonstration to investigate how advanced weapon concepts can be integrated with Covert Strike to fully exploit its covert capabilities. This project will examine tactical munitions dispensers with very low radar cross sections as well as alternative launch and forget missiles.

5. (U) Program to Completion: Feasibility of the Covert Strike concept is to be proved by FY 1987. If the Bistatic Target Acquisition, Bistatic Reference System Technologies, and Weapon System Demonstration are successful, the final phase of the program (Covert Strike Consolidated Demonstration) will begin in FY 1987. This provides a flight test of the "full-up" Covert Strike system including automatic target acquisition and classification, ultra-high resolution synthetic aperture radar imagery, and weapon delivery against tactical targets. The flight test will be completed in the 4th quarter of FY 1990.

6. (U) Milestones: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63202F
Title: Aircraft Propulsion Subsystems Integration (APSI)
DOD Mission Area: Engineering Technology (ATD), #553
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	13,416	23,013	21,468	27,875	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the design, development, and test of new techniques aimed at successful propulsion/airframe integration and compatibility, and improved installed performance in advanced aircraft. The scope of the program includes work on: (1) advanced inlet, fan, power turbine, engine control and nozzle components; (2) integrated testing of these components with advanced gas generators (i.e., Joint Technology Demonstrator engine); (3) methods to reduce engine life cycle cost; (4) definition of engine inlet/exhaust system installation design criteria and propulsion integration technologies; and (5) engine structural design criteria through hardware fabrication and test and improved engine stealth characteristics (infrared and radar cross section). Proper attention to the efforts under this program will provide aircraft systems with a potential for longer range, higher cruise speed with lower specific fuel consumption, surge power for successful engagements, high sortie rates with reduced maintenance, reduced life cycle cost and improved survivability in mission effectiveness.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Level II Joint Technology Demonstrator Engine (JTDE) efforts incorporating extended performance verification and structural/diagnostic test and evaluation will be continued. Altitude performance assessment will be conducted on a small engine JTDE. JTDE Accelerated Durability Assessment Configuration (ADAC) vehicles will be subjected to Experimental Accelerated Mission Testing (XAMT). A piggyback engine test will provide final verification of a life cycle cost model previously developed. Critical variable cycle engine technology demonstrations will focus on verification of operating characteristics through slave engine and rig tests at sea level and altitude conditions. This request will provide for: (1) altitude performance test assessment on a large engine JTDE; (2) Level II structural/ diagnostic and extended performance characterization of a large engine JTDE; (3) life assessment testing of two large engine JTDEs (4) exhaust system infrared signature reduction and control concept model testing and analysis (5) piggyback engine test of component designed for reduced life cycle cost (6) rig/environmental test of an advanced composite fan and (7) continuation of integrated control system development efforts, and (8) initiation of technology efforts for reduced engine observables (radar cross section). The cost estimates for this program are based upon contractual commitments which extend through early FY 84 plus historically backed cost estimates for a level of effort testing which is included in the APSI Five Year Plan as directed by the APSI Program Management Directive.

Program Element: #63202F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Aircraft Propulsion Subsystems Integration (APSI)
Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	18,416	23,100	23,500		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63202F	Title: Aircraft Propulsion Subsystems Integration (APSI)
DOD Mission Area: Engineering Technology (ATD), #553	Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides for the development and functional demonstrations for those advanced technologies which are necessary to assure propulsion and airframe compatibility, and permit the attainment of advanced performance objectives in future aircraft systems. The scope of this program includes: (1) the development of advanced components related to inlets, fans, power turbine, augmentors, controls and exhaust nozzles; (2) the overall integration of these components with the basic advanced gas generators to form a demonstrator engine to define the flowpath and assess the durability/life aspects of the engine concepts; (3) the development of methods to reduce engine life cycle costs by 20-25 percent; (4) the definition and verification of the methodology to structurally design, analyze, and test turbine engines to achieve increased engine durability; and (5) the definition of improved inlet/engine/exhaust system installation design criteria and propulsion integration techniques, and (6) the development of improved engine stealth characteristics through the reduction of infrared and radar cross section signatures. The components being developed will provide the basis for 10-20 percent reduction in specific fuel consumption, 10-15 percent increase in stall margins, 15-20 percent reduction in engine weight, increased life/durability, 15-30 percent reduction in engine life cycle cost and greater airflow matching potential when compared to the most modern engines currently in the inventory. These benefits can be traded off against one another to meet the specific needs of systems of interest. This program provides both the critical technology baseline for future system development and a source of data for ensuring the orderly resolution of any propulsion system problems encountered with development engines.

(U) RELATED ACTIVITIES: The exploratory development base for this program is provided by Aerospace Propulsion Program Element 62203F, Materials Program Element 62120F, and Aerospace Flight Dynamics Program Element 62201F. Close technical coordination is maintained with the Air Force Flight Dynamics Laboratory, Aerospace Structural Materials Program, Program Element 63211F, and with the Air Force Materials Laboratory. This program is closely related to the Advanced Turbine Engine Gas Generator program, Program Element 63216F, which is managed from the same office and provides the core gas generator development efforts. This program is thoroughly integrated with the Navy component work under Program Element 63210N, Advanced Aircraft Propulsion Systems, which is developing compatible components for a cooperative Air Force/Navy demonstration of advanced engine technology. The Air Force and the Navy currently have a formal Memorandum of Understanding covering efforts under the Joint Technology Demonstrator Engine (JTDE) program. Close coordination is maintained with related efforts conducted by the Army and National Aeronautics and Space Administration.

(U) WORK PERFORMED BY: This program is managed by the Air Force Aero Propulsion Laboratory, Wright-Patterson AFB, OH. The current contractors involved in this program and their work areas are: Detroit Diesel Allison Division of General Motors, Indianapolis, IN (Advanced Fan Aerodynamics, Joint Technology Demonstrator Engine, Reduced Cost Concepts); Garrett Turbine Engine Company, Phoenix, AZ (Low Cost Component Development); General Electric, Evendale, OH (Joint Technology Demonstrator Engine, Variable Cycle Engine, Reduced Cost Components, Structural Methodology); McDonnell Douglas, St. Louis, MO (Inlet/Aircraft Drag Investigation, Propulsion Simulator); Pratt & Whitney Aircraft, West Palm Beach, FL (Variable Cycle Engine, Structural Design Criteria, Joint Technology Demonstrator Engine); Teledyne CAE, Toledo, OH (Low Cost Component Development, Joint Technology Demonstrator Engine, Structural Methodology).

Program Element: #63202F | Title: Aircraft Propulsion Subsystems Integration (APSI)
DOD Mission Area: Engineering Technology (ATD), #553 | Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Seven contractual efforts, previously begun, have been completed. The reduced cost program culminated with the performance verification testing of selected components. These programs confirmed that reduced cost components can be successfully fabricated and rig tested to verify that components specifically designed to reduce life cycle cost by 10-30 percent can withstand the engine operating conditions. The structural design and development programs were completed with comprehensive environmental rig testing which will run the selected components to full life. The test results were used to verify that predicted failure modes and durability can be accurately predicted, verified and utilized in subsequent design practice. The initial advanced exhaust materials effort was completed with an engine test which provided an evaluation of the material in a realistic slave engine environment as well as evaluation of selected infrared (IR) suppression devices. Advanced nonaxisymetric nozzle assessment was completed with evaluation of air-to-ground and air-to-air application wind tunnel tests. This program provided the effects of nozzle design options on aircraft drag reductions. The propulsion simulator effort was completed and provided capability for more cost effective wind tunnel testing. In the JTDE program initial performance testing was completed on the first fully variable cycle JTDE. This test established the high spool/low spool interactive effects as well as the variable cycle effects. Two extended performance/structural diagnostic tests were completed on the small engine JTDE. The Variable Cycle Technology programs completed hardware fabrication and preparation for testing in a slave engine demonstrator. Three new starts were initiated in FY81 with two emphasizing the structural durability area. The new starts include (a) JTDE Accelerated Durability Assessment Configuration (ADAC) Experimental Accelerated Mission Testing (XAMT); (b) Life Cycle Cost/Damage Tolerance Assessment; and (c) Advanced Exhaust System Materials Demonstration. The JTDE ADAC XAMT testing will provide extensive durability assessment through severe testing in a complete engine demonstrator. This program will permit earlier extensive durability assessment of selected key JTDE component technologies. The Advanced Exhaust System Materials program will provide evaluation of full application of advanced materials in the augmentor and nozzle culminating in a slave engine test. The Life Cycle Cost/Damage Tolerance Assessment will develop a damage tolerant design system and provide a life cycle cost evaluation of it applied to hot section components.

2. (U) FY 1982 Program: Efforts during this time period will be concentrated on the Joint Technology Demonstrator Engine (JTDE) area. Extended performance/structural diagnostic testing will be conducted on two large engine JTDEs and fabrication/procurement of a third large engine JTDE will be completed. Initial altitude testing will be completed on a small engine JTDE. The initial life assessment testing of two large engine JTDE Accelerated Durability Assessment Configuration (ADAC) will also be conducted with follow-on testing in the outyears. These tests will provide extensive durability assessment of key JTDE component technologies. Concepts in the Variable Cycle Technology program will be assessed in sea level and altitude engine testing. In the Advanced Composite Fan program single blade foreign object damage testing and a full aerodynamic rig test will be conducted. Engine piggyback tests will be conducted on two reduced cost components previously developed. Model testing and analysis will be completed on selected exhaust systems, infrared signature reduction and control concepts. Four new efforts will be initiated: (a) Integrated Propulsion System Control development, which will develop the technology for integrated control systems with expanded aircraft flight control requirements, (b) Advanced Applications/LCC Analysis, which will provide trade-off data to be used in

Program Element: #63202F Title: Aircraft Propulsion Subsystems Integration (APSI)
DOD Mission Area: Engineering Technology (ATD), #553 Budget Activity: Advanced Technology Development, #2

identifying critical technologies to be demonstrated in the APSI program for the next generation propulsion systems, (c) Integrated Propulsion System Concepts, which will determine engine/airframe integration and compatibility characteristics of highly integrated designs, particularly those applicable to V/STOL and stealth advanced aircraft, and (d) Engine Durability Assessment, which will assess durability characteristics of fan/compressor when operating in conjunction with high pressure distortion inlets, such as those with low radar cross section signatures.

3. (U) FY 1983 Planned Program: Efforts during this time frame will continue to concentrate on the JTDE test assessment area. Follow-on contracts will be awarded with initial performance testing to be conducted on one large engine JTDE. Initial cycle endurance testing will be conducted on a large engine and small engine JTDE. Two large engine JTDE Accelerated Durability Assessment Configurations (ADAC) will complete their second Experimental Accelerated Mission Tests (XAMT) using life assessment testing philosophy and a small engine JTDE ADAC will complete similar testing. Component selection, design and fabrication using damage tolerant design criteria will be completed on selected components. The propulsion simulator for highly integrated systems will be fabricated for wind tunnel model tests. Piggyback tests will be conducted for engine environmental data on selected hot section components in the Engine Durability Assessment program. Fabrication of the advanced exhaust system with advanced materials will be completed in preparation for high performance turbofan slave engine testing. Three new efforts will be initiated: (a) Advanced Fan, which will provide the technology base for low radar cross section signatures from the front aspect angles of the engine, (b) Advanced Augmentor, to provide technology transition into the JTDE of afterburner technology of advanced tactical systems, (c) Infrared (IR) Suppression, to provide technology transition into JTDE of low IR signature designs of the engine. Funding was reduced from $23.5 million to $21.5 million for higher priority programs and deescalation.

4. (U) FY 1984 Planned Program: Efforts during this time period will continue on the JTDE test assessment. Emphasis will be placed on durability testing of the XAMT type, and initial operability testing at simulated altitude conditions. Efforts will be continued in the reduced observables area (IR and RCS signatures) with fabrication and initial test of component designs. In addition, efforts will be continued in the engine/airframe integration area, specifically in the advanced exhaust nozzle material applications area, and the integrated propulsion system concepts area. Two new start efforts will be initiated: (a) Advanced Exhaust Nozzle Technology Integration, which will integrate advanced materials, thrust vectoring/reversing capabilities, and low signatures in exhaust nozzle designs for subsequent engine test, and (b) Advanced Material (Eutectic) Turbine, to demonstrate life/durability of turbine design for long life, supersonic cruise applications.

Program Element: #63202F
DOD Mission Area: Engineering Technology (ATD) #553

Title: Aircraft Propulsion Subsystems Integration (APSI)
Budget Activity: Advanced Technology Development #2

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63203F
DOD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Avionics for Aircraft
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	10,809	14,944	18,201	22,556	Continuing	Not Applicable
666A	Advanced Aircraft Navigation	1,320	3,500	4,701	6,000	Continuing	Not Applicable
69CK	Advanced Devices	2,358	2,900	3,500	4,000	Continuing	Not Applicable
69DF	Advanced Weapon Delivery	7,131	5,544	5,100	6,640	Continuing	Not Applicable
2733	Advanced Reconnaissance/Strike Radar		3,000	4,900	5,916	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The threat posed by the Warsaw Pact is steadily increasing in both quantity and quality. To establish a capability to successfully contend with the threat postulated for the mid to late eighties, our forces require significant improvements in the performance provided by aircraft avionics. This program element is the principal Air Force source of advanced technology for avionics that accomplish the navigation, target acquisition, weapon delivery and fire control functions.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program will accomplish a carefully selected set of efforts that collectively represent a balanced approach to the satisfaction of the Air Force's requirements for affordable and reliable high performance avionic systems. The individual tasks will address specific needs such as improved aircraft survivability, improved navigation and weapon system resistance to enemy countermeasures, improved target acquisition capabilities, improved weapon control with reduction of pilot workload, and improved avionics supportability. Cost estimates are developed and provided by the concerned program offices.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	13,250	17,400	23,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63203F

DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Avionics for Aircraft

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force requires significant improvements in weapon system performance and availability if the United States and its North Atlantic Treaty Organization allies are to maintain a capability to successfully counter the threat posed by the Warsaw Pact. Key elements of this threat are a numerically superior air force and an environment characterized by intense electronic countermeasures and dense surface-to-air weaponry. The air-to-air and air-to-surface capability required by the Air Force to contend with this scenario can not be achieved effectively or economically without exploiting avionics technology currently emanating from basic research The Advanced Avionics for Aircraft Program is the Air Force's principal vehicle for the advanced development of avionics technology needed for navigation, target acquisition, weapon delivery and fire/launch control systems. The general goals of all work in these areas are improved weapon system performance, reliability and survivability with reduced pilot workload and decreased life cycle costs. The Advanced Aircraft Navigation Project is developing sensors, antennas, subsystems and subsystem integration techniques that are required for navigation, radar and flight control reference. The Advanced Devices Project is the only Air Force project for the advanced development of system-critical components and devices that are not available commercially. The Advanced Weapon Delivery Project is developing technology for air-to-air fire control, air-to-ground fire control and multimode fire control. The Advanced Reconnaissance/Strike Radar Project is developing radar and radar related technology.

(U) RELATED ACTIVITIES: The technology base for this program's developments is established under Program Element (PE) 62204F, Aerospace Avionics. This program provides technology products which have application in PAVE MOVER (PE 63747F), Aircraft Avionics Equipment Development (PE 64201F), Tactical Identification Systems (PE 63742F), Flight Vehicle Technology (PE 63205F) and Reconnaissance Sensors/Process Technology (PE 63208F). The technical program content is coordinated with Navy PE 63202N and Army PE 63207A programs responding to similar objectives.

(U) WORK PERFORMED BY: The Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright Patterson Air Force Base, OH, under the overall management of the Air Force Systems Command, manages the projects in the Advanced Avionics for Aircraft Program. Contractors include: General Dynamics, Fort Worth, TX and First Ann Arbor Corporation, Ann Arbor, MI for the Missile Launch Envelope programs; General Electric, Binghamton, NY for Firefly III; C.S. Draper Laboratories, Cambridge, MA for Advanced Global Positioning System Inertial Integration Technology development; Raytheon Company, Bedford, MA for development of the Gallium Arsenide Impact Ionization Avalanche Transit Time Combiner, Litton, Palo Alto, CA for development of the X-Band Radar Coupled Cavity Traveling Wave Tube; Hughes Aircraft Company, Culver City, CA for the infrared focal plane array effort; and Rockwell, Anaheim, CA for the development of an advanced bubble memory.

Program Element: #63203F
DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Avionics for Aircraft
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: This program accomplished the Forward Looking Advanced Multimode Radar flight test effort that successfully demonstrated the feasibility of a high resolution synthetic aperture radar. Real time digital processors, the key to autonomous airborne operations, which are used in high performance radar systems such as the F-15 AN/APG-63, were first developed within this program element. Low Light Level Television and Forward Looking Infrared sensors which are major advances in capability upgrading of the B-52 aircraft were developed within this program element. This program demonstrated the feasibility of using electrostatic gyros in a strapdown configuration for medium accuracy inertial systems. Improvements in modeling and Kalman filter techniques have led to the optimum integration of inertial systems with other navigation systems such as a Doppler, Long Range Navigation and the Global Positioning System. A solid state weapon delivery computer developed by the Advanced Devices Project was used by the Navy in the Angle Rate Bombing System validation flight tests. Algorithms for missile launch envelope determination have been provided for integration in the F-16.

2. (U) FY 1982 Planned Program: 666A The development of the Integrated Inertial Reference Assembly will continue. When completed this assembly will be used to demonstrate that a set of redundant sensors can provide the inertial data required for navigation, flight control and weapon delivery more reliably and economically than the array of dedicated sensors in aircraft today. The effort to develop technology for an integration of equipment associated with the Global Positioning System, the Joint Tactical Information Distribution System and Inertial Navigation Systems will progress through the mid-point of simulation evaluations. 69CK Development of devices for an active element solid state phased array will begin. An effort on two-micron bubble memories will continue with the objective of developing a high speed memory having 10,000 hours mean-time-between-failure. Efforts on X-Band radar coupled cavity traveling wave tubes and a high-power gallium arsenide impact ionization avalanche transit time combiner will continue. These devices are critical to the acquisition of more efficient and reliable transmitters for missile and aircraft radars. 69DF Initiate the development of launch envelope algorithms for the Advanced Medium Range Air-to-Air Missile. Continue the development of an infrared search and track system. Continue the flight evaluation of an integrated fire/flight control system. 2733 Continue the development of radar related technology initiated under Project 69DF. Tasks include continuation of simulation of the cockpit workload improvements to be derived from improved radar/pilot interfaces, simulation and assessment of slow ground moving target indication techniques, development of radar augmentation with radio frequency cueing, development of low probability of intercept terrain following radar, demonstration of real-time, ultra-high resolution synthetic aperture radar and integration of a high performance processor for airborne radar.

3. (U) FY 1983 Planned Program: 666A Continue development of a high accuracy, ring laser gyro and the integrated inertial reference assembly. These efforts will provide the technology needed for compact, reliable and high performance navigation systems in the next generation of aircraft. Continue the development and demonstration of an advanced, anti-jam receiver for Global Positioning System signal reception. Continue the development of the adaptive multifunctional antenna and the associated integrated navigation system simulation. These development activities are key to plans to reduce the weight and size of aircraft avionics while simultaneously improving

Program Element: #63203F Title: Advanced Avionics for Aircraft
DoD Mission Area: Electronic and Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

reliability, affordability and performance. 69CK The project will complete the development of the high power gallium arsenide combiner and the X-Band radar coupled cavity traveling wave tube. The development of the ultra-high frequency power source will near completion. These devices will provide the capability for more reliable, higher efficiency transmitters in airborne radars and radios. Development of the solid state phased array antenna, a standard family of analog-to-digital converters and the standard carbon dioxide laser will continue. 69DF Launch envelope algorithms for the Advanced Medium Range Air-to-Air Missile will be completed. Other efforts that provide improved weapon delivery capabilities that will be accomplished are discussed in the project section. 2733 The evaluation of pilot workload improvement to be acquired through proper radar augmentation will be completed. The advanced development of a low probability of intercept terrain following radar will be completed. This system will provide the stealth required for improved low altitude penetration. The project will complete demonstration of the real-time ultra-high resolution synthetic aperture radar. The project will initiate the design of an advanced, slow ground moving target indication/location radar In conjunction with project 69CK the project will develop the solid-state phased array antenna. The reduction in the estimated resource requirements of this program element relative to those identified in the FY 1982 Descriptive Summary is the result of reprogramming made necessary by the partial appropriation in FY 1982 and higher priority requirements.

4. (U) FY 1984 Planned Program: 6661 Continue development of the high accuracy ring laser gyro and the integrated inertial reference assembly. Continue the development of the jam resistant Global Position System receiver. Complete the design and initiate fabrication of the adaptive multifunction antenna. Complete the integrated navigation system simulation. Initiate the development of a frequency domain receiver. 69CK Complete the development of the UHF power source. Complete development of standard carbon dioxide laser. Continue development of solid state phased array components, analog to digital converters and a wavelength agile laser source. Initiate development of staring focal plane array. 69DF Continue development of infrared search and track system and technology for attack of multiple targets simultaneously. 2733 Complete development of low probability of intercept terrain following radar technology. Continue development of solid state phased array antenna and slow moving target radar.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES: Not applicable.

Project: #69DF
Program Element: #63203F
DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Weapon Delivery
Title: Advanced Avionics for Aircraft
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The Warsaw Pact threat poses massed armor, ground mobile counter air, and a numerically superior air force that has increased the criticality of the need for more sophisticated avionics systems. To counter this threat, air-to-ground attack must be conducted beyond the strike envelopes of the ground air defenses; thus requiring avionic systems with increased target acquisition and weapon delivery range. These new avionic systems must also be able to attack multiple targets per pass to counter the adversary's numerical superiority. The air-to-air engagement is similarly characterized by the need to increase the kills per sortie to offset our numerical inferiority. This project addresses these needs by developing advanced technology for air-to-air fire control, air-to-ground fire control and multimode fire control. The advent of the small maneuverable fighter and the sophisticated ground defense has resulted in highly dynamic fighter engagements. The Integrated Flight and Fire Control program (Firefly III) is blending the pilot and fire control inputs to provide increased accuracy in air-to-air engagements and increased survivability through nonlinear air-to-ground weapon delivery profiles. The highly dynamic fighter engagements have also led to significant errors in the missile launch envelopes that persist causing missiles to be fired when the kill probability is small while missing other high kill probability launch opportunities. The Missile Launch Envelope program will develop algorithms and displays to display the target kill probability taking into account the dynamics of the attacking and target aircraft.

(U) RELATED ACTIVITIES: The technology base for this project's tasks is established in Program Element (PE) 62204F, Aerospace Avionics. The products of this project furnish demonstrated technology necessary for the Night Attack Program (PE 63249F), Aircraft Avionics Equipment Development (PE 64201F), Reconnaissance Sensor/Processing Technology (PE 63208F) and Flight Vehicle Technology (PE 63205F).

(U) WORK PERFORMED BY: The Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright Patterson AFB, OH, an organization of the Air Force Systems Command, provides the Air Force program management of this project. Contractors include General Dynamics, Ft Worth, TX and the First Ann Arbor Corp, Ann Arbor MI for the Missile Launch Envelope program; McDonnell Douglas, St Louis, MO and General Electric, Binghamton, NY for the Integrated Fire Flight Control program; and ITT Avionics Division, Nutley, NJ for the Infrared Search and Track program.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The F-111D Mark II avionics originated in this project. The initial development of many night sensors used in Southeast Asia was performed in this project. The Forward Looking Advanced Multimode Radar flight tests demonstrated high quality synthetic aperture radar imagery in real-time using digital processing techniques. Flight testing of advanced infrared and active television systems provided quantitative performance data necessary for further development of electro-optical systems. The feasibility of the Electronically Agile Radar was demonstrated in this project. Within recent years the program emphasis has been divided between sensor and weapon delivery tasks for tactical close air support and interdiction, and the advanced radar efforts in support of advanced and strategic aircraft weapon delivery systems. In FY 1980 laboratory tests of the basic design of the Integrated Flight and Fire Control System (Firefly III) were successfully completed. In FY 1981 laboratory development of Integrated Gunfire Control Technology was completed.

Project #69DF
Program Element: #63203F
DOD Mission Area: Electronic and Physical Sciences, #551

Title: Advanced Weapon Delivery
Title: Advanced Avionics for Aircraft
Budget Activity: Advanced Technology Development, #2

2. (U) FY 1982 Program: Work on the Advanced Medium Range Air-to-Air Missile (AMRAAM) Launch Envelope algorithm will be initiated. The product of this effort should permit a 25% increase in the missile's calculated launch window and minimize the likelihood of unrecognizable out-of-bounds conditions. The development of an infrared search and track system that will provide pilots a long range passive detection and track capability will be continued. Testing of the Firefly III System will continue. Development of advanced technology for automatic target acquisition during low level air-to-surface attack will continue.

3. (U) FY 1983 Planned Program: The project will initiate an effort to develop and demonstrate fire control concepts for attack of multiple targets during air-to-air combat. The development of the missile launch envelope algorithm for AMRAAM will near completion. The Firefly III effort will be completed with a demonstration of the capability to strike ground targets accurately while engaged in maneuvers that provide a ten-fold increase in survivability against linear predictor antiaircraft weaponry. The advanced automatic acquisition system will be completed. An air-to-ground maneuvering attack concept evaluation for application to aircraft with austere avionics will be initiated. Work on the Infrared Search and Track System will progress through the mid-point of advanced development.

4. (U) FY 1984 Planned Program: The missile launch envelope algorithm for AMRAAM will be completed. The development of the infrared search and track system will continue. The development of concepts and supporting technology for multiple target attack in both air-to-air and air-to-ground combat will continue.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	7,131	[illegible]	5,100	6,640	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Budget Data:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
	8,300	6,700	6,900		Continuing	Not Applicable

The reductions are the result of reprogramming the partial appropriation in FY 1982 and outyear reprogramming actions initiated to provide funds for higher priority Air Force requirements.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63205F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Flight Vehicle Technology
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	7,874	6,675	7,301	9,979	Continuing	Not applicable
2506	Control of Flight	7,660	6,375	5,801	7,179		
2507	Vehicle Equipment	89	300	1,500	2,800		
2508	Aeromechanics	125					

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will develop new aeronautical technologies for transition to current and future Air Force weapon systems. Technologies investigated include enhanced flight control and weapons delivery systems for Air Force fighters, systems for increased aircraft survivability, and systems for increased aircraft fuel efficiency/range. Part of this program develops the aeronautical technologies to be integrated and demonstrated in PE 63245F, Advanced Fighter Technology Integration (AFTI), under project 2061, Fighter Attack Technology (AFTI/F-16).

(U) BASIS FOR FY 1983 RDT&E REQUEST: Develop selected technologies offering future aircraft large improvements in capabilities and survivability over current fighter aircraft. Continue hardware and software development of the Automated Maneuvering Attack System (formerly known as the Integrated Flight/Fire Control III system) for the F-16 testbed aircraft. The family of technologies comprising the Automated Maneuvering Attack System will be demonstrated on the digitally controlled F-16 test vehicle to validate the concept of single seat, low altitude, maneuvering attack against heavily defended ground targets and increased firing opportunities realizable in air-to-air combat. Completes Atmospheric Electricity Hazards Protection preliminary hardening criteria in preparation for actual ground test demonstrations of these criteria on advanced testbed aircraft.

(U) COMPARISONS WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT	7,900	6,800	10,000		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63205F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Flight Vehicle Technology
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Effective enemy surface defenses may force future fighter aircraft to a low level, maneuvering attack tactic for survivability. Moreover, circumstances may require attacks to be made at night or in adverse weather. The Automated Maneuvering Attack System (AMAS) being developed in this program provides a critical demonstration leading to automated night attack. AMAS consists of several new technologies integrated on the Advanced Fighter Technology Integration F-16 test vehicle which contains a digital flight control system and an independent six degree-of-freedom control capability. These new technologies include a Forward Looking Infrared (FLIR) sensor/tracker coupled with an integrated flight/fire control system, a helmet mounted sight, and a Standard Avionics Integrated Fuse to allow in-flight setting of the dispersal pattern for wide area anti-tank munitions. AMAS is expected to demonstrate a 3:1 increase in overall air-to-air firing opportunities and an increase in overall survivability in air-to-surface attack of defended targets. Atmospheric Electricity Hazards Protection (AEHP), also being developed in this program, becomes particularly important to future fighter aircraft for several reasons. First, advances in low wattage micro-electronic circuitry used in digital flight control systems and advanced avionics is particularly susceptible to atmospheric or static electricity transients. Second, the increasing use of advanced composites in aircraft construction provides less electromagnetic shielding for critical interior electrical components. Finally, the trend toward low level, adverse weather operations increases the exposure of future aircraft to lightning strikes.

(U) RELATED ACTIVITIES: This program is developing the Automated Maneuvering Attack System (AMAS) for demonstration in PE 63245F, Advanced Fighter Technology Integration (AFTI). The AFTI program, in turn, provides technology options for PE 63230, Advanced Tactical Fighter. The Advanced Tactical Fighter program will incorporate a menu of advanced technologies in the design of the next generation fighter. The Digital Flight Control System development being flight validated on the AFTI F-16 test vehicle during FY 1982 is jointly funded by Navy while the entire PE 63245F is a joint program with the National Aeronautics and Space Administration and is managed under an approved Memorandum of Understanding. The Atmospheric Electricity Hazards Protection program is a joint development with the Army, Navy, National Aeronautics and Space Administration, Defense Nuclear Agency, and the Federal Aviation Administration. It will be carried out in consonance with an approved Interagency Management Plan. The Integrated Inertial Reference Assembly work is in support of PE 63203, Advanced Avionics for Aircraft. The Avionics Laboratory, Wright Aeronautical Laboratories, is lead laboratory on the Integrated Inertial Reference Assembly effort.

(U) WORK PERFORMED BY: This program is managed by the Flight Dynamics Laboratory, Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH. Flight testing of the F-16 testbed vehicle will be accomplished at the Air Force Flight Test Center under an approved Statement of Capability. The contractor is General Dynamics Corporation, Fort Worth, TX. The McDonnell Douglas Corporation, St. Louis, MO is the prime contractor for the conventional Integrated Flight/Fire Control I development on the F-15 testbed. The AEHP program is currently in the contract negotiation stage.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Flight testing of the conventional Integrated Flight/Fire Control I program on the F-15 test vehicle began on schedule in mid-FY 1981. Twenty-nine flights out of a total of eighty required flights have been flown to date. The System integration task is nearly complete and the remaining flights represent

system development and optimization. The Digital Flight Control System for the F-16 test vehicle encountered problems in software integration causing an estimated six month delay in first flight to FY 1982. The Automated Maneuvering Attack System detail design for the F-16 test vehicle continued through FY 1981. The Atmospheric Electricity Hazards Protection program released Request for Proposals in late FY 1981 and is currently in the source selection phase.

2. (U) FY 1982 Program: The software integration problems on the Digital Flight Control System of the F-16 test vehicle appear to be overcome and first flight is now scheduled for mid-FY 1982 and flight test will continue throughout FY 1982. The Preliminary Design Review for the Automated Maneuvering Attack System was held in Dec 81. Phase I of the Atmospheric Electricity Hazards Protection program will continue through FY 1982. This phase will establish preliminary hardening design criteria and design of the testbed aircraft to be tested in Phase II of the program. Flight testing of the conventional Integrated Flight/Fire Control I on the F-15 test vehicle will be completed in late FY 1982.

3. (U) FY 1983 Planned Program: Preliminary design work will begin on the flight control aspects of the Integrated Inertial Reference Assembly (IIRA) program. The IIRA program is jointly funded with PE 63203F, Advanced Avionics for Aircraft, managed by the Avionics Laboratory, Air Force Wright Aeronautical Laboratories. The Avionics Laboratory is the lead organization for the IIRA program. The IIRA program will develop a processor to convert inertial data received from a set of ring laser gyros to information required by the navigation, weapon control, and flight control systems of the aircraft. Software development and modification of the F-16 test vehicle will continue in FY 1983 for the Automated Maneuvering Attack System (AMAS). This effort will culminate in first flight of AMAS in late FY 1983. Flight testing of the Digital Flight Control System and independent six degree-of-freedom control capability on the F-16 vehicle will be complete in mid-FY 1983. Phase I of the Atmospheric Electricity Hazards Protection program will continue throughout FY 1983. Current FY 1983 funds represent a 26 percent decrease in the funds projected in the FY 1982 RDT&E Descriptive Summary. The reduction of FY 1983 funding has caused a deletion of the Integrated Flight/Weapons Control follow-on to the Integrated Flight/Fire Control I program on the F-15 test vehicle. The reduction has also postponed the development of the Integrated Flight/Propulsion Control system to FY 1984. This system will support the STOL (Short Take-off and Landing) Fighter Technology (formerly Advanced Survivable Fighter Technology) program under PE 63245F, Advanced Fighter Technology Integration.

4. (U) FY 1984 Planned Program: Initiate the Integrated Flight/Propulsion Control system to support the STOL Fighter Technology program in PE 63245F, Advanced Fighter Technology Integration. The program will develop the guidance control systems and pilot/vehicle interface necessary for Short Take-off and Landing (STOL) fighter operation. Begin Phase II of the Atmospheric Electricity Hazards Protection program resulting in the design and fabrication of the testbed aircraft with hardened advanced microelectronic circuitry and advanced composite structures. Support software development and hardware design and fabrication for the flight control aspects of the Integrated Inertial Reference Assembly. Complete the development of the Automated Maneuvering Attack System for flight validation under PE 63245F, Advanced Fighter Technology Integration.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2506 Title: Control of Flight
Program Element: #63205F Title: Flight Vehicle Technology
DOD Mission Area: Engineering Technology (ATD), #553 Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Exploratory development efforts performed during past years have identified a number of promising aeronautical technologies that offer large improvements in capability and survivability over current fighter systems. In order to provide systems developers the assurance needed to build tactical combat aircraft using these advanced technologies, the laboratory developments must be validated in flight. Project 2506, Control of Flight, develops several of these technologies for flight testing. An Integrated Flight/Fire Control I system is being developed for aircraft equipped with a conventional flight control system and flight tested on an F-15 test vehicle. A Digital Flight Control System and pilot vehicle control and display interfaces are being developed for flight demonstration in the Advanced Fighter Technology Integration F-16 test vehicle under PE 63245F, Advanced Fighter Technology Integration (AFTI). The Digital Flight Control System, in conjunction with additional control surfaces on the AFTI/F-16 will provide independent six degree-of-freedom control and the capability to task-tailor the flight control laws to the aircraft mission. Additionally, this program will develop an integrated flight/fire control system, a Forward Looking Infrared (FLIR) sensor/tracker, and other technologies for integration during the Automated Maneuvering Attack System (AMAS) phase of the AFTI/F-16 program.

(U) RELATED ACTIVITIES: A portion of project 2506, Control of Flight develops technologies for demonstration in PE 63245F, Advanced Fighter Technology Integration. The Digital Flight Control development is jointly funded by the U.S. Navy. Further, the entire Advanced Fighter Technology Integration program is a joint program with the National Aeronautics and Space Administration and is managed under an approved Memorandum of Understanding. Lastly, the Integrated Flight/Fire Control I task is a joint development effort with the Air Force Avionics Laboratory.

(U) WORK PERFORMED BY: This program is managed by Flight Dynamics Laboratory, Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH. Contractors are McDonnell Douglas Corporation, St. Louis, MO; and General Dynamics Corporation, Ft. Worth, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The winglets technology program for reducing drag and increasing fuel efficiency completed the flight test on a KC-135 aircraft validating a 6 percent increase in fuel mileage. The conventional Integrated Flight/Fire Control I flight test began in mid-FY 1981 and is currently beginning the developmental flight test phase. The Digital Flight Control System development for the F-16 test vehicle suffered delays due to software integration problems. The Automated Maneuvering Attack System design and analysis continued throughout FY 1981.

2. (U) FY 1982 Program: The triplex, multimode, task-tailored Digital Flight Control System will begin flight validation on the Advanced Fighter Technology Integration F-16 vehicle in mid-FY 1982. This flight demonstration will also validate an independent six degree-of-freedom control capability and advanced displays for reduced pilot workload. Development and fabrication of the Integrated Flight/Fire Control system, the FLIR sensor/tracker with laser designator, and the helmet mounted sight for the Automated Maneuvering Attack System (AMAS) portion of the F-16

Project: #2506 Title: Control of Flight
Program Element: #63205F Title: Flight Vehicle Technology
DOD Mission Area: Engineering Technology (ATD), #553 Budget Activity: Advanced Technology Development, #2

testbed demonstration will continue throughout FY 1982. The development and optimization flight testing of the conventional Integrated Flight/Fire Control I system on the F-15 test vehicle will be completed in late FY 1982.

3. (U) FY 1983 Planned Program: Initiate support for the flight control portion of the Integrated Inertial Reference Assembly (IIRA) development. The system is much smaller, more dependable, and more survivable from battle damage than the processors currently needed to accomplish these functions. Continue development of Automated Maneuvering Attack System (AMAS) technologies leading to first flight of AMAS in late FY 1983. Complete support of the Digital Flight Control System and other technologies associated with the Phase I flight test of the Advanced Fighter Technology Integration F-16 vehicle. The decrease in funds for FY 1983 as compared to the FY 1982 RDT&E Descriptive Summary estimate will result in eliminating the Integrated Flight/Weapons Control work as a follow-on for the current F-15 test vehicle and postponing the Integrated Flight/Propulsion Control work for one year.

4. (U) FY 1984 Planned Program: Initiate a program in Integrated Flight/Propulsion Control to provide the necessary controls and displays to accomplish a Short Take-off and Landing (STOL) capability. This technology will directly support the STOL Fighter Technology project in PE 63245F, Advanced Fighter Technology Integration. Continue development of the flight control aspects of the Integrated Inertial Reference Assembly (IIRA) program. Complete support of the Automated Maneuvering Attack System for the F-16 test vehicle.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	7,660	6,375	5,801	7,179	Continuing	Not applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
RDT&E Funds	7,500	6,500	6,500		Continuing	Not applicable

The decrease in FY 1983 funds eliminates the Integrated Flight/Weapons Control program scheduled as a follow-on for the F-15 test vehicle and postpones for one year the Integrated Flight/Propulsion Control work supporting PE 63245F, Advanced Fighter Technology Integration.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63208F
DOD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Reconnaissance Sensors/Processing Technology
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5,866	4,085	6,383	8,984	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Program Element 63208F is a continuing Advanced Development Program Element that exploits new technologies to satisfy future tactical and strategic reconnaissance requirements. Project 665A emphasizes the development of real and near-real time reconnaissance capabilities. This program is providing the technology base and validated concepts for new and improved reconnaissance sensors. The objective is to provide alternatives for the future to satisfy current and projected reconnaissance and strike requirements and to provide growth potential for the Night Precision Attack (LANTIRN) program.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This program is comprised of advanced developments for real and near-real time reconnaissance sensor systems along with the inherent processing for timely data exploitation. Activities in FY 1983 continue development and validation for: automatic data processing and data handling to automate and expedite the exploitation of large quantities of reconnaissance data; automatic target cueing and classification sensor technology; and second generation Forward Looking Infrared (FLIR) technology. New activities include developing foliage penetration radar for all weather detection of concealed targets.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	5,900	4,200	4,600		Continuing	Not Applicable
Procurement	Not Applicable					

OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63208F
DOD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Reconnaissance Sensors/Processing Technology
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The activities conducted within this program exploit new technologies to meet reconnaissance requirements. The objective is to advance technology and improve the time responsiveness of reconnaissance sensor systems in order to provide real and near-real time information to tactical commanders during day, night and all-weather conditions for effective strike and surveillance of enemy forces. The program includes advanced development of real and near-real time sensor systems, with both airborne and ground processing, for the detection, location and classification of targets concealed by camouflage, foliage, or adverse weather conditions. This program will provide the necessary technology base and concept validation for new and improved reconnaissance sensor systems. The requirements for these reconnaissance systems are identified in various requirements documents established by the operational commands.

(U) RELATED ACTIVITIES: Exploratory development efforts are phased into this program from Program Element (PE) 62204F, Aerospace Avionics. Equipment developments from this program are transitioned into engineering development PEs such as 64710F, Reconnaissance Equipment; 64756F, Side Looking Airborne Radar; 64249F, Night Precision Attack (LANTIRN) System. Coordination with the Army and Navy on related advanced development work is accomplished by direct liaison between corresponding levels of program management and through the Joint Deputies for Laboratories Sub-Panel on Night Vision. PE 63203F, Advanced Avionics for Aircraft, is jointly funding the Second Generation Forward Looking Infrared (FLIR) Technology Demonstration. This support is planned to pursue the strike avionics aspects of FLIR technology as well as the reconnaissance applications. PE 63727F, Advanced Communication Technology, is developing the associated Airborne Imagery transmission data link required to provide timely reconnaissance information to Tactical Commanders.

(U) WORK PERFORMED BY: Program management is the responsibility of the Air Force Systems Command through the Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, with participation of the Rome Air Development Center, Griffiss AFB, NY. Major contractors are: Hughes Aircraft Co., Culver City, CA, for Second Generation FLIR Technology Demonstration; Harris Corp., Melbourne, FL, for ground based data processing (Data Handling/Recording System); Rockwell International Corp., Anahiem, CA, and Honeywell, Inc., Minneapolis, MN, for FLIR imagery processing (Imaging Sensor Autoprocessor).

Program Element: #63208F
DOD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Reconnaissance Sensors/Processing Technology
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Developed and validated technologies for new reconnaissance sensors and for improvements to existing systems that were provided under this program. These include: the long range Electro-Optical Reconnaissance (LOREORS) System which demonstrated high resolution and increased sensitivity for image collection in heavy haze; a butted chip demonstration of the Forward Looking Infrared (FLIR) focal plane resulted in potential for a marked improvement over the current generation common module thermal imaging system; preliminary algorithm development for infrared imagery automatic processing which has yielded promising technology for real time target classification. The technology to automatically classify targets offers much greater flexibility in weapon delivery over current manual target detection procedures by searching an entire scene and highlighting potential targets for the operator's decision.

2. (U) FY 1982 Program: Processor development will continue in FY 1982 for the automatic target classification system for forward looking infrared (FLIR) sensors. A new effort called the Automatic Target Acquisition Sensor Program will be started which will integrate the second generation FLIR focal plane, sensor hardware, signal processing and advanced auto-classification system for evaluation and demonstration using a high performance aircraft test bed. Fabrication will continue on the ground based Data Handling/Recording System for optimizing reconnaissance data processing and exploitation in real time.

3. (U) FY 1983 Planned Program: Development and testing will continue for the automatic target screening/classification system. The Automatic Target Acquisition Sensor Program will continue at an accelerated pace to flight test demonstrate the second generation FLIR system. Fabrication of the Data Handling/Recording System will be completed and system evaluation will commence. Increased funding in FY 1983 will augment the FLIR test program and fund a new effort to develop all-weather foliage and camouflage penetration radar for concealed target detection.

4. (U) FY 1984 Planned Program: Preliminary test and evaluation will be completed for the second generation FLIR and auto processor integration technology. Design and development of the concealed target detection system will continue. New technology development efforts will be initiated to compress imagery data and reduce data link bandwidth requirements. This will enhance real time reconnaissance information transmission in electronic jamming environments.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63211F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Aerospace Structures and Materials
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	15,535	19,427	23,545	25,610	Continuing	Not applicable
69CW	Advanced Composites	4,935	7,870	8,645	8,810		
486U	Advanced Metallic Structures	6,400	6,376	7,500	9,800		
2100	Laser Hardened Materials	4,200	5,181	7,400	7,000		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is the only Air Force program which demonstrates the application of new materials, advanced structural design concepts, new fabrication technology, and hardening techniques against high energy laser threats to Air Force systems, subsystems, and components. Metallic, nonmetallic, and laser hardened structures and components are designed with the advanced materials and new design/fabrication technology, and are built and tested to complete the technology validation process. The result is a demonstrated capability with improved structural integrity, damage tolerance, and durability ready for weapon systems application. Direct benefits are reduced systems cost, weight, and technical risk along with increased systems performance capability and survivability.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This program will develop and demonstrate advanced fiber reinforced metal/matrix and organic matrix composite structures having improved durability and damage tolerance, a 20 to 50 percent weight reduction, and a 10 to 25 percent total systems Life Cycle Cost reduction through reduced acquisition, maintenance, and operational costs. These will provide increased performance, durability and fuel efficiency for both current and future aircraft. Radar absorbing structures will be demonstrated for next generation aircraft and cruise missiles. Advanced design, materials, and manufacturing concepts will be applied to current operational aircraft high-cost/high-frequency of replacement parts to provide significant improvements in Life Cycle Cost through reduced maintenance costs. Advanced composites will be applied to space surveillance systems for longer systems life and increased performance. Laser hardened materials technology will be developed and demonstrated to harden tactical optical systems including human eye protection. Development will continue on laser hardened satellite components to counter advanced high energy laser threats with emphasis on low altitude satellite systems. The program cost estimates were derived using analogous contract manhour, material, and overhead charges adjusted for program complexity.

Program Element: #63211F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Aerospace Structures and Materials
Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	18,600	19,900	25,100		Continuing	Not applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63211F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Aerospace Structures and Materials
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element validates new materials and structural concepts along with technology to harden against current and projected high energy laser threats necessary to meet Air Force requirements for greater systems range, greater payload capability, runway independence, increased system/component reliability, durability, and maintainability; new and more ambitious missions; and survivability against directed energy beam threats. Advanced composites that are lighter, stronger, stiffer, and have highly directional properties are being developed for both primary and secondary major systems structure. Advanced metallic structures improving engine durability, reliability, efficiency, and performance as well as advanced metallic applications to reduce the maintenance costs of operational aircraft and new major structural concepts with greater strengths, stiffnesses, and temperature capabilities are underway. Laser hardened materials and design concept applications to aircraft, ballistic missile, cruise missile, and space systems applications are being developed and demonstrated to counter current and future high energy laser weapon capabilities.

(U) RELATED ACTIVITIES: Coordination with other Department of Defense and governmental activities is maintained under strong guidance of the Office of the Secretary of Defense's technical staff. Activities such as the Tri-Service Metal-Matrix Composite Steering Group, the Tri-Service Laser Hardening Materials and Structures Working Group, and bi-annual Department of Defense Materials and Structures Conference allow the development of a strong, nonredundant program. Close relationships are maintained with the National Aeronautics and Space Administration in areas of mutual interest. This program element is meshed with portions of the Air Force Manufacturing Technology Program (Program Element 78011F), with results of each program element feeding the other; with Aerospace Flight Dynamics (Program Element 62201F), Materials (Program Element 62102F), and Aerospace Propulsion (Program Element 62203F) all of which provide the basic technology developed within this program element; and with Advanced Radiation Technology (Program Element 63605F) and Satellite Systems Survivability (Program Element 63438F) which support and benefit from the laser hardened materials effort. Due to the universal nature of materials and structures and their application, this program element has potential application for essentially every major Air Force acquisition program.

(U) WORK PERFORMED BY: This program is managed by the Air Force Wright Aeronautical Laboratories' Materials Laboratory and Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. The major contractors of the program include: General Electric Company, Evendale, OH and Philadelphia, PA; Raytheon Corporation, Waltham, MA; TRW, Inc., Redondo Beach, CA; Vought Corporation, Dallas, TX; McDonnell Douglas, St. Louis, MO, Long Beach, CA, Huntington Beach, CA; Lockheed Aircraft, Marietta, GA; and Northrop Corporation, Hawthorne, CA; The Boeing Company, Seattle, WA; and Rockwell International, Los Angeles, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: New, high precision and reliable bulk casting technology was demonstrated and transitioned into the air launched cruise missile with a production cost savings of over $150 million on a 4000 unit buy. Adhesive bonding technology was shown to save 20 percent in cost and 15 percent in weight over conventional sheet metal joining techniques. This technology is now in use by the Air Force Logistics Command's Air Logistic Centers to support maintenance of the C-130, C-141, A-10, F-111, and C-5 aircraft. Advanced titanium metal

working projects have been completed with demonstrated final part weight savings of 30 percent and projected acquisition cost savings of 40 percent over current state-of-the-art titanium fabrication technology. Results of the initial Department of Defense/Congressionally directed programs in metal-matrix composites technology demonstrations have indicated a projected 23 percent reduction in aircraft size and a 10 percent reduction in total life cycle cost when these materials are used in a transport/bomber type aircraft. Advanced ballistic reentry vehicle composite substructure detailed design, fabrication, structural testing, and nuclear effects testing have been completed. Designs for advanced composite applications to both MX and satellite main body structures have been completed. Development and demonstration of laser hardening techniques for critically vulnerable, representative satellite subsystems for near term high energy laser threats have been completed. These demonstrations were accomplished on deployable antennas, solar arrays, thermal control systems and attitude control subsystems. Design guidelines for both space and aircraft systems were developed and furnished to system program offices.

2. (U) FY 1982 Program: Advanced titanium turbine engine compressor blades requiring no mid-span damping will be fabricated with a 15 to 30 percent expected weight reduction. Evaluations of metal-matrix composite and advanced powder metallurgy aluminum will continue. Testing of subscale and full scale composite MX missile structures will be completed yielding an expected 40 percent decrease in component weight at comparable cost. This will result in improved payload/range capability on the ability to absorb weight increased elsewhere in the total system. System verification of an advanced composite satellite equipment support module will be completed. Subscale and full scale satellite and electro-optical components will be fabricated for hardening against continuous wave and pulsed high energy laser energy. Programs to protect personnel against eye damage from lasers will be initiated.

3. (U) FY 1983 Planned Program: The graphite/epoxy composite aircraft wing/fuselage design and demonstration program will be continued. Programs to develop advanced reinforced titanium and eutectic high pressure turbine blades will be continued. Programs will be initiated to demonstrate lower cost/higher reliability parts to replace those of currently operational aircraft which are high cost/high maintenance items. The development and demonstration of radar absorbing structural components suitable for next generation aircraft and missiles will begin. The development of laser hardened satellite components, and eye protection techniques will be continued. New programs to harden tactical electro-optical systems will be started. Support of metal-matrix composites will continue at a high level. See project formats for explanation of FY 1983 adjustments made because of the $1,313 reduction in FY 1983 funding.

4. (U) FY 1984 Planned Program: The wing/fuselage program will concentrate on durability and damage tolerance. The development of composite subsystem structures for space based optical and infrared telescopes, and space based radars will be initiated. Radar absorbing structures development will continue. Flight test evaluation of adanced laser hardened electro-optical and infrared seeker technology will be conducted.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #69CW | Title: Advanced Composites
Program Element: #63211F | Title: Aerospace Structures and Materials
DOD Mission Area: Engineering Technology (ATD), #553 | Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops, demonstrates, and evaluates advanced composite materials for Air Force weapon systems and aerospace applications. The lightweight, high stiffness and strength, and tailorability of the properties of advanced composites provide unique capabilities and high likelihood of being a key technology necessary for many Air Force requirements including runway independence, greater range and payload capability, unique mission performance abilities, lower fuel usage, and reduced cost of operation and maintenance. The project has two major thrusts: materials and engineering design development and hardware demonstrations. The materials and engineering design development area results in new material systems of lower cost and develops the substantiating and supporting technology required to assure the suitability of these materials in systems applications. Hardware demonstrations are conducted to demonstrate the feasibility of a fully integrated concept of materials design and manufacturing, and to achieve the anticipated weight savings, flight worthiness and other potential advantages. Over the next ten years, the output of this project is expected to make composite structures less costly than metal items, while providing significant increased performance options to the aircraft, missile, satellite, and engine designer.

(U) RELATED ACTIVITIES: This program is related to Materials (Program Element 62102F) and Aerospace Flight Dynamics (Program Element 62201F). Coordination is accomplished with the Army, Navy, National Aeronautics and Space Administration, Defense Advanced Research Projects Agency, and industry through joint planning, technical symposia, professional societies, reviews of contractors' Independent Research and Development Programs, and technical reports.

(U) WORK PERFORMED BY: Work is performed by the Air Force Wright Aeronautical Laboratories' Materials Laboratory and Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. The major contractors for the program include: Northrop Corporation, Hawthorne, CA; The Boeing Company, Seattle, WA; and Rockwell International, Los Angeles, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Demonstrated that a projected 50 percent composite structure vehicle can reduce overall structural weight by 20 to 30 percent, fuel requirements by 10 to 25 percent, and Life Cycle Costs by up to 20 percent as compared to an all-metal aircraft with the same mission/payload. Designed and fabricated composite MX Stage IV primary structure components, satellite equipment support modules, and MX reentry vehicle deployment module with average 20 percent weight and 10 percent cost savings. Demonstrated the shielding of composites from electro-magnetic pulses.

2. (U) FY 1982 Planned Program: An aircraft wing/fuselage advanced composite structure damage tolerance effort will begin and full scale testing of wing/fuselage advanced composite structure durability will begin. The MX composite Stage IV design and the deployment module demonstration will be completed, providing up to 40 percent weight saving and 10 percent cost saving relative to state-of-the-art materials and structures technology. A program to apply organic matrix composites to the inertial upper stage for weight reduction will be started.

Project: #69CW | Title: Advanced Composites
Program Element: #63211F | Title: Aerospace Structures and Materials
DOD Mission Area: Engineering Technology (ATD), #553 | Budget Activity: Advanced Technology Development, #2

3. (U) FY 1983 Planned Program: The composite wing/fuselage structure program will continue with emphasis on damage tolerance. Radar absorbing structures will be fabricated, and optical subsystem structures for space will complete detailed design and be fabricated. Preliminary design will begin on large space radar support structures.

4. (U) FY 1984 Planned Program: Durability testing on wing/fuselage structure will be continued and damage tolerance test components will be fabricated. Radar absorbing structures will undergo testing. Programs to apply composites to large aircraft structures such as next generation advanced technology bombers will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,935	7,870	8,645	8,810	Continuing	Not applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	7,000	8,350	9,800		Continuing	Not applicable

The $1.155 million reduction in FY 1983 will delete the second year of the composite inertial upper stage design and demonstration program, and will delay the start of a program to design composite structures for advanced strategic reentry vehicles.

Project: #486U Title: Advanced Metallic Structures
Program Element: #63211F Title: Aerospace Structures and Materials
DOD Mission Area: Engineering Technology (ATD), #553 Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the design, fabrication, test, and evaluation of aircraft primary and secondary structures using new metallic concepts such as metal-matrix composites, advanced powder metallurgy, and the latest metal alloys; all combined with advanced structures technology. Reduced acquisition and maintenance costs, increased structural integrity, new mission capabilities, and more efficiently performing systems are the objectives. Major assemblies such as wing carry-through structures, fuselage sections wing structures, and others are built and tested to demonstrate that advanced technology can satisfy these objectives. The project was initiated in 1971 to address structural problems existing with operational inventory aircraft and has been continued to provide demonstration that new technology can significantly improve the structural integrity, performance capability, and overall costs for future and current Air Force systems. It is the primary program supporting the Department of Defense/Congressionally directed programs in metal-matrix technology.

(U) RELATED ACTIVITIES: This program is related to Aerospace Flight Dynamics (Program Element 62201F), Materials (Program Element 62102F), Aerospace Propulsion (Program Element 62203F), and the Mechanics Subelement of Defense Research Sciences Program (Program Element 61102F). Coordination with Army, Navy, National Aeronautics and Space Administration, and industry is accomplished through such methods as: membership on National Aeronautics and Space Administration Advisory Committees; participation in the Tri-Service Metal Matrix Composite Steering Group, and various professional societies; and reviews of contractors' Independent Research and Development Programs. Tri-service coordination is also accomplished during preparation of both the Materials and Structures Technology Coordinating Papers.

(U) WORK PERFORMED BY: Work is performed by the Air Force Wright Aeronautical Laboratories' Flight Dynamics Laboratory and Materials Laboratory, Wright-Patterson Air Force Base, OH. Management of the program is accomplished by the Flight Dynamics Laboratory. Contractors are: McDonnell Douglas, Long Beach, CA and St. Louis, MO; Rockwell International, Thousands Oaks, CA; Lockheed Aircraft, Marietta, GA; and Vought Corporation, Dallas, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Demonstrated and transitioned large, precision aluminum casting technology to air launched cruise missile production, reducing 28 forgings to 4 castings with a 35 percent cost saving on parts or a $150 million saving on 4000 unit buy. Demonstrated adhesive bonding technology on transport aircraft wing carry-through structure with a 20 percent cost saving and 400 percent life improvement. Demonstrated superplastic forming/diffusion bonding technology for working titanium with 30 percent weight and 40 percent acquisition cost savings. Conducted metal-matrix composite application studies to identify weight and cost savings.

2. (U) FY 1982 Program: Advanced, reinforced titanium fan blades will be fabricated for evaluation. These are projected to have lower weight (15-30%) and higher tip speeds than state-of-the-art blades and will have no mid-span damping shroud. Results in engine evaluation are expected to include both higher thrust-to-weight performance and a concurrent improvement in specific fuel consumption. Evaluation and engine testing will be performed for eutectic high pressure turbine blades that will have a higher operating temperature of about 250°F greater than current

Project: #486U | Title: Advanced Metallic Structures
Program Element: #63211F | Title: Aerospace Structures and Materials
DOD Mission Area: Engineering Technology (ATD), #553 | Budget Activity: Advanced Technology Development, #2

materials. These blades will also have an 8 percent reduction in required cooling air and an improved rupture life of about three times that of current blades, resulting in improved engine operation (thrust and efficiency) and lower operation and maintenance costs. Structural verification of advanced powder metallurgy aluminum alloys will begin with aircraft wing design, offering the potential of improved strength and stiffness-to-weight ratios on the order of 20 to 30 percent. Metal-matrix composite programs in aluminum, two sheet fiber/titanium matrix design development, and missile/space payoff will continue. Demonstration of full-scale metal-matix aircraft wing and missile body structures will continue.

3. (U) FY 1983 Planned Program: The lower cost/higher reliability operational aircraft components will complete detailed design and enter fabrication. Aluminum and titanium metal-matrix composite programs will continue with aluminum metal-matrix missile and aircraft demonstration parts entering detailed design and fabrication. Powder aluminum demonstration will complete design and enter parts fabrication. An effort to provide integral visco-elastic damping of space system structures will be initiated. This requirement results from the lack of atmosphere to damp vibrations generated by satellite activity such as maneuvering. Such vibration, if not damped, could compromise system performance and mission.

4. (U) FY 1984 Planned Program: FY 1983 programs will continue with metal-matrix structures entering testing. Fabrication of powder aluminum parts will be completed and a parallel program in powder titanium structures will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	6,400	6,376	7,500	9,800	Continuing	Not applicable

8. (U) Comparison with FY 1981 Descriptive Summary:

RDT&E	7,400	6,350	8,900

The $1.400 million reduction in FY 1983 will terminate the advanced titanium turbine engine fan blade development program and delete a planned supporting program in metal-matrix composite turbine engine shaft development.

Project: #2100 Title: Laser Hardened Materials
Program Element: #63211F Title: Aerospace Structures and Materials
DOD Mission Area: Engineering Technology (ATD), #553 Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops materials and concepts that measurably reduce the vulnerability of Air Force systems to high energy laser damage. It addresses hardening of representative critical components and subsystems of all type systems, including aircraft, satellites, missiles, sensors, and the human eye. It includes development of materials and concepts for laser hardening by retrofitting existing and near-term systems as well as concepts for inherently hardening systems and components for the future. The program is responsive to intelligence estimates.

(U) RELATED ACTIVITIES: This program is related to Materials (Program Element 62102F), Aerospace Flight Dynamics (Program Element 62201F), Aerospace Propulsion (Program Element 62203F), Advanced Radiation Technology (Program Element 63605F), and Satellite Systems Survivability (Program Element 63438F). Coordination is accomplished with the Navy, Army, and Defense Advanced Research Project Agency, the High Energy Laser Review Group, through the Laser Hardened Materials and Structures group established by the Office of the Under Secretary of Defense for Research and Engineering; and industry through joint planning, technical symposia, professional societies, reviews of contractors' Independent Research and Development Programs, technical reports; and for Tri-service coordination through both the Materials and Structures Technology Coordinating Papers.

(U) WORK PERFORMED BY: The Materials Laboratory, Wright-Patterson Air Force Base, OH is the organization responsible for management of this program. Contractors include McDonnell Douglas, St. Louis, MO and Huntington Beach, CA; General Electric, Philadelphia, PA; Acurex Corporation, Mountain View, CA; Raytheon Corporation, Waltham, MA; TRW, Inc., Redondo Beach, CA; Science Application Inc., El Segundo, CA; and IITRI, Chicago, IL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Subscale evaluations of concepts to protect satellite systems to near-term projected threats have been completed. Demonstrations have included a 16-foot deployable antenna. Materials, fabrication, and installation techniques for protection of internal aircraft components such as avionics systems, wiring, flight control systems, and materials for hardening fuel systems have been developed. Techniques have been developed to produce reflective surfaces on aircraft surfaces. A full scale F-4 demonstration canopy has been hardened and has undergone structural tests. Methods to harden infrared optics and electro-optical systems have been developed and demonstrated.

2. (U) FY 1982 Program: Fabrication will continue and evaluation/demonstration will begin for both subscale and full scale satellite and electro-optical components hardened against continuous wave and pulsed lasers, both ground and space based. Programs will be initiated which protect human eyes from laser damage. Sensor hardening technology demonstration efforts will continue fabrication of hardened components. Strategic and tactical systems will continue to be supported.

Project: #2100 Title: Laser Hardened Materials
Program Element: #63211F Title: Aerospace Structures and Materials
DOD Mission Area: Engineering Technology (ATD), #553 Budget Activity: Advanced Technology Development, #2

3. (U) FY 1983 Planned Program: Satellite component hardening demonstration will continue to higher energy levels. A hardened forward looking infrared sensor component demonstration will be initiated as will flight test evaluation of an AIM-9L hardened sensor optics. Personnel eye protection concepts will be selected and full scale evaluation of satellite components will be performed.

4. (U) FY 1984 Planned Program: Continue satellite and missile sensor hardening development and demonstrations; and initiate flight test of laser hardened seeker technology demonstrator. Continue personnel eye protection, including human engineering evaluations. Initiate aircraft scale-up of pulsed hardening and flight test full scale laser hardened canopy/windshield.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,200	5,181	7,400	7,000	Continuing	Not applicable

8. (U) Comparison with FY 1981 Descriptive Summary:

RDT&E	4,200	5,200	6,400

The $1.000 million increase in FY 1983 represents programs to develop eye protection techniques which are compatible with Air Force mission requirements.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63215F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Aviation Turbine Fuel Technology
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number		FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	8,437*	6,486	8,699	8,465	Continuing	Not Applicable

* Includes $4,100 Congressionally approved supplemental

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Hardware testing in this Program Element will validate aviation turbine fuel specifications for fuels derived from low quality petroleum crudes and non-petroleum sources such as shale oil and coal. The program will concentrate on the hardware (aircraft) implications of the transition to non-petroleum fuels. The program provides the Research, Development, Test and Evaluation (RDT&E) basis for first operational use of shale fuel in the Air Force Operational Validation Program and is a part of the DOD program to utilize fuels incentivized by the Energy Security Act of 1980. This supports the need to assure availability of aviatio fuel and to assure a domestic source for such fuels.

(U) BASIS FOR FY 1983 REQUEST: First commercial deliveries of production quantities of shale derived JP-4 aviation jet fuel are expected in FY 1984. The deliveries are the result of the Defense Production Act synthetic fuels contracts of the Energy Security Act of 1980 (Union Oil and the TOSCO Corporation). This R&D program, including laboratory testing and fullscale production turbine engine testing, is necessary to allow Air Force bases to operate on the shale derived fuels in 1984. This program will complete the full-scale engine shale testing and testing data analysis in FY 1983.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,350	6,900	8,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #632.5F　　　　Title: Aviation Turbine Fuel Technology
DOD Mission Area: Engineering Technology (ATD), #553　　　　Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Numerous studies have predicted large shortfalls in petroleum production in relation to consumption patterns. The Air Force has reduced its aviation fuel consumption by about one-third since 1973 but the fuel bill has risen from less than one billion dollars annually to almost five billion ($4.7 Billion in FY 1981). Also, poorer quality petroleum crudes (Alaskan crudes as an example) make poor stock for our current specification fuels. Much of the petroleum now converted to aviation fuel is imported crude. By utilizing our domestic source of oil shale we can improve our defense posture through increased availability and security of our sources while improving our balance of payments problem. Shale derived fuel will be tested in current Air Force hardware to determine what fuel property changes can be made without incurring unreasonable system support costs. At our current consumption rates, a savings of one cent per gallon in fuel cost equates to a cost avoidance of $36 Million annually. Fuels made from poorer quality petroleums are currently being studied and fuels from coal liquids and tar sands will be studied starting in FY 1984.

(U) RELATED ACTIVITIES: This program extends the work of Program Element 62203F, Aerospace Propulsion. This program and the companion exploratory development programs in PE 62203F are coordinated with National Aeronautics and Space Administration (NASA) and Department of Energy (DOE). NASA is conducting cooperative planning with the Air Force Aero Propulsion Laboratory to assure the military and civilian synthetic fuels efforts are complementary. The Army, Navy and Air Force synthetic fuels programs are coordinated through the Under Secretary of Defense for Research and Engineering and test fuel planning in cooperation with the DOE is being coordinated through the Office of the Secretary of Defense. Test fuels acquisition, transporation and storage is being handled by the Defense Fuels Supply Center of the Defense Logistics Agency.

(U) WORK PERFORMED BY: Work is managed and performed by the Air Force Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. Another Air Force organization in the engine testing portion is the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. The majority of the work will be conducted under contracts to qualified bidders. Current contractors are: General Electric Engine Group, Evendale, OH; Pratt and Whitney Aircraft Group, Government Products Division, West Palm Beach, FL; Boeing Military Airplane Co., Seattle, WA; and General Dynamics, Fort Worth Division, Fort Worth, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The initial effort in this program is to identify performance degradation and durability of contemporary turbine engines such as the F100, TF30, J79, and J85, caused by steady state, transient and cyclic operations with shale derived fuels and variable quality petroleum fuels. The main-burner and turbine component work stated in FY 1979. Sector burner and full size component rig testing and analysis was initiated to test a range of fuel qualities and to provide durability data. Testing is being done under contracts to major turbine engine manufacturers. Combustor testing has been performed to determine characteristics of ignition, fuel injector location, heat release rates, pattern factor, temperature distribution,

Program Element: #63215F | Title: Aviation Turbine Fuel Technology
DOD Mission Area: Engineering Technology (ATD), #553 | Budget Activity: Advanced Technology Development, #2

radiant heat transfer, carbon formation and cooling requirements. Turbine components testing was also done to determine characteristics of metal temperature, thermal gradients, cooling requirements, and erosion of coatings. These component level evaluations resulted in a low assessment of risk (no degradation in performance or durability) for the Air Force operational use of shale derived fuel. The shale processing trade-off studies were initiated in FY 1979 to determine how shale processing would affect availability and cost of aviation fuels. A Congressionally approved supplemental of $4.1 Million was used to purchase shale test fuels.

2. (U) FY 1982 Program: Component evaluations of turbine engine augmentors (afterburners) and auxiliary power units (APU) will be completed. The augmentor tests will be done at both sea level and simulated altitude conditions. Aircraft fuel systems (pumps, fuel controls, tanks, metering valves, heat exchangers, etc.) will be tested and evaluated on shale fuels.

3. (U) FY 1983 Planned Program: Full-scale engine testing of both the J79 and F100 engines will be initiated and completed in FY 1983. The J79 testing has been delayed from FY 1982 due to lack of shale derived test fuels. Testing of APUs was accelerated in FY 1982 since these tests use much less fuel than full-scale turbine engines. Each engine (J79 and F100) will be run for 350 accelerated mission test hours which is equivalent to about 1,000 flight hours. Limited flight testing on shale fuel will begin. All final assessments prior to beginning Operational Validation at active Air Force bases will be completed.

4. (U) FY 1984 Planned Program: This program will support the Air Force's Operational Validation Program (Program Element 71112F) with engineering-technical manpower and data. This effort will also analyze maintenance data relative to using the shale derived fuel. In addition R&D will be conducted on fuels made from other feedstocks such as coal liquids and tar sands. The major emphasis will shift from shale derived fuels to coal derived fuels. Testing similar to the previously conducted shale program will be conducted with coal derived fuels with the intent of changing the aviation fuel specifications to increase availability by accepting feedstocks from multiple sources (shale oil, coal, tar sands, etc.).

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Test and Evaluation Data: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63216F
DOD Mission Area: Engineering Technology (ATD), 553

Title: Advanced Turbine Engine Gas Generator (ATEGG)
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	30,940	33,278	30,979	33,128	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF PROGRAM ELEMENT AND MISSION NEED: This program ensures that there is a continuous development and demonstration of the most advanced turbine engine high pressure core components. Advanced compressors, combustors and high pressure turbines are integrated into gas generators in which the durability, cost and performance aspects of these core engine technologies can be assessed. A building block approach is utilized to systematically assess both the independent component characteristics and the interactive, interdependent component characteristics under the most realistic operating environment. This critical integrated hardware demonstration enhances the early low risk transition of these technologies to engineering development. Advanced aircraft and/or growth aircraft systems are dramatically affected by propulsion related capability such as durability, reliability, life cycle cost and performance. These features are directly translated to thrust/weight; specific fuel consumption at cruise and in afterburner; stall-free operation; matched cycle performance within a mission envelope; ease of maintenance; lower acquisition cost; and increased reliability/durability. Proper attention to these propulsion features will ensure that advanced aircraft systems can achieve longer range, higher payload, increased maneuverability, increased sortie rate and improved operability.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Competitive gas generator options will continue to be pursued to maintain a minimum four contractor competitive technology baseline. Emphasis will be placed on continued enhancement of durability oriented testing of hardware designs with special attention to accelerated life testing. Gas generator component designs/redesigns and testing will focus on those efforts prerequisite to the definition and full scale development of the next generation fighter engine in the mid to late 1980s time period. The focus will be on conducting those environmental characterization tests and accelerated life tests required to verify the structural design system of the advanced components. This testing will make possible an accurate correlation between the predicted and actual design life of engine hardware. During this period, five builds/tests will be conducted on large engine gas generators and two builds/tests will be conducted on a small engine gas generator. The cost estimates for this program are based upon a level of effort test program in accordance with the ATEGG Five Year Plan and the ATEGG Program Management Directive.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Complete	Total Estimated Costs
RDT&E	30,940	33,400	32,300		Continuing	Not Applicable

Program Element: #63216F | Title: Advanced Turbine Engine Gas Generator (ATEGG)
DOD Mission Area: Engineering Technology (ATD), #553 | Budget Activity: Advanced Technology Development, #2

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) DETAILED BACKGROUND AND DESCRIPTION: This Advanced Development Program will ensure that turbine gas generator technology is available to meet the requirements of future aircraft propulsion systems. To ensure that these needs can be met requires a better definition of the engine's operating environment; advanced designs that maximize the trade-offs between performance and life characteristics within this environment; and effective test and measurement techniques to verify this capability. The gas generator is the basic building block of the engine and it consists of a compressor, a combustor, and a turbine to power the compressor. The objective of this program is to provide the continued evolution of the most advanced core engine technologies (compressors, combustors, and high pressure turbines) into an advanced gas generator in which the performance, cost and durability aspects can be assessed in a real engine environment. This critical hardware demonstration will enhance the early low risk transition of these technologies to engineering development where they can be applied to growth systems and/or new systems. The technologies are scalable, flexible, and applicable to a wide variety of potential systems applications. Flight size, flight weight gas generators are initially tested to define flow path characteristics. Once the flow path has been characterized and mechanical integrity verified, the gas generators are subjected to accelerated life testing to characterize the structural aspects of the advanced component designs. New component technologies are introduced on a step-by-step basis so that their individual performance/structural characteristics can be assessed and so that the relationship (effect) of the new component on other components and the integrated gas generator can be accurately assessed.

(U) RELATED ACTIVITIES: Gas generator and other engine component feasibility and practicality is demonstrated initially in Exploratory Development under Program Element 62203F, Aerospace Propulsion. The other engine subsystems such as fans, controls and afterburners which, when added to the basic gas generator complete the engine, are demonstrated in advanced development under Program Element 63202F, Aircraft Propulsion Subsystems Integration (APSI). Close coordination will be continued with the Navy, Army and NASA to ensure that resources are effectively utilized for common needs. Current and planned development efforts by the Navy Advanced Propulsion Program (63210N), the APSI Program (63202F), Turbine Fuel Technology Program (63215F), Materials Laboratory (62102F, 78011F) and Flight Dynamics Laboratory (63211F) directly complement ATEGG effort.

(U) WORK PERFORMED BY: The program is managed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. Four turbine engine contractors are currently involved in this effort: The Detroit Diesel Allison Division of General Motors, Indianapolis, IN; Teledyne CAE, Toledo, OH, General Electric, Evendale, OH; and Pratt and Whitney, West Palm Beach, FL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Every commercial and military engine which has been developed since about 1967 has contained technology which was initially assessed in the Advanced Turbine Engine Gas Generator (ATEGG) program. This program is the only Department of Defense program for the integrated gas generator testing of advanced turbine engine technologies. The unique four contractor demonstration concept has proven itself through aggressive pursuit of

Program Element: #63216F   Title: Advanced Turbine Engine Gas Generator (ATEGG)
DOD Mission Area: Engineering Technology (ATD), #553   Budget Activity: Advanced Technology Development, #2

performance goals which, when compared to operational engines, have demonstrated dramatic improvements in pressure ratio (higher pressure ratio in 50 percent fewer stages than current designs); combustor heat rise (1000°F increase in a combustor that is 20 percent shorter than current configurations); turbine rotor inlet temperature (500-1000°F increase over current engines); and gas generator size and weight (20-30 percent decrease over current configurations). Since FY 1977, increasing emphasis has been placed upon demonstrating enhanced durability/life characteristics in advanced component designs, especially in combustor and turbine hardware. Comprehensive accelerated life testing to assess the time-dependent durability aspects of designs has become an integral part of the test program for each gas generator design. During this time period, increased structural diagnostic testing was conducted at all contractors. This testing focuses on isolation/identification of life limited components. Gas generators are heavily instrumented in order to adequately assess components. This structural diagnostic testing is prerequisite to future more complex structural tests. Specific large engine gas generator accomplishments include: (a) continued design/fabrication on three high through flow gas generator designs; (b) completion of the first ATEGG accelerated life test, including over 350 hours of testing and over 2100 test cycles. In this testing, the gas generator hardware was cycled to visible levels of distress. Results of this testing have made possible for the first time an accurate correlation between the predicted and actual life of a component. This effort also demonstrated a new life test concept using "mixed-life" components to provide a substantial reduction in test costs for an expanded data base. Accelerated life testing is considered absolutely essential to the low risk transition of advanced gas generator technology/hardware to growth and/or new development systems. Testing conditions were designed to assess the effects of time-dependent life limiting factors (i.e., low cycle fatigue, creep, stress rupture, etc.); (c) completed the first demonstration and evaluation of the new class of high-through-flow compressors. Excellent compatibility between the high flow combustor and compressor was demonstrated including forty-four stall recoveries. Advanced techniques to assess and improve compressor stall-recovery characteristics were also evaluated; and (d) demonstrated advanced instrumentation techniques which more than doubled the number of rotating channels of data acquisition for structural measurements. This is the key for structural tests and assessment efforts. Small engine gas generator efforts have included hot section environmental characterization. Over eight hundred thermal cycles and over one hundred hours of testing were accomplished to ensure that the gas generator was ready for the rigors of accelerated life testing.

2. (U) FY 1982 Planned Program: During this time period, three new gas generator designs will complete initial flow-path definition testing. A total of seven major gas generator builds/tests will be accomplished. Large engine gas generator efforts will focus on the assessment of gas high-through-flow (HTF) gas generators. Two large engine gas generator designs will complete a maturation process which includes comprehensive flowpath documentation and durability/life testing. Specific efforts will include: (a) turbine vane environmental characterization testing, accelerated mission-type durability testing, and fabrication and test of a HTF gas generator at one contractor; (b) initial test of a new HTF gas generator and structural testing of an advanced combustor (four lifetimes when compared to current operational combustor) at a second contractor; and (c) turbine environmental characterization testing including up to 800 durability cycles, and HTF compressor fabrication at a third contractor. All large engine contractors will be fabricating additional hardware needed for extended structural tests of gas generators and will initiate installation of additional structural instrumentation. Small engine gas generator efforts will be aimed at the initial flowpath testing on a new gas generator

with a three-stage compressor, vaporizer plate combustor, and high rim speed turbine. This new gas generator will represent a 25 percent reduction in stages/parts and a three-fold increase in life compared to current small engine gas generators. An environmental characterization test will be conducted on a small gas generator to determine the effects of variable cooling on the high pressure turbine. During this time period, additional hardware fabrication will be completed to support high risk structural/durability testing.

3. (U) FY 1983 Planned Program: One large engine gas generator and a small engine gas generator will complete the maturation process which includes comprehensive flowpath documentation followed by extensive durability/life testing. By this period, a major program milestone will be achieved: each contractor will conduct at least two core engine test vehicles, one to assess the most advanced new components under the ATEGG Task I Flowpath effort and a second more mature vehicle to assess the durability of advanced concepts under the ATEGG Task II Structures effort. The goal will be to test each of these vehicles on a yearly basis. All contractors will be conducting accelerated life testing on gas generators. Specific large engine efforts will include: (a) turbine vane/combustor accelerated life testing (including 3000 thermal cycles), extended life assessment tests using composite test cycles and additional HTF gas generator component assessment at one contractor; (b) accelerated life testing of a "mixed-life" turbine using both monocrystal and rapid-solidification-rate blades, and performance/structural testing of a five-stage HTF compressor gas generator at a second contractor; and (c) turbine and combustor accelerated life testing at a third contractor. Small engine gas generator efforts include turbine blade/combustor accelerated life testing and additional flowpath performance test and new component design/integration on a three-stage gas generator. Funding was reduced from $32.3 million to $31.0 million for deescalation.

4. (U) FY 1984 Planned Program: All ATEGG contractors will be conducting extensive accelerated life tests and will have completed the Flowpath/Performance testing of advanced HTF gas generators. This substantial increase in structurally oriented testing will provide increased confidence and reduce the risks in transitioning advanced technology options which offer a 3-4 times improvement in life, seven to ten percent reduced fuel consumption and 20-30 percent lower life cycle cost. Specific large engine efforts include: (a) up to 4000 thermal cycles of experimental accelerated mission type durability testing over various potential system usage conditions and maximum temperature durability assessment of a HTF gas generator at one contractor; (b) rammed-cyclic accelerated life testing of a new combustor and rapid solidification rate/radial wafer turbine at a second contractor to access the effect of acceleration times on component life; and (c) extensive accelerated life testing of hot section components and comprehensive flowpath testing of a HTF gas generator with cooling flow modulation at a third contractor. Small engine gas generator efforts include extensive life testing of all hot section components and structural diagnostic testing of the new three stage gas generator.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63226F
DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: DoD Common Programming Language (Ada)
Budget Activity: Advanced Technology Development, #2

(U) . SOURCES (PROJECT LISTING): ($ in Thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	6,974	6,930	5,748	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is part of the total DoD effort to implement, introduce, and provide life-cycle support for Ada, the DoD common, high-order programming language for embedded computers. It will provide resources to meet those language support requirements which are common to the services and agencies. It will provide for configuration control of the Ada language, enforcement of standardization via compiler validation, educational promotion, development of an Ada Programming Support Environment (APSE), and partial implementation of Ada responsive life-cycle software development tools/methodologies.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The Ada Program was supported during FY 1977-81 with funds from the Military Departments, and to a lesser extent from the Defense Advanced Research Projects Agency (DARPA) and the Defense Communications Agency (DCA). These funds have provided for both common and service specific needs. In FY 82, FY 83 and subsequent years, funding for the common needs of the Ada Program has been and will continue to be provided by this program element. The Military Departments and Agencies are separately funding their own Department/Agency specific needs. The Air Force serves as the executive agent for funding the common Ada Program requirements through this program element while the Under Secretary of Defense for Research & Engineering maintains oversight authority for this and other program elements in the Military Departments involving Ada related activities. Major milestones that will be completed by the end of FY 83 include: American National Standards Institute (ANSI) adoption of Ada as a standard programming language, an operational Ada Compiler Validation Facility, availablity of a commerical network based Ada programming course, completion of an initial Ada Programming Support Environment (APSE) and definition of a life-cycle methodolgy for optimal development of Ada software.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimate Costs
RDT&E	0	7,000	TBD		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63226F
DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: DoD Common Programming Language (Ada)
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: DoD computer software life-cycle costs are measured in the billions of dollars. Inflation and increased applications of computers to new functions threaten to make software an even more substantial portion of the DoD budget. The DoD recognizes that use of a common, high order language and a modern programming support environment coupled with modern programming practice will provide leverage to control the cost and improve the reliability of software. In 1975 the Director, Defense Research and Engineering (DDR&E), established the High Order Language Working Group (HOLWG), with representation from Army, Navy, Air Force, Defense Communications Agency (DCA), National Security Agency (NSA), and Defense Advanced Research Projects Agency (DARPA), to investigate the feasibility of adopting a common, high order computer language for use on embedded computer systems. By July 1980 the HOLWG had successfully published a formal definition of the new standard DoD computer programming language, Ada. On December 12, 1980, the Under Secretary of Defense for Research and Engineering established the Ada Joint Program Office, (AJPO), attached to the Office of the Deputy Under Secretary of Defense (Acquisition Policy). The AJPO Charter assigns to the AJPO the management responsibility formerly provided by the HOLWG and DARPA. For the future, there are three major tasks in the Ada Program to be accomplished: the AJPO must ensure the implementation and maintenance of Ada as a consistent unambiguous standard recognized by the DoD and also by the widest possible community; the AJPO must ensure the smooth introduction and acceptance of Ada in the DoD as early as possible consistent with the needs of individual components; and the AJPO must ensure the provision of life-cycle support for Ada through the development of a robust Ada Programming Support Environment (APSE) to improve productivity both in development and in continued evolution. Ada is an important step forward for U.S. Department of Defense software technology. The major programming language innovations of the last ten years have been consolidated and unified in a language which meets the needs of nearly all DoD applications. By transitioning to a single modern high order language in Defense systems, DoD will derive significant benefits in the areas of training, compiler and programming tool availability, software maintainability and reduction of other software development costs. PE 63226F funds the service and agency common remaining tasks in the Ada program needed to successfully complete this transitioning.

(U) RELATED ACTIVITIES: The Ada Program is managed by the AJPO through coordination with the components. In general, the AJPO is responsible for the common Ada-related needs of the DoD and the components are are responsible for component-specific needs. For example, rehosting/retargeting of Ada Programming Support Environment software to a component specific architecture is the responsibility of the components. Each component has developed an introduction strategy and is responsible for implementation of that strategy. Related program elements supporting component specific Ada needs are: PE64740F, PE63728F, PE63723A, PE62746A, PE63526N and PE63253F.

(U) WORK PERFORMED BY: The Ada Joint Program Office is responsible for all work performed under this program element. Specific efforts will be conducted by Air Force, Army and Navy organizations as appropriate. Major contractors are Honeywell, Mineapolis, Min; Softech, Boston, MA; Intermetrics, Boston, MA; Computer Science Corp, Falls Church, VA; Texas Instruments, Dallas, TX.

Program Element: #63226F
DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: DoD Common Programming Language (Ada)
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

(U) 1. FY 1981 and Prior Accomplishments: The language was refined in response to language standardization activities. Ada was designated Military Standard 1815 in December 1980. American National Standards Institute (ANSI) procedures were initiated to establish Ada as a national standard. An effort to provide Ada programming courses at the Air Force Academy and West Point was successfully completed. Competitive designs were initiated for Ada Programming Support Environments. Development of an Ada Compiler Validation Capability was initiated.

(U) 2. FY 1982 Program: ANSI standardization activities are being completed. NATO and International Standards Organization (ISO) procedures are being initiated. The initial Ada Compiler Validation Capability will be operated by a Compiler Validation Office. Development of Ada Programming Support Environments will continue. Conventions will be defined for interfaces between tools, users and data beses. Standard library and applications library requirements will be defined and implementations initiated. Conventions for reusable Ada software components will be developed. Style and documentation standards will be defined. A software development methodology with supporting tools based on Ada will be defined. Ada Training and automated support facilities will be initiated.

(U) 3. FY 1983 Planned Program: Standardization activities will continue. The Ada Compiler Validation Capability will be completed. Development of more advanced compiler validation facilities and performance benchmarks will be initiated. Development of libraries will continue. The initial Ada Programming Support Environment will be available. Projects will begin to use Ada. Development of programming support tools will continue. Programmers will be trained in the use of Ada via commercial network based Ada progamming courses. Public review and comment on the definition of a software development methodology based on Ada will be solicited.

(U) 4. FY 1984 Planned Program: NATO and ISO standardization activities will continue along with development of compiler validation capabilities. An effort to provide a Formal Semantic Definition of Ada that is mathematically precise will be pursued. Large scale training of military personnel in Ada will be undertaken. A Full Ada Programming Support Environment (APSE) development will be underway as well as APSE rehosts on different manufacturers' computers. Specific tool developments to support a software development methodology will be initiated. Several major weapon system development programs will be using Ada.

(U) 5. Program to Completion: This is a continuing program.

(U) 6. Milestones: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63227F
DOD Mission Area: Environmental and Life Sciences (ATD), #552

Title: Advanced Simulator Technology
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	3,163	2,192	10,739	6,941	Continuing	Not Applicable
2363	Advanced Visual Technology System	3,163	2,192	8,889	6,841	8,000	35,213
2743	Advanced Simulator Concepts			1,850	100	28,000	30,009

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force must train and maintain a skilled force of combat-ready pilots. Improved simulator training technology is essential in order to meet this requirement. Currently, air-to-air, air-to-ground, and terrain-following simulator training is limited by the lack of visual scene detail and complexity, and display brightness and resolution. This program element supports work in the training and personnel category of TRAINING DEVICES AND SIMULATION. It develops subsystems to improve the performance capabilities of flight simulators, with special emphasis on developing and demonstrating improved visual image generation and projection techniques to provide more adequate visual displays for combat mission training. In the visual display area, significant improvements in display resolution, brightness and the number of responsive moving targets will be possible. Advanced image generation techniques will be developed to provide more complex and realistic combat scenes for training. This program will also demonstrate the feasibility of using helmet mounted display technology as a low cost transportable alternative to the large pancake window or dome displays currently used for providing wide field of view visual scenes.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Detailed designs will be completed and fabrication started on an advanced computer image generator. This device will provide complex visual scenes for flight simulators which will enable them to provide realistic air-to-ground combat training. Development will continue on high brightness, high resolution visual displays which can provide multiple high resolution targets for both air-to-air and air-to-ground combat training. A program will also be initiated to develop a Combat Mission Trainer utilizing a helmet-mounted visual display. The use of a helmet-mounted display should provide a high quality visual scene for fighter aircraft training, which should cost significantly less than the current large field-of-view visual displays and can be used for a transportable flight simulator.

Program Element: #63227F
DOD Mission Area: Environmental and Life Sciences (ATD), #552

Title: Advanced Simulator Technology
Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	3,170	2,200	4,500		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63227F
DOD Mission Area: Environmental and Life Sciences (ATD), #552

Title: Advanced Simulator Technology
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The program supports the Air Combat Tactics and Training thrust of the Air Force Human Resources Laboratory (AFHRL). It provides for the development and demonstration of simulation devices for improved aircraft simulators. Project 2363 will fund developments in computer image generation technology and in visual display image projection systems. Substantial improvements will be provided in computer-generated scene quality, including advances in scene detail, complexity, and update rate. These improvements will result from advances in edge-oriented computer image generation technology to produce a highly detailed and complex visual display which will be adequate for tactical training requirements. Significant visual display projection improvements, especially in image resolution and brightness, will be possible with the development of improved light-valve projector technology, which will also be able to display multiple, high-resolution targets across the entire visual scene. This capability should eliminate the predicted need to develop complex add-on simulator subsystems that track head or eye movement and display high-resolution targets in the designated, small field-of-view area where the pilot is looking. Project 2743 will develop a Combat Mission Trainer (CMT) that should provide effective transportable air combat training at minimum cost. This will be accomplished through the use of a helmet mounted display utilizing fiber optic bundles to transmit the visual scene from image generators and associated light valve displays to helmet-mounted optics. The entire CMT, consisting of the visual system, cockpit, and instructor/operator station, will be modular in construction and transportable. This will make it possible to use aircraft simulators at the squadron level. A future project will develop an advanced non-edge computer image generation system which should have even greater scene detail and image complexity at a lower overall system cost. Such non-edge image generation technology currently works for non-real-time applications, but anticipated advances in integrated circuit and related computer hardware will be required before it will be feasible for large scale real-time (30 or 60 hertz update rates) simulator applications.

(U) RELATED ACTIVITIES: Related program elements: 61102F, Defense Research Sciences; 62205F, Training and Simulation Technology; 62202F, Aerospace Biotechnology; and 63751F, Innovations in Education and Training; 64227F, Flight Simulator Development; 63738A, Non-Systems Device Development; 63216A, Synthetic Flight Simulators; 62757N, Human Factors and Simulation Technology; 63733N, Training Device Technology; and 63720N, Education and Training. Both at the working and headquarters levels, there is continuing interface and close coordination among the Army, Navy, and Air Force on simulation for training purposes. The Air Force Human Resources Laboratory as the Air Force Systems Command laboratory focal point for training simulation technology, closely monitors all significant research and development being conducted by other Department of Defense, National Aeronautics and Space Administration, and industrial organizations to eliminate redundancy. A major interservice cooperative effort involves a jointly funded effort with the Army Program Manager for Training Devices to develop improved silicon light-valve projector technology. Close coordination within the Air Force user community is also ensured by semiannual research and development coordinating meetings between AFHRL, the Aeronautical Systems Division and the Major Commands (TAC, SAC, MAC, ATC). These meetings were held in April and November 1981.

(U) WORK PERFORMED BY: The program is performed by the Air Force Human Resources Laboratory through the Operations Training Division, Williams Air Force Base AZ. Major contractors are: Hughes Aircraft Company, Fullerton CA; General Electric Company, Daytona Beach FL; Sodern, Limeil-Brevannes, France.

Program Element: #63227F | Title: Advanced Simulator Technology
DOD Mission Area: Environmental and Life Sciences (ATD), #552 | Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A prototype color holographic lens to replace the currently used infinity optics systems (collimating lenses) was demonstrated. This technology provides substantial size and weight savings with no loss in image clarity. A wide field-of-view refractive optics system was also developed for large-cabin simulators. This system provides advances in refractive optics by reducing image and color distortion, and enlarging the viewing volume. Two noteworthy advances in image projection technology were also developed. A color liquid-crystal light-valve projector was completed and is serving as a demonstration of progress in light-valve projector technology. Two 2-inch breadboard demonstration projectors were completed which have higher resolution than the demonstration projector and offer multiple very high resolution moving targets. Each device illustrated a different approach to the light-valve projection concept for providing higher brightness and higher resolution displays. One projector was built around a solid-crystal light-valve while the other utilizes liquid-crystals. Development of both light valve projectors is continuing to improve brightness, resolution and target size. The preliminary design review for a new computer image generator was held and the designs approved. Mapping details of the Nellis AFB range were obtained for the Advanced Visual Technology System (AVTS) data base.

2. (U) FY 1982 Program: The electronics design of an advanced computer image generator will continue. This device will provide adequate visual scenes for training air-to-air and air-to-ground combat mission tasks in a flight simulator. A low level of effort will continue on the development of an advanced prototype light valve. Progress on the FY 1982 program has been delayed, due to a shortage of funding, causing Project 2363, the Advanced Visual Technology System (AVTS), to be stretched with many FY 1982 efforts being delayed until FY 1983.

3. (U) FY 1983 Planned Program: The critical design review of the computer image generator (CIG) program will be conducted. After the final designs are approved, the contractor will procure the necessary electronic hardware items and begin fabrication of special purpose visual image processors for the system. Many engineering design tasks and the order of long lead time hardware items have been delayed from FY 1982. Thus, in FY 1983, the contractor will require greatly increased funding in order to obtain all the required hardware items and expedite completion of the design engineering, fabrication and test of the first in plant prototype hardware. It will also be necessary to purchase and install at least ten current state-of-the-art light valves for single and dual (miniraster capable) light valve displays on the Advanced Simulator for Pilot Training (ASPT) so that the image generator can be installed on the ASPT as soon as it is completed in FY 1984. This will permit the rapid demonstration of the advanced CIG system and the conduct of training effectiveness research studies which are urgently required to define hardware requirements for operational trainers. The development effort will progress on the advanced solid crystal light valve projector which will be capable of higher resolution, high brightness, and multiple moving target presentations (electronic minirasters). In addition to the large simulator system AVTS development, a new project will be initiated to develop a Combat Mission Trainer (CMT) utilizing a helmet mounted visual display. The use of a helmet mounted display should produce a high quality visual scene which can be used in a transportable Combat Mission Trainer. This helmet-mounted display system should also have a lower cost than the large wide-angle visual displays used on current simulators. During this year the CMT computational system will be procured, a generic fighter cockpit constructed, and the design of the instructor-operator station completed.

Program Element: #63227F | Title: Advanced Simulator Technology
DoD Mission Area: Environmental and Life Sciences (ATD), #552 | Budget Activity: Advanced Technology Development, #2

4. (U) FY 1984 Planned Program: The development and manufacture of the Project 2363 computer image generator will be completed. The computer image generator will then be installed at AFHRL/OT and integrated with the light valves procured for its immediate installation and simulator utilization. The rapid installation and utilization of the computer image generator will enable AFHRL to conduct the initial training effectiveness studies. The results of these research studies are urgently required by the Simulator System Program Office, TAC and SAC before they make final procurement decisions on the visual system requirements for the Tactical (F-16, F-15, A-10) and Strategic (B-1B) Air Commands. The development of a prototype solid crystal light valve projector will progress towards completion in FY 1985. Software development for the Combat Mission Trainer (CMT) will be completed. The projectors for the helmet mounted display will be procured and the complete system integrated. The laboratory demonstration model of the fiber optic helmet mounted display will be completed, and training effectiveness research will be conducted in order to define the training system requirements for developing this laboratory demonstration system into a transportable CMT. The engineering design for the transportable CMT hardware will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

Project: #2363 Title: Advanced Visual Technology System
Program Element: #63227F Title: Advanced Simulator Technology
DoD Mission Area: Environmental and Life Sciences (ATD), #552 Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the development and installation of an advanced computer image generation system on the Advanced Simulator for Pilot Training (ASPT). The Advanced Visual Technology System (AVTS) represents a two-pronged approach to advancing the state-of-the-art in visual simulation technology and demonstrating the utility of this technology for critical Tactical Air Force (TAF) training requirements. One development prong will develop an advanced multi-channel (10 channels) computer image generation (CIG) system that will be capable of meeting all the TAF training requirements for scene detail and complexity. The other development prong will develop an advanced prototype light valve that will be capable of meeting all the TAF training requirements for visual display resolution, fine detailed target images (miniraster inserts), scene brightness and contrast. The combination of the advanced CIG and light valve displays will produce a research visual simulation system which is more than adequate to demonstrate and define the TAF simulator hardware training requirments. These simulator visual system requirements issues concern many CIG and display hardware parameters such as edge and circle feature density and utilization, surface texturing, point feature density, object spacing and utilization, general data base complexity and requirements, maximum range for cue generation, shadows and brightness gradients, planar versus non-planar terrain, edge smoothing, area(s) of interest implementation (for fine detail), visual field-of-view, color, contrast, display persistence, display resolution, geometric distortion, inter-channel mismatch, and disparities between visual displays and other cockpit displays (sensor, radar, etc.). Many of the CIG and some of the display hardware parameters can be investigated with current prototype state-of-the-art light valve displays. The AVTS CIG will be implemented as soon as possible with interim light valve displays and new display optics in order to obtain research answers to many of the parametric questions listed above as soon as possible. The advanced prototype light valve will be completed and units will be installed on the ASPT at a later date.

(U) RELATED ACTIVITIES: Same as the program element.

(U) WORK PERFORMED BY: Same as the program element.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Project 2363 is the only active project in FY 1981 and FY 1982.

1. (U) FY 1981 and Prior Accomplishments: This project was transferred to a different laboratory division in 1980 and restructured in July 1980. The 1981 and prior accomplishments are listed under the program element.

2. (U) FY 1982 Planned Program: Same as the program element.

3. (U) FY 1983 Planned Program: Covered under the program element.

4. (U) FY 1984 Planned Program: Covered under the program element.

Project: #2363 Title: Advanced Visual Technology System
Program Element: #63227F Title: Advanced Simulator Technology
DoD Mission Area: Environmental and Life Sciences (ATD), #552 Budget Activity: Advanced Technology Development, #2

5. (U) Program to Completion: The prototype advanced light valve display will be completed in FY 1985. When its development is completed and the accomplishment of the advanced design specifications have been demonstrated, production model light valves will be ordered and installed on the Advanced Simulator for Pilot Training (ASPT). The total replacement of the ASPT visual system displays, including spares, will occur over the FY 1985 through FY 1988 time period.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	3,163	2,192	8,889	6,841	8,000	35,213

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	3,170	2,192	4,500		3,773	19,443

The difference between the current and FY 1982 descriptive summary is due to two major factors. The first factor is increased costs due to program delay and stretch resulting from insufficient funding primarily in FY 1982. The original cost estimates were based upon completion of both the computer image generator and prototype light valve in FY 1983. Severe funding shortages in FY 1982 will delay the completion of the computer image generator until late in FY 1984 and the prototype light valve until FY 1985. The second major factor producing increased costs is the previous lack of accurate cost estimates for production copies of the prototype light valve projector. The projector development has now progressed to a point where cost estimates can be obtained. The early production model light valves and associated display hardware are estimated to cost $500K each. Fourteen light valve displays plus spares are required for both cockpits of the Advanced Simulator for Pilot Training. This light valve cost generated the $8,000K figure for "Additional to Completion." Program stretch costs are primarily reflected in FY 1983 and FY 1984. General inflationary increases also increased the outyear costs in the stretched program.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63231F
DOD Mission Area: Environmental and Life Sciences (ATD) #552

Title: Crew Systems Technology
Budget Activity: Advanced Technology Development #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT			4,055	3,905	Continuing	Not Applicable
2830	Advanced Life Support Systems			4,055	3,905	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Front line tactical aircraft have performance envelopes, mission tactics and laser threat which can easily overwhelm the life support systems needed to protect and sustain pilots. This program will provide the technology base development required to prove new concepts for protecting aircrew maneuvering under high gravitational forces (G-forces), rapid altitude changes, and eye exposure to lasers.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Existing aircrew life support equipment represent old design concepts gradually improved by incremental advances in materials and electronics. Integrated design concepts for maneuvering acceleration protection, altitude protection, and helmet/visual protection are not available. This program will develop and integrate several technology advances which offer significant increases in pilot protection and performance. These include uniform pressure suit G-protection to increase G-onset tolerance by 25 percent and maximum G-tolerance time by over 100 percent; on-board oxygen generation subsystems for two-man crews; and, development of laser protective eye shields against specific Warsaw Pact threats.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not applicable. This is an FY 1983 new start.

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Project: #2830
Program Element: #63231F
DOD Mission Area: Environmental and Life Sciences (ATD) #552

Title: Advanced Life Support Systems
Title: Crew Systems Technology
Budget Activity: Advanced Technology Development #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Existing fighter aircraft can sustain maneuvering gravitional forces greater than 7 G with onset rates grearer than 6 G per second, have altitude capabilities well above 50,000 feet, require excellent out-of-cockpit vision because of tactics, and require new aircrew protective concepts against unconventional weapons threats. Existing life support equipment represents old design concepts which have made the aircrew a limiting factor in total system performance, well below the performance capability of present day tactical aircraft. On-coming improvements in tactical aircraft technology will further widen the gap between aircraft and pilot capabilities. These improvements include increased maneuvering available from composite materials applications and higher thrust, lower weight turbine engines, unconventional maneuvering regimes being tested, increased use of laser designators, and more rapid turn-around capabilities afforded by various combat support and armament initiatives. Although life support technology has been relatively dormant for 10 years, recent exploratory advances in several technology areas offer considerable promise for future systems. Recent laboratory centrifuge experiments have demonstrated that uniform pressure g-protection, in combination with the Air Force High Flow Ready Pressure G-valve, can increase G-tolerance time by over 100 percent at high G-onset rates. Combinations of uniform pressure with upper body protection offer considerable promise to extend altitude protection above the 50,000 feet limit for fighter aircraft. Advances in materials technology indicate coated polycarbonates offer narrow band absorption of specific threat laser wave lengths without degrading the remaining spectrum needed for human vision. These promising technologies will be developed to the laboratory brassboard stage, and integrated to provide a demonstration article for human compatibility testing.

(U) RELATED ACTIVITIES: This program depends on technology development in the areas of materials and electronics conducted by other laboratories. Formal agreements with those laboratories are in effect. The transition organization for this program is the Aeronautical Systems Division, Life Support System Program Office. This program and all technology plans have been formally approved by the Aeronautical Systems Division. In addition, life support Research, Development, Test and Evaluation (RDT&E) activities of the three military services are coordinated through the Triservice RDT&E Steering Group reporting to the Joint Logistics Commanders. Laser protective technology is coordinated additionally through the Triservice Laser Hardened Materials and Structures Group, chaired by the Office of the Under Secretary of Defense for Research and Development.

(U) WORK PERFORMED BY: This program will be performed by the Aerospace Medical Division through its two laboratories, the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB OH, and the United States Air Force School of Aerospace Medicine, Brooks AFB TX. This program will be primarily contractual, but does not yet have a contract history

Project: #2830
Program Element: #63231F
DOD Mission Area: Environmental and Life Sciences (ATD) #552

Title: Advanced Life Support Systems
Title: Crew Systems Technology
Budget Activity: Advanced Technology Development #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable.

2. (U) FY 1982 Program: Not applicable.

3. (U) FY 1983 Planned Program: This program starts in FY 83. Initiation of an integrated life support ensemble will begin that is aimed to provide protection at a sustained vertical gravitational force of 9G, 60,000 feet altitude, and 50°C cockpit ambient temperatures. Development will begin on: an oxygen mask that will provide positive pressure breathing and be compatible with On-Board Oxygen Generation Systems; a dual port regulator for oxygen delivery, and pressure for anti-G protection and chest counter pressure; and, a multicrew oxygen generation system.

4. (U) FY 1984 Planned Program: Multiwavelength laser filter material will be demonstrated for helmet/visor integration. The uniform pressure G-suit, counterpressure garment, and liquid cooled garment will be in the final development stages. The integration laboratory will be completed and initial phase of ensemble integration will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63245F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Fighter Technology Integration (AFTI)
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	10,353	11,855	10,967	14,570	Continuing	Not applicable
2061	Fighter Attack Technology (AFTI/F-16)	3,500	6,000	5,657	4,200		
2568	Mission Adaptive Wing (AFTI/F-111)	6,853	5,855	5,210	2,699		
2682	STOL Fighter Technology			100	7,671		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will develop and demonstrate in flight, separately and in combination, advanced aeronautical technologies that can substantially enhance the combat potential and improve the survivability of our future military fighter/attack aircraft. The Digital Flight Control System and Automated Maneuvering Attack System (AMAS) technologies developed under PE 63205F, Flight Vehicle Technology, will be integrated and flight demonstrated on the F-16 testbed under project 2061 of this PE. Testing several technologies on the same test vehicle reduces costs and facilitates the integration of these technologies. Project 2568 will develop and demonstrate in flight the smooth skin variable camber Mission Adaptive Wing concept on an F-111 test vehicle. Project 2682 will develop Short Takeoff and Landing (STOL) applicable technologies addressing the need for future fighter aircraft to operate from damaged runways. The selection of candidate technologies for integration in the program is carefully weighed in each case to provide maximum benefit and mission relevance for the testbed demonstration aircraft.

(U) BASIS FOR FY 1983 RDT&E REQUEST: A new project, STOL Fighter Technology (previously Advanced Survivable Fighter Technology), is planned to start in FY 1983. This project will develop a thrust vectoring/thrust reversing two dimensional nozzle, rough/soft field landing gear system and other STOL (Short Takeoff and Landing) related technology options for future STOL fighter aircraft. The program addresses the serious runway denial problem facing future tactical aircraft at forward bases. The Mission Adaptive Wing program will accomplish flight testing of the manually controlled wing to determine optimum wing camber settings for efficient operation in a wide variety of flight envelopes. Flight testing of the Advanced Fighter Technology Integration F-16 equipped with a Digital Flight Control system and forward canards providing independent six degree-of-freedom flight control will be completed in FY 1983. The Digital Flight Control system provides a selection of task-tailored control laws for optimum aircraft performance in a variety of missions. The aircraft will then be modified with the Automated Maneuvering Attack System (formerly known as the Integrated Flight/Fire Control III system) to demonstrate enhanced combat effectiveness and greater survivability.

Program Element: #63245F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Fighter Technology Integration (AFTI)
Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT	10,400	12,100	12,900		Continuing	Not applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63245F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Fighter Technology Integration (AFTI)
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Exploratory development efforts performed during past years have identified a number of promising aeronautical technologies that offer large improvements in capability and survivability over current fighter systems. In order to provide systems developers the assurance needed to build tactical combat aircraft using these advanced technologies, it is necessary that they first be validated in flight. The Advanced Fighter Technology Integration (AFTI) program will develop and demonstrate in flight selected technologies identified in these exploratory development efforts. These technologies include independent six degree-of-freedom control coupled with the versatile Digital Flight Control System, an Integrated Flight/Fire Control system coupled with a Forward Looking Infrared (FLIR) sensor/tracker, an advanced pilot/vehicle interface to reduce pilot workload and a smooth skin variable camber wing (Mission Adaptive Wing) for mission versatility. Thrust vectoring, advanced high lift systems, and other technologies applicable to Short Takeoff and Landing concepts will be developed and validated in this program.

(U) RELATED ACTIVITIES: This program is using the Advanced Fighter Technology Integration (AFTI) F-16 test vehicle to test the Digital Flight Control System and Automated Maneuvering Attack System technologies developed under PE 63205F, Flight Vehicle Technology. This program will also flight validate the integrated flight/propulsion control system and pilot/vehicle interface for Short Takeoff and Landing (STOL) mode operation being developed under PE 63205F. The AFTI program is related to PE 63230F, Advanced Tactical Fighter. The AFTI program develops and validates technology items on a demonstrator aircraft which will then be available for incorporation in the design of the Advanced Tactical Fighter. The AFTI program is a joint program with the National Aeronautics and Space Administration and is managed under an approved Memorandum of Understanding. The Digital Flight Control System development in project 2061 is jointly funded by the Navy.

(U) WORK PERFORMED BY: This program is managed by the Air Force Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. Contractors are General Dynamics Corporation, Ft. Worth, TX for project 2061; and The Boeing Company, Seattle, WA for project 2568. Flight testing for both projects will be performed jointly by Dryden Flight Test Center and the Air Force Flight Test Center at Edwards Air Force Base, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Software development for the Advanced Fighter Technology Integration F-16 test vehicle equipped with the Digital Flight Control System, direct side force and direct lift control, and weapon line pointing features continued throughout FY 1981. The flight test scheduled for late FY 1981 and reported in the FY 1982 RDT&E Descriptive Summary was postponed due to software integration problems incurred during the verification and validation testing leading to first flight. Verification and validation has now resumed and first flight has been rescheduled for mid-FY 1982. Fabrication of the variable camber Mission Adaptive Wing for the F-111 testbed aircraft began on schedule in mid-FY 1981.

2. (U) FY 1982 Planned Program: Complete integration and begin flight validation of the Digital Flight Control System and independent six degree-of-freedom control capability on the F-16 test vehicle. The new project, STOL Fighter Technology (formerly known as Advanced Survivable Fighter Technology), which was described as a FY 1982 start in the FY 1982 RDT&E Descriptive Summary has been postponed to a late FY 1983 start. Reduction in FY 1983 funds (also

described under the FY 1983 Planned Program) precluded funding STOL Fighter Technology throughout FY 1983 and forced cancellation of the planned FY 1982 start. First flight of the Mission Adaptive Wing has been postponed from late FY 1982 to early FY 1983 due to (1) an under estimate of the time required for safety of flight reviews prior to first flight and (2) earlier incorporation of the Automatic Flight Control System hardware for the second phase of flight testing.

3. (U) FY 1983 Planned Program: The STOL Fighter Technology program (previously Advanced Survivable Fighter Technology) will begin in late FY 1983. This program will integrate a two dimensional thrust vectoring/reversing nozzle, an advanced high lift system, and rough/soft field landing gear on a selected testbed aircraft. The program is intended to address the runway denial threat posed by enemy attack of our forward located air bases. A 50 perent reduction in takeoff distance and 80 percent reduction in landing distance will be demonstrated with no decrease in range or payload over current fighter aircraft. The Mission Adaptive Wing will begin flight validation on the F-111 testbed in early FY 1983. The Mission Adaptive Wing flight test program will be accomplished in two phases. Phase I will require in-flight manual setting of the wing camber which will determine optimum camber settings for a wide range of flight conditions. Phase II will add an Automated Flight Control System to allow automatic and instantaneous control of wing camber for gust alleviation and maneuver load control. Maneuver load control provides increased maneuverability by shifting wing bending moments inboard. Phase II flight testing is scheduled to begin in late FY 1983. The Automated Maneuvering Attack System (AMAS) flight demonstration on the F-16 test vehicle will begin in late FY 1983. AMAS was designated the Integrated Flight/ Fire Control III system in the FY 1982 RDT&E Descriptive Summary. AMAS adds an Integrated Flight/Fire Control system, a Forward Looking Infrared (FLIR) sensor/tracker conformally mounted in the right wing strake, a helmet mounted sight, and a Standard Avionics Integrated Fuze (SAIF) system to the F-16 vehicle which is already modified with a Digital Flight Control System providing independent six degree-of-freedom control capability. Integration of the AMAS technologies on the F-16 vehicle provides a critical demonstration of technologies leading to single seat, night, under weather, automated maneuvering attack. The SAIF development provides the capability for in-flight selection of the optimum dispersal pattern for wide area munitions. Flight validation of the Digital Flight Control System on the F-16 vehicle will complete in mid-FY 1983. The reduction in FY 1983 funds from the FY 1982 Descriptive Summary estimate resulted in delaying initiation of the STOL Fighter Technology program from late FY 1982 to late FY 1983.

4. (U) FY 1984 Planned Program: Continue the Automated Maneuvering Attack System flight test on the F-16 vehicle throughout FY 1984 with completion in early FY 1985. Continue the STOL Fighter Technology design and analysis throughout FY 1984. Complete the flight validation of the Mission Adaptive Wing equipped with the Automatic Flight Control System in late FY 1984.

5. (U) Program to Completion: This is a continuing technology base program.

6. (U) Milestones: Not applicable.

Project: #2061 Title: Fighter Attack Technology (AFTI/F-16)
Program Element: #63245F Title: Advanced Fighter Technology Integration (AFTI)
DOD Mission Area: Engineering Technology (ATD), #553 Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops and demonstrates in flight new aeronautical technologies offering improvements in combat effectiveness and survivability over current fighter aircraft. The program demonstrates these technologies, both separately and in combination, on the Advanced Fighter Technology Integration F-16 test vehicle. Technologies to be demonstrated include direct side force control, direct lift control and weapon line pointing using a Digital Flight Control System integrated with a forward canard. This system gives the aircraft independent six degree-of-freedom control capability for increased maneuverability. The Digital Flight Control System also allows selection of task-tailored flight control laws providing optimized aircraft performance for air-to-air combat, bombing, and evasive maneuver. Other technologies to be integrated and flight tested on the same aircraft include advanced pilot displays and the Automated Maneuvering Attack System (AMAS) linking the fire control system to the flight control system of the aircraft. AMAS will enable the aircraft to strike a target without direct overflight and will increase the firing opportunity envelope in air-to-air combat. AMAS will show a multiple improvement in survivability against all threats while maintaining conventional delivery accuracies.

(U) RELATED ACTIVITIES: Project 2061 flight tests technologies developed under PE 63205F, Flight Vehicle Technology, project 2506, Control of Flight. Project 2061 is a joint project with both the National Aeronautics and Space Administration and with the Navy. The integration of the Standard Avionics Integrated Fuze (SAIF) is a joint effort with the Air Force Armament Laboratory, Eglin Air Force Base, FL under PE 63601F, Conventional Weapons.

(U) WORK PERFORMED BY: This program is managed by the Air Force Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. The prime contractor for project 2061 is General Dynamics Corporation, Ft. Worth, TX. Flight testing will be performed at Dryden Flight Test Center as part of a joint flight test organization with the Air Force Flight Test Center, Edwards Air Force Base, CA under an approved Statement of Capability.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Fabrication and modification of the F-16 test vehicle equipped with Digital Flight Control System and advanced pilot/vehicle control and display functions were completed in FY 1981. First flight, scheduled in mid-FY 1982 awaits only the integration of the software that controls the Digital Flight Control System. The Automated Maneuvering Attack System (previously the Integrated Flight/Fire Control III system) continued in the design and analysis phase through FY 1981.

2. (U) FY 1982 Program: Begin the flight validation of the Digital Flight Control System on the F-16 test vehicle. Begin software development and fabrication of the Automated Maneuvering Attack System (AMAS). The Preliminary Design Review for the AMAS system was held in Dec 81.

3. (U) FY 1983 Planned Program: Begin flight validation of the AMAS technologies on the F-16 test vehicle in late FY 1983. Complete flight validation of the Digital Flight Control System on the F-16 vehicle in mid-FY 1983. The increase in FY 1983 funds for the project as compared to the estimate in the FY 1982 RDT&E Descriptive Summary reflects a more complex software integration task than originally planned for the Digital Flight Control System and a resulting six month delay in first flight.

Project: #2061 Title: Fighter Attack Technology (AFTI/F-16)
Program Element: #63245F Title: Advanced Fighter Technology Integration (AFTI)
DOD Mission Area: Engineering Technology (ATD), #553 Budget Activity: Advanced Technology Development, #2

4. (U) FY 1984 Planned Program: Continue flight validation of the Automated Maneuvering Attack System and evaluation at the Nellis test range throughout FY 1984.

5. (U) Program to Completion: This is a continuing technology base program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	3,500	6,000	5,657	4,200	Continuing	Not applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E Funds	3,500	6,000	4,700		Continuing	Not applicable

Increase in FY 1983 funds due to six month delay in first flight of the F-16 test vehicle because of software integration problems.

Project: #2568
Program Element: #63245F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Mission Adaptive Wing (AFTI/F-111)
Title: Advanced Fighter Technology Integration (AFTI)
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This project will develop a smooth skin variable camber wing system and flight test the system on an F-111 test aircraft. The wing box on the transonic aircraft technology F-111 test vehicle will be fitted with the variable camber leading and trailing edge wing system. The wing camber may be tailored in flight to achieve peak aerodynamic efficiency for a variety of missions. The development will increase aircraft range and maneuverability and is applicable to fighters, fighter bombers, strategic bombers and possibly airlift aircraft. Initial flight testing will evaluate characteristics of a manual variable camber control system. An automatic flight control system to vary camber as a function of flight condition is being developed and will be evaluated after the manual system trials.

(U) RELATED ACTIVITIES: Project 2568 is a joint program with the National Aeronautics and Space Administration and is managed by a signed Memorandum of Understanding.

(U) WORK PERFORMED BY: This program is managed by the Air Force Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. The contractor is the Boeing Company, Seattle, WA. Flight testing will be performed jointly by Dryden Flight Test Center and Air Force Flight Test Center at Edwards Air Force Base, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Fabrication of the variable camber Mission Adaptive Wing began in mid-FY 1981. The supercritical wing box of the transonic aircraft technology F-111 No. 13 will be modified and the variable camber leading and trailing wing edges will be installed. Preliminary design review of the Automatic Flight Control System was held in mid-FY 1981. Wind tunnel tests on the wing were completed in early FY 1981. Detail design of the manually controlled wing has been completed.

2. (U) FY 1982 Program: Design of the Automatic Flight Control System for the Mission Adaptive wing will continue through FY 1982. Fabrication of the manually controlled wing will be complete in FY 1982 leading to first flight in Dec 82. This flight test has been delayed three months from the date presented in the FY 1982 RDT&E Descriptive Summary due to (1) an under estimate of the time required for safety of flight reviews prior to first flight and (2) earlier incorporation of the Automatic Flight Control System hardware for the second phase of flight testing.

3. (U) FY 1983 Planned Program: Flight validation of the manually controlled Mission Adaptive Wing begins in early FY 1983 and ends in late FY 1983.

4. (U) FY 1984 Planned Program: Flight validation of the automatically controlled Mission Adaptive Wing begins in early FY 1984 and continues throughout the year. The flight test of the automatically controlled system will demonstrate the full potential of the Mission Adaptive Wing for providing increased range/fuel economy, an expanded flight envelope, enhanced maneuverability (tighter turns and direct lift capability), and gust alleviation.

Project: #2568 Title: Mission Adaptive Wing (AFTI/F-111)
Program Element: #63245F Title: Advanced Fighter Technology Integration (AFTI)
DOD Mission Area: Engineering Technology (ATD), #553 Budget Activity: Advanced Technology Development, #2

5. (U) Program to Completion: This is a continuing technology base program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	6,853	5,855	5,210	2,699	Continuing	Not applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E Funds	6,900	6,000	5,300		Continuing	Not applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63250F | Title: Lincoln Laboratory
DOD Mission Area: Electronic & Physical Sciences (ATD), #551 | Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	22,452	22,117	23,079	25,898	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Lincoln Laboratory Program is a high technology research and development effort conducted through the provisions of a cost reimbursement contract with Massachusetts Institute of Technology. Lincoln Laboratory is operated as a Federal Contract Research Center with manpower control administered by the Department of Defense. The fundamental objective is to maintain a stable technology base in advanced electronics from which military systems may be developed. Utilizing this advanced electronics base, Lincoln actively engages in advanced research, primarily in the area of satellite communications, tactical technology, space surveillance, and radar techniques. Lincoln also provides technical advice and consultation to the military services and defense agencies.

(U) BASIS FOR 1983 RDT&E REQUEST: This request will provide funds for a highly professional staff required to develop and maintain an advanced electronics technology base and conduct advanced research essential to national defense. Satellite communications technology development is planned and is directed toward support of future strategic and tactical satellite communications systems. Space object surveillance and identification technology development and system support efforts are planned to be continued. Research in radar techniques and development of radar system trade-offs is also planned. Budget estimates are based on manpower and material costs for similar, completed projects.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	21,500	22,600	24,100		Continuing	Not Applicable
Procurement	Not Applicable					

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63250F Title: Lincoln Laboratory
DOD Mission Area: Electronic & Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Lincoln Laboratory was established in 1951 by the Air Force with participation by other agencies of the Department of Defense. The primary mission is to conduct research and development pertinent to national defense, with particular emphasis on advanced electronics. The Lincoln program extends from fundamental investigations in science through the development of electronic devices and components to the design, development, and field demonstration of conceptual models containing the new technology. Lincoln actively engages in advanced research, primarily in the areas of satellite communications, tactical technology, space object surveillance and identification, and radar techniques. Lincoln also provides technical advice and consultation to the military services and defense agencies.

In order to provide policy and program guidance to the management of Lincoln Laboratory, a Joint Advisory Committee has been established. The Commander, Air Force Systems Command, is the Chairman; the Director, Defense Advanced Research Projects Agency, a senior officer from the Army and a senior officer from the Navy are members. The Committee is supported by an Executive Group chaired by the Director of Sciences and Technology, Air Force Systems Command, with members from the Army, Navy, Defense Advanced Research Projects Agency and Defense Communications Agency.

(U) RELATED ACTIVITIES: Additional efforts are planned to be funded by the following respective program elements. Re-Entry Systems, 63311F; Military Satellite Communications, 33601F and 63431F; Ground Electro-Optical Deep Space Surveillance, 63428F and 12424F; Space Object Identification, 31310F, 31022F, and 31015F; Strike and Weapons Guidance, 62702F and 63601F; C^3 Countermeasures, 62702F and 63601F; IFF, 63742F; Airborne Countermeasures, 64738F; Speech Technology, 33401F, 27417F, and 28010F; Multi dimensional Signal Precessing, 62702F.

(U) WORK PERFORMED BY: Lincoln Laboratory, Lexington, MA, is operated as a special laboratory of the Massachusetts Institute of Technology under contract with the Air Force and is designated a Federal Contract Research Center. General policy and program guidance is provided by the Joint Advisory Committee in accordance with the provisions of the Departmen of Defense Plan for Administration of Lincoln Laboratory, dated 27 May 1975.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Lincoln Laboratory's significant accomplishments include: design of the Semi-Automatic Ground Environment (SAGE) System; development of the Distant Early Warning (DEW) Line and Ballistic Missile Early Warning System (BMEWS) radar technology; design of foliage penetration Moving Target Indicator radars; development and testing of penetration aids for ballistic missile re-entry systems; development and fabrication of Lincoln Experimental Terminals (LET-1 through LET-4) and a series of Lincoln Experimental Satellites (LES-1 through LES-9), including the successful launch of LES-8 and LES-9 which demonstrated advanced military communications technology and system capabilities; the continued development of solid state technology and data systems which have supported the other major programs conducted by Lincoln Laboratory; a study of the use of a Microwave Landing Guidance System for air traffic control; and the development and demonstration of a Lincoln Training System designed to facilitate self-instruction of technical subjects with a potential reduction in the cost of technical training.

Program Element: #63250F Title: Lincoln Laboratory
DOD Mission Area: Electronic & Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

2. (U) FY 1982 Program: Lincoln is continuing efforts in the advanced electronics research area on electro-optical devices such as tunable infrared lasers, infrared imaging devices and high speed photodiode detectors and integrated optical circuits. A submicrometer technology effort is devoted to exploring x-ray lithography techniques for fabricating advanced solid state devices having dimensions well below 1 micron. Research is also continuing on microwave devices involving both semi-conductor and surface acoustic wave devices, microelectronics and digital integrated circuits for use in such areas as radar signal analysis, speech processing and satellite communications systems. The satellite communication program is developing the technology to permit more effective military communications systems. The current efforts are directed toward a survivable communications technology and on the conceptual design of a general purpose military satellite system. The guidance and control of air-to-surface weapons against mobile targets in a high-threat environment is being investigated. Support to the Ground Electro-Optical Deep Space Surveillance Program and development of advanced electro-optical camera and star/satellite processors will continue.

3. (U) FY 1983 Planned Program: The Laboratory's advanced electronics effort will continue to provide a technology base that supports mission programs and includes advanced development in digital integrated circuits and solid state areas such as electro-optical semiconductor devices, quantum electronics, surface acoustic wave devices, microwave semiconductor devices and microelectronics. The x-ray lithography techniques for fabricating advanced electronic devices will be continued, as will infrared laser and infrared detector investigations. Technology development will be continued in support of future satellite communications systems.

4. (U) FY 1984 Planned Program: The advanced electronics technology base efforts in solid state electronics and digital electronics will continue. Satellite communications technology will continue in support of strategic and general purpose satellite communications systems. The tactical technology program will be continued. Advanced radar techniques and technology transfer to developing programs is also planned.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63253F Title: Advance System Integration Demonstrations (PAVE PILLAR)
DoD Mission Area: Electronics and Physical Sciences, #551 Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING)($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	-	6,774	16,421	34,566	Continuing	Not Applicable
2734	Advanced System Avionics (ASA)	-	5,080	10,288	16,918	Continuing	Not Applicable
2735	Integrated Flight Demonstrator (IFD)	-	94	1,484	4,838	Continuing	Not Applicable
2538	Integrated Communication-Navigation-Identification Avionics (ICNIA)	587*	1,600	4,649	12,810	43,600	63,248

*Project 2538 was transferred from Program Element 63727F, effective in FY 1982.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Current avionics systems are major contributors to inadequate weapon system reliability and represent a substantial and increasing fraction of aircraft acquisition and support costs. The PAVE PILLAR program will exploit a number of recent innovations in systems architecture, semiconductor technology, computer standardization, and computer software to integrate and automate avionics functions for advanced aircraft. Objectives include operational performance improvements, very high mission reliability, fault tolerance, substantial reductions in both acquisition and support costs and reduction of crew workload in dense threat environments.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Provides funds to:

(U) Initiate dual development contracts for brassboard integrated airborne radio subsystems based on system definition work completed in FY 1982.

(U) Define compatible extensions to the current baseline avionics architecture to allow incorporation of advanced concepts involving programmable color displays, high speed fiber optic multiplex busses, fault tolerant computer architectures, and software written in Ada, the DoD standard high order computer programming language.

(U) Continue design and integration studies of testbed aircraft suitable for low cost flight testing of integrated avionics systems. Cost estimates are based on historical data from other advanced development programs.

Program Element: #63253F   Title: Advanced System Integration Demonstrations (PAVE PILLAR)
DoD Mission Area: Electronics and Physical Sciences, #551   Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	600	6,900	25,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force is conducting a concerted engineering and management effort to contain the rising cost, complexity, and proliferation of airborne electronic equipment (avionics) through a comprehensive program of avionics planning, standardization, and control. Toward this end, AFR 800-28 which outlines new policies on acquisition and support, was published in September 1978. A Deputy for Avionics Control has been established to carry out avionics policy as stated in AFR 800-28. The thrust of this effort is directed toward application of a family of standard architectures to avionics systems in order to enhance responsiveness to new threats and thereby improve capability and survivability. The standard architectures will be based upon the concept of common, shared resources which are transferable across aircraft types and missions. An early attempt at such an architecture was the concept successfully demonstrated under Program Element 63243F, Digital Avionics Information System. The Digital Avionics Information System utilized a "core" avionics approach in which all on-board avionics shared common processing resources, a common multiplex data bus, a common set of controls and displays, and, in some cases, common software programs. The system was designed in such a way that modules related to a given avionic function can be removed, updated and replaced without altering the function of other on-board subsystems. Under such a concept, retrofit becomes much less difficult and substantially less expensive since the manhours required to install a retrofit system can be reduced by as much as 90 percent. Evolving from the Digital Avionics Information System program were: MIL-STD-1750A, the Air Force Standard 16-bit Computer Instruction Set Architecture; MIL-STD-1589B, the Air Force Standard Higher Order Language (J73); and MIL-STD-1553B, the Department of Defense Multiplex Data Bus Standard. These three standards form the architectural basis for all avionics development and retrofit programs. Starting in FY 1982 the PAVE PILLAR Program, will address future functional integration employing a maximum of commonality and standardization. The avionics community has accepted the fact that the only cost effective approach to our present-day problems of proliferation, nonstandardization and unacceptable mission reliability of avionics systems is increased functional integration. All electronic subsystems on board the aircraft must be effectively tied together to operate as a system. The PAVE PILLAR Program contains three projects: 1. Advanced System Avionics (ASA), 2. Integrated Communications, Navigation, Identification Avionics (ICNIA), and 3. Integrated Flight Demonstrator (IFD). The ASA project will define an avionics system architecture which is suitable for the next generation aircraft yet possesses the backward compatibility features necessary to assure that advanced technology avionics subsystems (i.e., those designed for a next generation aircraft) can be used to upgrade existing aircraft through low cost retrofits. As part of this project the existing Avionics Simulation and Integration Laboratory (AVSAIL) will be substantially upgraded with new computers and simulation/support hardware and software. This project will also provide an early opportunity to apply the Ada high order computer programming language to avionics applications prior to its use on engineering development programs as a risk reduction effort (i.e., learning what not to do). In

Program Element: #63253F Title: Advanced System Integration Demonstrations (PAVE PILLAR)
DoD Mission Area: Electronics and Physical Sciences, #551 Budget Activity: Advanced Technology Development, #2

order to stay closely coupled to the operational needs of the Air Force, the ASA project will investigate application of the Very High Speed Integrated Circuit (VHSIC) technology to avionics incorporating the high reliability and graceful degradation characteristics necessary for routine operations at night and in weather. The ICNIA project will explore two technological approaches to providing a flexible integrated airborne radio terminal. This compact multifunction communication, navigation, identification system is designed to provide the interface between radio frequency signals in the atmosphere and the internal information needs of the avionics system. It will have the potential for waveform flexibility and rapid low cost modification to meet a changing threat. The IFD project will provide an airborne testbed for developmental avionics systems. The test aircraft will be equipped with the baseline core avionics systems found in the current aircraft and instrumentation adequate to support data collection on new (breadboard or brassboard) avionics subsystems. The architecture will be that developed by the Advanced System Avionics project. The combination of an advanced ground based simulation/integration laboratory and a compatible testbed aircraft will provide for avionics the same opportunity to learn from low cost testing that wind tunnels provide for the engine and airframe communities. Additional projects involving cockpit design, electronic warfare, flight control, stores management and propulsion systems will be added in the future.

(U) RELATED ACTIVITIES: Exploratory and advanced development projects in various functional area Program Elements (for example: PE62204F, Aerospace Avionics; PE63203F, Advanced Avionics for Aircraft; PE63245F, Advanced Fighter Technology Integration; PF63205F, Flight Vehicle Technology; PE63718F, Electronic Warfare Technology; PE63601F, Conventional Weapons; PE63103F, Advanced Airborne Radar Development; and PE63202F, Advanced Propulsion System Integration) will be using the architecture developed under this Program Element as a baseline for future subsystem developments. The Integrated Flight Demonstrator project will provide the flight vehicle for many of the projects in PE62204F, Aerospace Avionics, and 63203F, Advanced Avionics for Aircraft. PE63226F, DoD Common Programming Language (Ada) Advanced Development, will develop multiservice Ada support software, PE63728F, Advanced Computer Technology, will develop Air Force unique Ada support software, and this Program Element will use the software products developed under these other program and apply them to avionics related software developments. Technology developed under PE63452F, Very High Speed Integrated Circuits, will be applied to meet needs for high speed avionics computers and signal processors. Support equipment interface and avionics equipment testability requirements will be defined under PE64247F, Modular Automatic Test Equipment. PE64201F, Aircraft Avionics Equipment Development, will provide feedback on the utility of proposed interface standards, review project activities for potential application to ongoing full scale development programs, and provide standard subsystems for use in both the ground integration laboratory and in the Integrated Flight Demonstrator. PE63253F is reviewed annually by the Air Force standing panel on avionics standardization and by the Joint Service Review Committee on Avionics Subsystems and Components for conflict with other programs and for opportunities to increase standardization.

(U) WORK PERFORMED BY: The work will be managed by the Air Force Wright Aeronautical Laboratories, at Wright-Patterson Air Force Base, OH, with the Avionics Laboratory serving as lead laboratory. System definition contractors for the Integrated Communication, Navigation, Identification Avionics project are TRW, Inc., San Diego, CA, and ITT Avionics Division, Nutley, NJ.

Program Element: #63253F Title: Advanced System Integration Demonstrations (PAVE PILLAR)
DoD Mission Area: Electronics and Physical Sciences, #551 Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: This Program is a FY 1982 new start. The baseline architecture and standards were provided by efforts completed under PE63243F, Digital Avionics Information System, and PE64219F, Integrated Digital Avionics. PE63727F, Advanced Communication Technology, has provided the preliminary efforts required for the initiation of the ICNIA Project. PE 62204F, Aerospace Avionics, has contributed several efforts such as Integrated Head-Up Display, Airborne Electronic Terrain Map System, MIL-STD-1750A Instruction Set Architecture Studies, Multibus Avionics Architecture Studies, Integrated Test and Maintenance Studies, and Flight Test Definition Studies. Dual award system definition contracts were awarded by ICNIA to TRW, San Diego, CA and ITT, Nutley, NJ. The ICNIA Evaluation Testbed definition was accomplished by TRW, Dayton, Ohio.

2. (U) FY 1982 Planned Program: The System Definition contracts and the Evaluation Facility Definition contract in the ICNIA Project will be completed. A contract for the design, fabrication, and integration of the ICNIA Evaluation facility will be awarded. The ASA project will initiate design of the enhanced system integration laboratory and definition the advanced avionics system architecture. The Integrated Flight Demonstrator project will define flight test instrumentation requirements in conjunction with defining the interfaces between the core avionics subsystems to be used in test aircraft.

3. (U) FY 1983 Planned Program: The ICNIA Project will proceed with dual award contracts for the design, fabrication and integration of the ICNIA subsystem. The ASA Project will design an advanced crew station for the integration laboratory, and begin development of hardware and software necessary to demonstrate the advanced avionics architecture in realistic simulated mission environment. FY 1983 budget request has been reduced from that projected in the FY 1982 Descriptive Summary to fund higher priority programs.

4. (U) FY 1984 Planned Program: Initial laboratory demonstration of the advanced avionics architecture will be accomplished. The aircraft to be used as the Integrated Flight Demonstrator will be selected and modification design will be started. Detailed design of the ICNIA terminals will be completed and fabrication of long lead parts will begin.

5. (U) Program to Completion: This is a continuing program. PAVE PILLAR provides a foundation of facilities and organizational expertise for evolving new architectural concepts, developing interface standards, and integrating advanced avionics into the systems of today and tomorrow. It will allow early, low cost assessments of advanced avionics concepts through a combination of laboratory simulations and flexible flight testing.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

Project: #2734 | Title: Advanced System Avionics
Program Element: #63253F | Title: Advanced System Integration Demonstrations (PAVE PILLAR)
DoD Mission Area: Electronics and Physical Sciences, #2734 | Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Historically, in aircraft systems, only avionics and weapons change over the life of the airframe. While we may make some structural modifications to improve aerodynamics or increase structural life, we have not rebuilt airframes with the kind of revolutionary change that we have incorporated into avionics improvement programs. We make component improvements in engines and we may even change the engines on the KC-135 to improve fuel efficiency, but these changes do not match in scale the changes that we have made in the weapons that our fighter and bomber aircraft must carry. As a matter of course, the avionics and weapons on a given aircraft are in almost continuous change, and it is these changes that maintain the basic capability of the system. In order to allow rapid change at low cost the Air Force has adopted as Military Standards key avionics and weapons interfaces, thereby defining a baseline avionics architecture. Because of the dynamic nature of avionics technology, the Air Force will be faced with decisions over the next few years on when to depart from the use of existing standards to get the benefits of advanced technology. In the absence of an advanced avionics architecture which allows technology to be applied to both existing and future aircraft, continued high retrofit cost and reduced capability for older aircraft are inescapable. The PAVE PILLAR program was established to provide the necessary groundwork so that advanced avionics technology can be applied to existing aircraft as retrofits, and to new aircraft as initial equipment while reducing development and modification costs. The Advanced System Avionics project will develop the advanced avionics architecture and provide the laboratory capability to assure that advanced subsystem developments are compatible with the advanced architecture. The modest investment to be made in equipping a laboratory to allow low cost integration and testing of avionics subsystems will provide a missing link in the avionics development process: an inexpensive way to find out what not to do during full scale development. This is exactly the function provided by our multibillion dollar investment in aerodynamic wind-tunnel and propulsion test facilities, and one not available within the avionics research and development community.

(U) RELATED ACTIVITIES: Exploratory and advanced development projects in PE 62204F, Aerospace Avionics, and PE 63203F, Advanced Avionics for Aircraft, will use the ground integration laboratory developed within this project. PE 63226F, DoD Common Programming Language (Ada) Advanced Development, and PE 63728F, Advanced Computer Technology, will provide Ada support software products for use by this project for application to avionics related software developments.

(U) WORK PERFORMED BY: The project will be managed by the Wright Aeronautical Laboratories, Avionics Laboratory, Wright-Patterson AFB, OH.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PLANS:

1. (U) FY 1981 and Prior Accomplishments: This project is a FY 1982 new start.

2. (U) FY 1982 Program: The project will: initiate dual award contracts to determine baseline system integration requirements for automating the information management processes associated with offensive, defensive, and vehicle control subsystems; start design of an upgraded system integration/simulation laboratory; start design of an Ada based software executive for avionics applications.

Project: #2734 Title: Advanced System Avionics
Program Element: #63253F Title: Advanced System Integration Demonstrations (PAVE PILLAR)
DoD Mission Area: Electronics and Physical Sciences, #2734 Budget Activity: Advanced Technology Development, #2

3. (U) FY 1983 Planned Program: The Advanced System Avionics project will expand its activities supporting the simulation/integration laboratory upgrade with configuration definition of an advanced crew station and development of a terrain data base. Implementation of a potential new standard high data rate multiplex bus will be initiated along with development of the fiber optic components, tooling, and techniques necessary to implement the fiber optic option in MIL-STD-1760, the Aircraft-to-Store Electrical Interface. The advanced architecture design effort will continue along with development of architecture validation hardware and software.

4. (U) FY 1984 Planned Program: The growing capability of the simulation/integration laboratory will be used to begin evaluation of the advanced avionics architecture. A MIL-STD-1760 interface will be tested with fiber optics installed to determine tolerance to environmental stress. Initial guidelines will be published for using Ada in avionics applications.

5. (U) Program to Completion: This is a continuing project.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63259F
DOD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Cartographic Applications
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT			890	2,345	7,000	10,235
2810	Digital Mapping and Charting Technology			890	2,345	7,000	10,235

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will provide direct support to Air Force users and developers of tactical and strategic systems which are dependent upon, or whose performance can be enhanced through the use of digital cartographic data. This support will be in the form of functional applications software, digital data format specifications and identification of data content requirements for specific systems/functions. This program will provide the technology tools to specify digital cartographic data requirements for multi-system requirements, provide the software to perform system unique functions employing digital cartographic data, and will allow for the demonstration of various functional applications in a cost effective environment prior to transitioning resulting technology to the operational user.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This new start program will tie together various unique exploratory development technologies utilized in handling digital cartographic data and develop them into a set of manipulative tools (mainly software, such as data base management packages). This software will be used on a dedicated hardware package consisting of a small computer (VAX 11780 possibly), disc storage, and interactive analysts terminals. This capability will be developed over a five-year period leading to demonstration of a flexible environment which can be used by weapon system developers during the design stage to work "off line" with the digitized cartographic data. The technical interface between weapons developers and cartographic data producers will be greatly improved and will result in faster systems development by putting the right tools in the engineer's hands.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable. This program is an FY 1983 new start.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Project: #2810
Program Element: #63259F
DOD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Digital Mapping and Charting Technology
Title: Cartographic Applications
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Numerous tactical and strategic systems are being transitioned into the operational Air Force inventory that either do or will depend to a large extent upon digital cartographic information to enable the system to function as planned. No capability exists in the Air Force for systematically conducting experimentation and comparative analysis of the various technologies involved in the application of digital cartographic information to a broad spectrum of Air Force tactical and strategic system requirements. Historically, the application of technology to Air Force requirements for the use of digital cartographic data has been accomplished as isolated subtasks under major system development contracts. This has presented several significant problems for the Air Force. First, it has resulted in the unnecessary proliferation of system dependent data bases having little or no functional applications or utility by other Air Force systems because of the manner in which requirements were stated. Second, Air Force systems have failed to take full advantage of the potential offered by digital cartographic data. And third, the Air Force has not been afforded the opportunity to consolidate system requirements, to implement cost effective organic data bases and to reduce production costs or lead times. With the ever increasing demand being placed on the Defense Mapping Agency (DMA) for digital cartographic data, the Air Force must stop competing with itself for limited DMA production capabilities. This program will provide the technology development to build a flexible set of tools to be used by weapon system designers dealing with cartographic data so optimum use can be made of existing data bases and so optimum operational advantages will be gained by incorporating digital cartographic technology in new weapon designs.

(U) RELATED ACTIVITIES: Supporting exploratory development activities are conducted in PE 62702F, Command and Control Communications (C^3). Other related work is on-going in PE 63701B, Mapping and Charting, and PE 64701B, DMA Mapping, Charting and Geodessy.

(U) WORK PERFORMED BY: In-house efforts and contract monitoring will be done at the Rome Air Development Center, Griffiss AFB, NY.

(U) PROGRAM ACOCMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable. FY 1983 New Start.

2. (U) FY 1982 Program: Not Applicable. FY 1983 New Start.

3. (U) FY 1983 Planned Program: Based on exploratory development studies conducted in FY 1982, the functional design of the software required to support users' requirements will be completed. A validation of that functional design will be done. Limited hardware will be acquired to support the in-house laboratory experiments and user hands-on demonstrations. Hardware will most likely be a small computer with array processors, large volume on line storage, video disc storage and display/analyst terminals. Definition and implementation will begin on the data base required and on the process needed to take the data base and convert it to user required data structures.

Project: #2810 Title: Digital Mapping and Charting Technology
Program Element: #63259F Title: Cartographic Applications
DOD Mission Area: Electronic and Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

4. (U) FY 1984 Planned Program: Detailed design, implementation, and demonstrations will begin of the integrated hardware, software, and data base packages as an integrated design tool. After successful demonstrations emerging pieces of functional software and data base specifications of use to selected system developers will begin transition to those developers. Additional implementations of the developing data base will be added and a feedback loop established with the system design engineers will be monitored to adjust the program as needed.

5. (U) Program to Completion: Data base refinements and system upgrades will continue as necessary and successful tools developed will be made available to users as they are produced. The final system of an interactive flexible "workbench" will be completed in FY 1987 and transitioned to an appropriate facility for common use by designers and users of weapon systems dependent on digital cartographic data.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63302F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Missile Propulsion
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	8,477	7,174	894	1,279	Continuing	Not Applicable
2445	Advanced Airbreathing Propulsion	3,997	2,200				
6339	Air Launched Missile Propulsion	1,321	1,274	594	1,279		
6340	Space Systems Propulsion	2,487	3,000	300			
6341	Ballistic Systems Propulsion	672	700				

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program assesses the performance, reliability, cost and service life of advanced rockets and airbreathing (ramjet) propulsion concepts. Propulsion options to increase payload for space launched and ballistic missiles and increase launch range and/or reduce the intercept flight time of tactical missiles will be demonstrated. The scope of this program includes comprehensive integrated propulsion system testing in sea level and simulated altitude test facilities and flight tests of the selected concept.

(U) BASIS FOR THE FY 1983 REQUEST: During this period two tasks will be pursued. A contract with Hercules, Incorporated, Cumberland, MD, was started in July 1978 to develop a radial burning pulse motor. This solid rocket motor concept allows two discrete burns with variable coast time between the thrust pulses. This technology would provide an Advanced Medium Range Air-to-Air Missile additional performance through range extension and higher missile velocity during the critical terminal flight phase. The flight demonstration of this radial pulse motor concept will be started in FY 1982 and completed in FY 1983. This flight demonstration will utilize residual validation hardware remaining from either the Hughes Aircraft Company or Raytheon, Inc. Advanced Medium Range Air-to-Air Missile validation contract. The second task completes the demonstration of applying advanced ballistic missile propulsion technology in the Inertial Upper Stage for use in the Space Shuttle. This task was started in May 1980 and includes demonstration of advanced propellant, lighter weight case and high-area-ratio expandable nozzle for the small Inertial Upper Stage motor. Applying this technology to both Inertial Upper Stage motors would provide a 20% to 30% payload growth.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	8,500	7,300	10,400		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63302F | Title: Advanced Missile Propulsion
DOD Mission Area: Engineering Technology (ATD), #553 | Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element has evaluated advanced rocket and airbreathing (ramjet) propulsion concepts, and provided for early demonstration and orderly, low-risk transition of these technologies into engineering development of air launched, space and ballistic missile systems. Emphasis is placed on early assessment of the performance, cost, reliability and service life of propulsion options for growth and/or new systems developments. The concepts validated under this program will provide significantly decreased life cycle cost in addition to major expansion of mission capability over current operational systems. Demonstration of full-scale lightweight propulsion systems for air launched, space launched, and ballistic rocket systems will be conducted under the most realistic systems oriented conditions. The planned flight demonstration of the ducted rocket propulsion concept was cancelled in FY 1982 due to project funding being zeroed in FY 1983. Demonstration of engine performance, propulsion cost, and engine reliability will be assessed through a series of freejet ground tests conducted in FY 1982. A demonstration effort of a motor in the Advanced Medium Range Air-to-Air Missile size will include reduced smoke propellant to reduce aircraft and missile detectability and the radial-burning-pulse concept to provide for more end-game maneuverability. This technology will be validated in FY 1982 and FY 1983 through a series of five flight tests. A space propulsion effort will use technology spin-off from ballistic missiles to address the need to improve the payload capability of Air Force space launch vehicles. High-energy propellants, high-performance nozzles, and lightweight cases when applied to an advanced Inertial Upper Stage will result in greater than 20% payload increase for Space Shuttle launches. Technology in solid propellants that was considered too high risk to enter MX development will be demonstrated in this program in FY 1982. These technologies, when applied in the third stage, can provide 11% throwweight increase.

(U) RELATED ACTIVITIES. Programs to demonstrate component feasibility and practicality are initially accomplished in exploratory development under Program Element 62302F, Rocket Propulsion, and Program Element 62203F, Aerospace Propulsion. Work on rocket and ramjet propulsion by the services and National Aeronautics and Space Administration is coordinated through the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee. In addition, the Office of the Under Secretary of Defense for Research and Engineering reviews and coordinates all services' programs through the auspices of the Propulsion Technology, Missiles and Space Vehicles Technology Coordinating Paper. This program element provides technology for the following program elements: PE 64314F, Advanced Medium Range Air-to-Air Missile; PE 64312F, MX; and PE 64411F, Space Transportation System.

(U) WORK PERFORMED BY: The Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA, is managing the overall program. The Air Force Wright Aeronautical Laboratories, Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH, is a co-participant and manages the Advanced Airbreathing Propulsion, Project 2445. All work is done under contract. A list of contractors/bidders includes: Hughes Aircraft Company, Canoga Park, CA; Hercules, Incorporated, Cumberland, MD and McGregor, TX; Thiokol Chemical Corporation, Brigham City, UT and Huntsville, AL; Atlantic Research Corporation, Alexandria, VA; Aerojet Solid Rocket Company, Sacramento, CA; and United Technologies Corporation, Sunnyvale, CA.

Program Element: #63302F
DOD Mission Area: Engineering Technology (ATD) #553

Title: Advanced Missile Propulsion
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The first effort under this program element, November 1976 to April 1979, demonstrated an improved satellite orbit transfer motor capable of placing a 170 pound heavier NAVSTAR satellite into proper orbit. In September 1977, Aerojet Manufacturing Company and Rockwell International Corporation were issued competing efforts to demonstrate expulsion/tankage concepts for the MX post-boost propulsion system. The Aerojet Manufacturing Company approach was selected as the MX baseline in FY 1980 and has entered engineering development. Hughes Aircraft Company was issued a contract in September 1979 to demonstrated the fixed-fuel-flow ducted rocket. The ducted-rocket program will be completed in FY 1982 through a series of freejet ground tests. Thiokol Corporation was issued a contract in December 1979 to demonstrate technique to lower the production cost of rocket motors by greater than 30%. The first application of these techniques was in the Army's Multiple Launch Rocket System. Hercules, Incorporated was selected in July 1978 to incorporate the radial burning pulse and reduced propellant concepts into motor designs compatible with the two Advanced Medium Range Air-to-Air Missile prime contractor approaches. These efforts will be completed in FY 1982. Radial pulse motors will be delivered allowing a FY 1982-1983 flight demonstration in residual hardware from the Advanced Medium Range Air-to-Air Missile validation program. A contract was issued to Thiokol Corporation in May 1980 to provide technology that will allow payload growth for the Space Shuttle Inertial Upper Stage. This contract will be completed in FY 1983 in a three motor test series.

2. (U) FY 1982 Program: During this period the fixed-fuel-flow ducted-rocket engine freejet testing will be completed. Preliminary Flight Rating Test of a reduced-smoke two-pulse rocket motor will be completed and a flight test phase started. The effort incorporating ballistic missile propulsion technology into the small Inertial Upper Stage motor will be continued demonstrating the capability of providing greater than 10% payload increase. An effort to provide propellant technology for future versions of MX or Minuteman II replacement will be completed. MX technology is providing a 40% payload increase over that available from Minuteman II; however, significant technology gains are still available. This long-term task (planned completion 1989) will provide integral second/third-stage technology allowing at least a 10% payload growth and/or range flexibility. The first effort under this task is focused on demonstrating high-energy propellant and is scheduled to be completed in FY 1983.

3. (U) FY 1983 Planned Program: The flight demonstration of the radial pulse motor concept started in FY 1982 will be completed. A series of motors will be delivered in FY 1982 from the contract with Hercules, Incorporated. These motors were developed using identical motor cases to those demonstrated in the Advanced Medium Range Air-to-Air Missile competition. The winner of that competition will be selected to integrate and flight demonstrate the radial pulse motor concept in residual flight validation hardware. This will provide a near-term option to incorporate advanced propulsion in the Pre-Planned Product Improvement (P^3I) to the Advanced Medium Range Air-to-Air Missile.

Program Element: #63302F | Title: Advanced Missile Propulsion
DOD Mission Area: Engineering Technology (ATD), #553 | Budget Activity: Advanced Technology Development, #2

The three motor test series for the small Inertial Upper Stage will be completed. The demonstration of technology improvement will allow the start of an engineering development program that provides more than 10% payload increase for a Space Shuttle mission in post-FY 1985. Funding changes from the FY 1982 Descriptive Summary reflect the Air Force decision to terminate flight testing of the ducted rocket, terminate demonstration of propulsion technology for the large Inertial Upper Stage for the Space Transporation System, delay the planned FY 1982 start of an effort to demonstrate the boost-glide standoff missile concept and delay the FY 1983 start of an effort to demonstrate the variable fuel flow ducted rocket concept.

4. (U) FY 1984 Planned Program: An effort to increase tactical and strategic standoff missile range by up to 100% through use of advanced propulsion combined with the boost-glide (skip trajectory) will be conducted. Ground testing of these motors will address producibility and reliability, and flight testing will demonstrate staging and the ability of the missile to skip on the earth's upper atmosphere after flying a semi-ballistic trajectory. An effort will be conducted to develop liquid propellant propulsion technology, allowing maximum use of the Space Shuttle payload bay. This technology will allow payloads of up to 18,000 pounds as compared to today's capability with the Inertial Upper Stage of 5,000 pounds. An effort to demonstrate the variable fuel flow ducted rocket concept will be started. This technology will provide an option to significantly increase range and reduced time of flight for an AMRAAM variant.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63363F
DOD Mission Area: Engineering Technology, #553

Title: Hypervelocity Missile Program
Budget Activity: Advanced Technology Development, #2

Project Number	Title	FY 1981 1/ Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	900	8,070	992		0	9,962

1/ In FY 81, work preformed under PE 63249F, Night Attack Program Project 2693 (LANTIRN)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Hypervelocity Missile is a small, low cost, hypersonic, anti-vehicular, multiple kill per pass missile. The Armamont Division has devised a 24-month program which will culminate with the ground demonstration of multiple weapons being fired and independently guided to multiple targets. This approach to killing armor is affordable and doable. It will allow the U.S. to buy enough anti-armor missiles and carry enough of those missiles per aircraft to make a major dent in any Soviet armor aggression.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This fiscal year's funding will enable the contractor (Vought) to accomplish appropriate ground testing of the critical missile technologies such as guidance, warhead penetration and rocket motor sizing.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

FY 1981 1/	FY 1982 2/ Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
2,000 1/	8,200	900	0	0	11,100

1/ Work performed under PE 63249, Night Attack Program, Project 2693 (LANTIRN)

2/ Transferred from PE 63601F, Conventional Weapons Technology; Project 2718 Hypervelocity Missile.

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63363F

DOD Mission Area: Engineering Technology, #553

Title: Hypervelocity Missile

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The Hypervelocity Missile is a fast (Mach 5.0+), small (20-45 lbs), low cost ($5K or less), anti-vehicular, multiple engagement weapon. It is necessitated by the marked imbalance in armor and air defense capabilities of the Warsaw Pact vis-a-vis the North Atlantic Treaty Organization. This missile represents a completely different approach to killing armor than is used by current weapons such as MAVERICK, HELLFIRE, and TOW. It uses a kinetic energy penetrator (rod and/or tube) instead of a chemical energy warhead, as the kill mechanism. Thus it achieves a substantial reduction in missile size, weight and cost while dramatically increasing the missile's flight velocity and aircraft combat load. These characteristics provide a marked increase in firepower per sortie while simultaneously decreasing the aircraft's exposure time. The potentially high payoff of the Hypervelocity missile is that it will enable the U.S. Forces to dramatically increase the weapons available and the armament carried per sortie. Additionally, the low cost per missile combined with its simple employment procedures will enable the tactical forces to train our aircrews to effectively use these munitions.

(U) RELATED ACTIVITIES: The Multifunctional Infrared Coherent Optical Scanner (MICOS) program (PE 62204) provides the CO_2 Scanner development required for this missile. This effort is transferred to this program element in FY 82.

(U) WORK PERFORMED BY: The Armament Division (AFSC) Eglin AFB, FL

(U) PROGRAM ACCOMPLISHED AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This is an FY 81 new start program

2. (U) FY 1981 Program: The Vought Corporation was selected for the 24 month program.

3. (U) FY 1982 Planned Program: The missile's subsystems will be tested and validated. The MICOS program is transferred to this program element.

4. (U) FY 1983 Planned Program: Ground demonstration of multiple missiles being ripple launched and subsequently simultaneously and independently guided to multiple targets. This demonstration will validate the missile's guidance concept and kill mechanism.

5. (U) Program to Completion: Not applicable

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63410F
DOD Mission Area: Environmental and Life Sciences (ATD), #552

Title: Space Systems Environmental Interactions Technology
Budget Activity: Space Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT			1,583	2,637	37,780	42,000
2821	Space Systems Design and Test Standards			399	970	11,531	12,900
2822	Interactions Measurement Payload			784	1,067	21,049	22,900
2823	Charge Control System			400	600	5,200	6,200

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Effects of the space environment on large, high power space systems are unknown. Physical processes and their interactions with spacecraft must be defined to assure reliability and survivability of projected systems. This program counters adverse effects of the space environment on Air Force space systems by developing and demonstrating techniques, concepts and flight hardware to mitigate systems-limiting effects. Program Element 63410F represents the Air Force Advanced Development portion of an interdependent National Aeronautics and Space Administration/Air Force (NASA/AF) Space Technology Investigation.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Funds will be used to identify requirements for space simulation chamber testing and computer modeling of Space Shuttle interactions with the high latitude reentry environment; apply exploratory development studies of electrical properties of thermal protection tiles to produce assessment of charging/discharging impact. Define engineering sensor concepts for Interactions Measurement Payload for Shuttle Flight. Initiate development of active charge control system for automatic stabilization of spacecraft charge state.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63410F
DOD Mission Area: Environmental and Life Sciences (ATD), #552

Title: Space Systems Environmental Interactions Technology
Budget Activity: Space Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Environmental interaction impacts are anticipated as space operations shifts to larger, higher power, longer life, manned spacecraft. Impacts identified by preliminary studies, include: Space Shuttle charging/discharging during high latitude reentry; defocusing of Space Based Radar antenna and large optical system optics due to charging, plasmas and fields; limiting of large solar array efficiency due to power drain through the space plasma; damage to high power solar array produced by space plasma acceleration and focusing; limits on manned operations due to charging/discharging of surfaces, and decreases of material staility with associated increase of contaminant deposition due the space environment. These impacts will be resolved in the environment planned for the Shuttle/Inertial Upper Stage (IUS) and other programmed space systems. Technology developments from ongoing NASA and AF exploratory development programs will be applied to provide design models, develop guidelines and test requirements and computer design tools for the Shuttle/IUS and large, high powered space systems such as the Space Based Radar. An Interactions Measurement Payload will be developed and flown on the Shuttle to provide engineering data for an environmental MIL STD for large space systems. A charge control unit will be deigned, developed and space flight qualified to provide the capability for active control of charge buildup on mission spacecraft by the emission of plasma/ionized beams.

(U) RELATED ACTIVITIES: The principal related activity is the NASA/AF interdependent program on Spacecraft-Environment Interactions established in May 1980. The NASA/AF Program supplies the Exploratory Development technology base which will be transitioned by PE 63410F to provide the solutions to specific systems problems, with the Major AF input from PE 62101F/P7661. Programs in the broad area of the space-environment are conducted by the Navy and the National Oceanic and Atmospheric Administration. When applicable to AF requirements, information gathered by others will be used in the AF programs. The work within this PE is coordinated formally at the annual tri-service briefings to the Office of the Undersecretary of Defense for Research and Engineering during the apportionment review and through the semi-annual meetings of the NASA/AF Space Technology Interdependency Working Group.

(U) WORK PERFORMED BY: Work performed under this line item will be in-house and contractually managed by the Air Force Geophysics Laboratory, Hanscom Air Force Base, MA. Potential bidders on the contractual efforts include: AVCO Corp., Wilmington, MA; Boeing, Seattle, WA; Hughes Aircraft, Culver City, CA; Jet Propulsion Laboratory, Pasadena, CA; Martin-Marietta Corp., Denver, CO; Rockwell International - Space Systems Group, Downey, CA; and TRW Space and Missile Systems Group, Redondo Beach, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable.

2. (U) FY 1982 Program: Not Applicable.

Program Element: #63410F
DOD Mission Area: Environmental and Life Sciences (ATD), #552

Title: Space Systems Environmental Interactions Technology
Budget Activity: Space Advanced Technology Development, #2

3. (U) FY 1983 Program: Requirements for computer modeling and space simulation chamber testing of Large Space Systems will be defined. Design requirements for a large Space Structures MIL STD will be prepared. These elements are critical to ensure that planned large, high power space systems are designed to survive and operate effectively in the space environment. Engineering design of an active charge control system will begin. This effort will provide a small off-the-shelf piece of hardware which will control the charge buildup on a space structure. The potential for significant charging of large spacecraft in polar earth orbits has been identified. Computer engineering models and space chamber testing of the shuttle tile electrical properties will be initiated to characterize performance on missions in the high latitude auroral environment. An Interactions Measurement Payload (IMP) will be defined for a shuttle flight in FY 1987. The payload will verify environmental conditions on polar mission orbits, provide validation of the computer aided engineering design tools for large, high power space systems, and provide spaceflight qualification for the active charge control system.

4. (U) FY 1984 Planned Program: Complete assessment of charging/discharging impact on operations in polar orbit. Produce outline of MIL STD for space environmental effects on Large Space Systems. Complete definition study of Interactions Measurement Payload for flight on Shuttle. Complete engineering design phase of charge control system.

5. (U) Program to Completion: Evaluate spacecraft-environment interaction computer codes as engineering design tools. Conduct shuttle flight test of IMP and charge control system. Conduct ground chamber tests of charge control system flight model. Produce draft MIL STD. Validate engineering design tools. Publish MIL STD. Deliver spacecraft charge control system. Engineering design tools, MIL STD, and spaceflight qualified charge control system will be delivered at the end of FY 89, the program completion date.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63452F TITLE: Very High Speed Integrated Circuits (VHSIC)
DOD Mission Area: Electronics & Physical Sciences (ED), #551 Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	41,541*	65,547**	66,004	61,479	49,146	312,148*

*Funds in Program Element 62704F in FY 1980 and 1981.
**Includes Congressionally-directed reprogramming.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a Tri-Service program to develop two generations of integrated circuits with very high data processing capacity for a wide range of military systems. Initial applications will be in digital signal processors for radar, antisubmarine warfare, communications, missile guidance, electronic warfare, and optical sensor systems. Payoff in these systems will include enhanced performance and reliability and reduced life-cycle cost. Many systems will not be achievable at all without this component technology. The program structure stresses ready access to the technology by military system designers and rapid introduction of these components into the operational inventory. By Congressional direction, the program is centrally managed in the Office of the Undersecretary of Defense for Research and Engineering, and the Air Force budgets for and administers the total program funding.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Provides funds for the next stage of development and testing of the first generation of very high speed integrated circuit chips, with emphasis on establishment of pilot production lines and computer-aided design facilities. This will provide the industrial base to deliver components to customers in the system design community. Provides funds for long lead time work in preparation for the second chip generation to meet system needs in the late 1980s. Provides funds for supporting technology efforts to limit technical risk in the overall program. These high speed components are required to be available in time to support development of such systems as aircraft and seaborne sensors for automatic target classification, jam-resistant communications networks, and fire-and-forget missiles. Commercial components cannot survive in military environments, lack the necessary architectural emphasis on processing throughput, and have excessive costs and delivery times. Cost estimates were developed in consultation among technical and cost experts in the three Services and the Office of the Undersecretary of Defense for Research and Engineering and have been revised on the basis of contract awards made during 1981

Program Element: #63452F TITLE: Very High Speed Integrated Circuits (VHSIC)
DOD Mission Area: Electronics & Physical Sciences (ED), #551 Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	26,600	41,500	42,500		78,600	217,631

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63452F TITLE: Very High Speed Integrated Circuits (VHSIC)
DOD Mission Area: Electronics & Physical Sciences (ED), #551 Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The Very High Speed Integrated Circuit program was begun: (1) to prevent erosion of our lead over our adversaries in the keystone area of integrated circuit technology, (2) to meet military specific requirements for integrated circuits not being met by commercial integrated circuit market pressures. These requirements include high speed signal processing applications for radar, electronic warfare, imagery sensors, communications, missile navigation and guidance, and acoustic sensors. The requirements further include the abilities to survive and operate over the military temperature range (-55 degrees Celsius to 125 degrees Celsius) and in radiation environments. In addition to performance enhancements, the components being developed will yield 10- to 100-fold increases in system reliability; 5- to 10-fold reduction in size, weight, and power consumption; and reduced costs for acquisition, spares, maintenance, and system modification. The overall objective is to develop two generations of very high speed integrated circuits through pilot production line capabili and to achieve the earliest possible use in military systems. The program is structured in four parts. The Definition Phase was a nine month effort which considered the following areas: (1) chip set architecture (to designate functional chips usable in a wide variety of applications), (2) computer aided design system definition, (3) device design and modelling, (4) fabrication process development, (5) requirements for circuit patterning equipment, (6) requirements for chip testing equipment, (7) requirements and strategy for fault tolerance and on-chip test, (8) initial design of first generation very high speed integrated circuit demonstration subsystems. Phase I, now in progress, is a three year effort to: (1) develop the first generation very high speed integrated circuit chips (1.25 micrometer minimum feature size) to the pilot production line stage together with the architecture, design and fabrication of these chips and the demonstration brassboards for proof of very high speed integrated circuit capabilities, (2) develop second generation very high speed integrated circuit technology for chips having minimum feature sizes of 0.5 to 0.8 micrometers (about one-thousandth the diameter of the period at the end of this sentence) to demonstrate second generation feasibility. Long lead time major items for second generation very high speed integrated circuit are computer-aided design software, non-optical patterning equipment, and fabrication process development. Phase II will be a two year effort to (1) test and evaluate the first generation very high speed integrated circuit demonstration subsystems, and (2) complete second generation very high speed integrated circuits chip sets through pilot production line capability. Phase III contains the Technology Support work. It is a six year effort which runs concurrently with and supports the Definition Phase, Phase I, and Phase II. The Technology Support work consists of a number of independent efforts with the intent of (1) providing innovative ideas which can make very high speed integrated circuits even more productive and (2) filling gaps and reducing risk in Phase I and II efforts. Innovative architecture and computer aided design approaches, critical aspects of fabrication processing, and tester development are examples of areas being pursued.

(U) RELATED ACTIVITIES: This is a Tri-Service program with management and technical oversight executed by the Office of the Undersecretary of Defense for Research and Engineering. The Program Director is in the Office of the Undersecretary of Defense for Research and Engineering and coordinates the work within the program and work related to it. The Services, the Defense Advanced Research Projects Agency, the National Aeronautics and Space Administration and the National Security Agency are represented on the Very High Speed Integrated Circuits Executive Committee chaired by the Office of the Undersecretary of Defense for Research and Engineering (Research and Advanced Technology). Related activities include: Aircraft Avionics (PE #62202A); Electronic and Electron Devices (PE #62705A); Electron Device Technology (PE #62762N); Aerospace Avionics, (PE #62204F); Aircraft Avionics Equipment, (PE #63207A); Avionics, (PE #63202N); Advanced Device Development, (PE #63742N); Advanced Avionics for Aircraft, (PE #63203F); and Electronic Warfare Technology (PE #63718F).

Program Element: #63452F TITLE: Very High Speed Integrated Circuits (VHSIC)
DOD Mission Area: Electronics & Physical Sciences (ED), #551 Budget Activity: Advanced Technology Development, #2

(U) WORK PERFORMED BY: The Office of the Undersecretary of Defense for Research and Engineering executes program management of Very High Speed Integrated Circuits. Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base OH, provides overall financial management. The work is monitored in the following organizations: Electronic Technology and Device Laboratories, Electronic Warfare Laboratory, and Communications Research and Development Command, all of Fort Monmouth NJ; Army Missile Command, Huntsville AL; Army Armament Research and Development Command, Dover DE; Army Night Vision and Electro-Optics Laboratory, Fort Belvoir VA; Army Research Office, Research Triangle Park NC; Naval Electronic Systems Command, Naval Research Laboratories, both in Washington DC; Office of Naval Research, Arlington VA; Naval Air Development Center, Warminster PA; Naval Surface Weapons Center, Dahlgren VA and White Oak MD; Naval Weapons Center, China Lake CA; Naval Ocean Systems Center, San Diego VA; Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base OH; and Rome Air Development Center, Griffiss Air Force Base NY and Hanscom Air Force Base MA. The top ten contractors were Hughes Aircraft Corporation, Malibu and Culver City CA; Varian, Beverly MA; Texas Instruments, Dallas TX; TRW, Redondo Beach CA; University of Illinois, Urbana IL; Westinghouse, Baltimore MD; Rockwell International, Anaheim CA; Perkin Elmer, Norwalk CT; Honeywell Inc., Minneapolis MN; and Raytheon, Bedford MA. There were 16 other contractors located nationwide. The total number of contracts was 66.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The Definition Phase was completed in December 1980. Results of the nine parallel contracts included data establishing the feasibility of the first very high speed integrated circuit generation, initial design and evaluation of brassboard demonstration subsystems, and assessment of technology needs of the overall program. In May 1981, six contracts were awarded to begin Phase I, the first generation chip development. This is a three year effort and will lead to establishment of pilot production lines and supporting computer-aided design centers. Each contract calls for a brassboard demonstration which is of broad military system applicability. In addition, long lead time is underway to establish feasibility of the planned second chip generation (Phase II) and to develop needed technology. This same period saw initiation of 59 smaller Technology Support efforts with a variety of university, industrial, and government laboratories in areas such as high resolution lithography, design and testing methods, and advanced wafer processing methods. This work reduces risk in the Phase I and II efforts by providing a source of new and improved technology and also provides a mechanism to advance the fundamental integrated circuit art for the benefit of the entire military electronics community. An additional contract was awarded under Phase I to develop an electron-beam lithography system which will be of use to the entire program under Phase II by allowing sub-micrometer chip fabrication with acceptable throughput and cost. A supplemental appropriation of $15.0M in FY 1981 supported expansion of the original program plan for Phase I to the level described; this will ensure coverage of all applicable technologies and will accelerate introduction in additional high-payoff system application areas.

2. (U) FY 1982 Program: Under Phase I, detailed design of first generation chips and brassboard will be completed. These components contain 20,000 to 50,000 logic gates, typically replacing 50 or more components in present technology, and incorporating built-in test and reliability features. The designs stress broad system applicability along with techniques to customize characteristics inexpensively for specific uses. The initial group of Technology Support efforts will complete, and the results will be fed into the Phase I program. A limited number of new Technology Support efforts may be started if needs are identified in Phase I. The funding increase of $24.0M from the FY 1982 Descriptive Summary supports the Phase I expansion described in the previous paragraph.

Program Element: #63452F TITLE: Very High Speed Integrated Circuits (VHSIC)
DOD Mission Area: Electronics & Physical Sciences (ED), #551 Budget Activity: Advanced Technology Development, #2

3. (U) FY 1983 Planned Program: In the second half of the three-year Phase I program, emphasis will be on completion and qualification of pilot production and supporting facilities, including computer-aided design centers. Additional first generation chip sets and brassboards will enter design to support high priority system applications in such areas as command, control, and communications, and space systems. Technology Support efforts begun in response to initial Phase I requirements will complete, and the results will support finalization of the first generation chip design and fabrication facilities. Initial lots of first generation chips will be intensively evaluated for data processing capacity, manufacturability, reliability, and testability. Fabrication of brassboard hardware will be elevated to a major activity. Advance technology work for Phase II will enter the prototyping and trial run stage, and Technology Support efforts will be started as needed to address deficiencies found in preparing for these higher complexity components. The change from the funding level of the FY 1981 Descriptive Summary reflects transfer of $10.0M from a cancelled project in another defense agency plus a Department of Defense budget decision to increase funding by $13.6M. This will continue the fully scoped program to obtain the earliest and widest benefits from application of the technology in crucial system categories for all three Services.

4. (U) FY 1984 Planned Program: Phase I will complete with delivery of initial chip sets and brassboard along with established capacity to design and build chips for system customers. Phase II will be initiated to develop technology and pilot production capability for second generation very high speed integrated circuits having submicrometer features and typically 100,000 gates per chip. Technology Support efforts will continue to complete in an orderly time phasing, and results will support Phase II. The program will actively seek additional opportunities to employ first generation chips in military systems in order to realize maximum return on the Phase I investment. Testing will begin on the Phase I brassboards.

5. (U) Program to Completion: Phase II will be a two year effort and will complete in FY 1986 with establishment of second generation chip design and fabrication facilities. Technology Support efforts will continue to be conducted to meet overall program needs and will complete in FY 1985. Testing of Phase I brassboards will also complete in 1985 and the results will be used to facilitate use of the new components in operational system designs. The electron-beam lithography system begun under Phase I will be incorporated into pilot production lines.

6. (U) Milestones: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63601F | Title: Conventional Weapons Technology
DOD Mission Area: Engineering Technology (ATD), #553 | Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING): ($ In thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	21,152	22,220	20,017	17,930	Continuing	Not Applicable
670A	Ordnance Technology	4,834	4,033	4,017	2,830	Continuing	Not Applicable
670B	Air-to-Surface Guided Weapons Technology	13,206	13,297	8,900	8,800	Continuing	Not Applicable
670E	Air-to-Air Technology	1,599	3,624	2,900	2,500	Continuing	Not Applicable
670F	Aircraft Gun Technology	1,513	1,166	1,900	1,200	Continuing	Not Applicable
670G	Advanced Explosives		100	2,300	2,600	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Includes all Air Force advanced development effort for technology base demonstrations of advanced non-nuclear aircraft armament and weapons guidance technology. New weapons concepts and technology applications are developed and tested to demonstrate feasibility, effectiveness and operational potential. This program serves as the basis for follow-on system development and advanced prototyping programs.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This is the only program for Conventional Weapons Technology (6.3) program within the Air Force. It is a many-faceted, broad scoped program which will: (1) continue conventional weapons development initiated in FY 1982 and prior years such as Low Altitude Dispenser, Infrared and Millimeter Wave guidance demonstration, (2) continue promising new technology demonstrations such as the Joint Service Adverse Weather Guidance Demonstration and Infrared High Value Guidance demonstration which appears to offer a guidance option for increased capability to destroy high value targets; and (3) Tactical Global Positioning System demonstration which will provide low cost guidance for conventional cruise missiles. Funding requirements are derived from currently contracted commitments, historical data, and Air Force cost models.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	21,452	23,300	20,900		Continuing	Not Applicable

Difference between FY 82 submission and approved funds is caused by Congressional reduction of $2M.

(U) OTHER APPROPRIATION FUNDS. Not Applicable

Program Element: #63601F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Conventional Weapons Technology
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to apply state-of-the-art technology to the development of non-nuclear weapons. These developments are driven by a broad range of tactical and strategic requirements for new and improved non-nuclear weapons. All aspects of conventional weapons are included in the program: bomb/missile warheads, fuzing systems, aircraft/stores interface equipment, adverse weather air-to-surface and air-to-air seekers, gun mechanisms, ammunition and propellants. In addition, promising foreign technology is evaluated for possible application to Air Force requirements. This program element is the only Air Force advanced development effort for conventional weapons technology which forms the basis for follow-on engineering development programs to demonstrate advancement in the state-of-the-art.

(U) RELATED ACTIVITIES: This program demonstrates non-nuclear technology advances initially investigated in Air Force exploratory development Conventional Munitions (PE 62602F), Aerospace Avionics (PE 62204F) and Rocket Propulsion (PE 62302F) programs. Coordination is maintained with Advanced Avionics for Aircraft (PE 63203F), Digital Avionics Information System (PE 63243F) and NAVSTAR/Global Positioning System (PE 64778F) programs. Outputs from this program are to: The Advanced Missile Subsystem Demonstration (PE 63313F), Advanced Short Range Air-to-Air Missile Technology (PE 63360F), Advanced Medium Range Air-to-Air Missile (AMRAAM) (PE 63370F/64416F), Advanced Attack Weapons (PE 63609F), Armament/Ordnance Development (PE 64602F), Close Air Support Weapons System (PE 644608F), Air Delivered Land Mines (PE 64610F), and Surface Defense Suppression (PE 64733F) programs. Tri-Service coordination is accomplished through the Joint Technical Coordinating Group (JTCG) for Munitions Development, the JTCG for Munitions Effectiveness and the Joint Service Guidance and Control Committee for guidance and control activities. Other joint specialized committees have been formed for specific technology sub-areas. Jointly funded/sponsored tasks in this program include Standard Store Interface and the Ring Laser Gyro programs and the demonstration of Millimeter Wave/Synthetic Aperture Radar seeker technology on Adverse Weather Seekers. International cooperation and coordination is effected under the auspices of The Technical Cooperation Program and various specific country-to-country data exchange agreements, such as the NATO infrared and millimeter wave target/background signature measurement program.

(U) WORK PERFORMED BY: The Air Force Armament Laboratory, Eglin Air Force Base, Florida is the responsible technical activity for this program. Test facilities at the Armament Division, Eglin Air Force Base, Florida; the Arnold Engineer Development Center, Arnold Air Force Station, TN; and the Central Inertial Guidance Test Facility, Holloman Air Force Base, NM support this program. Major contractors on this program are: Brunswick, Costa Mesa, CA; McDonnell Douglas, Huntington Beach, CA; General Dynamics Corporation, Pomona, CA; Texas Instruments, Dallas, TX; Honeywell Inc., Minneapolis, MN; Hughes Aircraft Company, Canoga Park, CA; Martin Marietta, Orlando, FL; Teledyne Systems Company Northridge CA; Lear Seigler, Grand Rapids, MI; SRI International, Menlo Park, CA; Motorola, Scottsdale, AZ; Ford Aerospace, Newport Beach, CA. Eighteen other contractors and non-Air Force Government activities hold additional contracts

Program Element: #63601F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Conventional Weapons Technology
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Most of the new conventional ordnance in the Air Force inventory or currently in acquisition programs was initially demonstrated under this program. The most significant FY 1981 accomplishments in the areas of ordnance, air-to-surface guided weapons, air-to-air weapons and aircraft gun technologies are as follows:

(U) Ordnance Technology: The first two Low Altitude Dispenser vehicles were fit checked for flight testing on the F-15, F-16, and F-4 in Aug 81. A contract was signed in Jul 81 for the Antimateriel Incendiary Submunition program. Baseline cluster warhead configurations, including safe/arm/fuzing subsystems, have been established for several missiles and extensive effectiveness analyses conducted against a spectrum of targets. Final fabrication and testing of the Modular Fuze program brassboards were completed.

(U) Air-to-Surface Guided Weapon Technology: Millimeter-Wave contrast guidance seekers for autonomous lock-on-after-launch terminal guidance against armor were successfully demonstrated over a wide variety of targets and clutter background. The millimeter-wave seekers achieved a technological breakthrough for high target detection probabilities in low to moderate clutter. The Z8000 instruction set was accepted for use in defense computer systems to enable the Air Force to use the same assembly language for many types of missile computers. The Global Positioning System (GPS)was successfully demonstrated as a technique for updating tactical missile inertial systems in a jamming environment and paves the way for the development of a lightweight, low-cost GPS receiver for integration into the Midcourse Guidance Demonstration (MGD) program. The preliminary design for the MGD has been approved which will demonstrate, through captive and free-flight tests, low-cost midcourse guidance technologies which have potential application to USAF cruise missiles and tactical missile programs such as Medium Range Air-to-Surface Missile (MRASM). The first practical sub-wave length passive interferometer capable of sorting and accurately selecting a single UHF emitter from a field of like emitters broadcasting co-frequency Continuous Wave (CW) wavefroms was flight demonstrated. The accuracy of the interferometer and system compactness promises a new class of seeker capable of operating an order of magnitude lower in frequency than any previous seeker against multiple CW emitters. This capability exposes a whole new class of targets, represented by C3 and jammers, to lethal countermeasures.

(U) Air-to-Air Technology: In FY 1981 no air-to-air technology was developed due to Congressional reduction of funds for this Program Element. These technologies have been moved back to explority development.

(U) Aircraft Gun Technology: Advanced concepts for 30mm API long rod penetrator projectiles needed for defeat of future Soviet armor by the A-10 aircraft have been identified, development initiated, and preliminary design completed. Completed the development of a 30mm linear linkless ammunition feed system which successfully demonstrated cycle rates up to 4,000 rounds concept for 20 and 30mm ammunitions. Completed development of a 30mm projectile for air-to-air applications that exhibits increased lethality reduced weight and 4,000 ft/sec muzzle velocity.

Program Element: #63601F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Conventional Weapons Technology
Budget Activity: Advanced Technology Development, #2

2. (U) FY 1982 Planned Program: The FY 82 program emphasizes the technology for weapons development geared to the needs defined by user requirements for nonnuclear conflicts in Europe and the Middle East. Specific major efforts are as follows:

(U) Ordnance Technology: Investigation of standardized aircraft/store electrical interface technology to enhance interoperability on in-flight fuze setting capability will be continued. Initiate development of an Advanced Stores Management System which develops and implements a generic stores management system applicable across all aircraft/stores. The Low Altitude Dispenser (LAD) technology development will be continued which will provide lifting, stand-off, and off-axis delivery capability as well as a German Ministry of Defense program will be completed to demonstrate the LAD tube dispensing technique proposed forthe German MWX dispenser concept. Continue the development of an Anti-materials Incendiary Submunition. Continue at a reduced level the development of Standardized Avionics Integrated Fuzing which uses data available in aircraft avionics to provide real time optimum fuze setting. Development of the Modular Fuze program will be completed. Demonstration of depleted uranium warhead technology concepts for defeat of advanced armor will be completed.

(U) Air-to-Surface Guided Weapon Technology: Development of a flight weight Tactical Global Positioning System Class M receiver will be continued. Development of technology for all-weather guidance, standoff delivery, and low cost digital subsystems for tactical guided weapons will continue. Development of Tuned Rotor Gyro technology will be initiated under the Midcourse Guidance Demonstration (MGD) program. The Joint Navy/Air Force Millimeter Wave/Synthetic Aperture Radar technology development will be continued for guidance application in standoff missiles to provide autonomous search, acquire, and track capability to defeat highvalue targets. Emitter Homing Technology will be initiated to develop a new seeker design for the Remote Piloted Vehicle program specifically oriented for use against early warning/ground control intercept radars, noise modulated continuous wave jammers, and ground based satellite jammers. Initiate advanced development of the Infrared High Value Target Acquisition program to design, fabricate, and captive flight test brassboard hardware for a low cost autonomous infrared seeker for terminal guidance for attacking high value fixed targets with conventional tactical weapons. Initiate advanced development of a Carbon Dioxide (CO_2) Laser Technology Guidance Unit which will demonstrate the capability to accomplish midcourse update, feature following, terrain following/terrain avoidance/obstacle avoidance, autonomous real time 3-D target detection/classification, and submunition dispenser cueing with a CO2 laser radar sensor.

(U) Air-to-Air Technology: Initiate the Passive/Active All-Weather Seeker development which will demonstrate passive/active RF seeker guidance for air-to-air missile application and advance the state-of-the-art of multi-mode seeker technology.

Program Element: #63601F Title: Conventional Weapons Technology
DOD Mission Area: Engineering Technology (ATD), #553 Budget Activity: Advanced Technology Development, #2

(U) Aircraft Gun Technology: Initiate studies to define increased payoffs achievable through the development of a compact, light-weight, fixed barrel 30mm gun in comparison with existing 20 and 30mm gun systems. Continue development of an advanced 30mm API projectile capable of defeating Soviet armor. Complete the development of an advanced high explosive projectile with augmented lateral effects (ALE) which projects discrete fragments of a predetermined size and weight at velocities exceeding 5000 ft/sec.

(U) Advanced Explosive Technology: Initiate advanced development of a low cost insensitive explosive (EA) for use in shaped charge and submunition warheads, and hard target penetrating warheads.

3. (U) FY 1983 Planned Program: The FY 1983 program predicated upon adequate funding will emphasize the development of technology to support the development of weapons for adverse weather/night and increase the survivability of the delivery aircraft through the use of standoff and indirect attack weapons. The major efforts within each project are as follows:

(U) Ordnance Technology: Investigation of standardized aircraft/store electrical interface technology to enhance interoperability and in- light fuze setting capability will be continued with final design and fabrication. Development of an Advanced Stores Management System which develops and implements the architecture of a generic stores management system applicable across all aircraft/aircraft stores will continue. A powered Low Altitude Dispenser technology development will be continued which will provide standoff and off-axis delivery capability as well as optimum patterns for the submunitions deployed. Complete the development of an Antimaterial Incendiary Submunition which combines self-forging fragmentation technology with integral incendiary technology to provide an effective submunition for defeat of diesel fueled and lightly armored targets. Continue the development of Standardized Avionics Integrated Fuzing technology, which uses data available in aircraft avionics to provide real time optimum fuze settings for bomb dispensers.

(U) Air-to-Surface Guided Weapons Technology: The development of light weight Tactical Global Positioning System Class M receiver will be completed and flight tested to evaluate its utility as part of an advanced tactical midcourse guidance subsystem in the Midcourse Guidance Demonstration (MGD) program. Development of Tuned Rotor Gyro technology will be completed as part of the MGD program. The Joint Navy/Air Force Millimeter Wave/Synthetic Aperture Radar technology development for guidance application in standoff missiles will be completed to provide autonomous search, acquire, and track capabilities to defeat high value targets such as ships, airfields, and POL. Emitter Homing Technology will continue in support of developing a new seeker design for the Remote Piloted Vehicle program for use against early warning/ground control intercept radars, noise modulated continuous wave jammers, and ground based satellite jammers. The Infrared High Value Target Acquisition program will continue with brassboard fabrication integration, and performance of captive flight testing to demonstrate the feasibility of attacking high value fixed targets with conventional tactical weapons utilizing a relatively low cost autonomous infrared seeker for terminal guidance. Development of a Carbon Dioxide (CO_2) Laser Technology Guidance Unit will continue which demonstrates the capability to accomplish midcourse update, feature following, terrain following/terrain avoidance/obstacle avoidance, autonomous real time 3-D target detection/classification and submunition dispenser cueing with a CO2 laser radar sensor associated signal processing algoritms.

(U) Air-to-Air Technology: The Passive/Active All-Weather Seeker development program will continue which will demonstrate passive/active guidance for air-to-air missile application and advanced state-of-the-art multi-mode seeker technology.

(U) Aircraft Gun Technology: Initiate advanced development of a new compact, light-weight fixed barrel 30mm gun for the Advanced Tactical Fighter to provide increased effectiveness against aerial and armored targets greater standoff ranges than are currently available with existing systems. Complete development of an advanced 30mm API projectile capable of defeating advanced Soviet armor. Initiate development of a Sabot Diverter program to allow the advanced 30mm API projectile to be fired from the GPU-5 Gun Pod and A-10 aircraft.

(U) Advanced Explosives Technology: Continue development of lowest cost insensitive explosive (EA) for use in shared charge and submunition warheads and hard target penetrating warheads.

4. (U) FY 1984 Planned Program: The FY 1984 program will continue the development of technology to support air-to-surface weapons for use in adverse weather and night as defined by European and Middle East non-nuclear scenarios.

(U) Ordnance Technology: Investigation of standardized aircraft/store electrical interface technology to enhance interoperability and in-flight fuze setting capability will be completed. Development of an Advanced Stores Management System which develops and implements the architecture of a generic stores management system applicable across all existing aircraft/aircraft stores will continue with application to the Advanced Tactical Fighter aircraft. The powered Low Altitude Dispenser program, which will provide standoff and off-axis delivery capability as well as optimum patterns for the submunitions deployed, will be continued. Initiate advanced development of an airfield attack submunition and evaluate dispenser concepts for the submunition. Complete the development of Standardized Avionics Integrated Fuzing technology which uses data available in aircraft avionics to provide real time optimum fuze settings for bombs and dispensers.

(U) Air-to-Surface Guided Weapons Technology: Complete development of technology under the Midcourse Guidance Demonstration program for an all-weather, standoff delivery, low cost, digital guidance subsystem for tactical guided weapons. Complete development of Emitter Homing Technology for a new seeker for the Remote Piloted Vehicle program for use against early warning/ground control intercept radars, noise modulated continuous wave jammers, and ground based satellite jammers. complete development of the Infrared High Value Target Acquisition program with brassboard fabrication integration, and performance of captive flight testing to demonstrate the feasibility of attacking fixed targets with conventional tactical weapons utilizing a relatively low cost autonomous infrared seeker for terminal guidance. Development of a Carbon Dioxide Laser Technology Guidance Unit will continue which demonstrates the capability to accomplish midcourse update, feature following, terrain following/terrain avoidance/obstacle avoidance, autonomous real time 3-D target detection/classification and submunition dispenser cueing with a CO_2 laser radar sensor and associated signal processing algoritms. Initiate an Emitter Homing Technology seeker advanced development program for application to defense suppression missiles and advanced dispenser concepts. Initiate an advanced development program to evaluate and develop seeker processor technology to reduce the risk of developing the Tactical Defense Suppression missile. Initiate development of the Advanced Optical Rotation Sensor program, a gyro advanced development program utilizing laser technology, which has potential use incurrent or follow-on conventional cruise missiles.

(U) Air-to-Air Technology: Development of the Passive-Active radar guidance development will continue.

(U) Aircraft Gun Technology: Continue development of a new compact, light-weight, fixed barrel 30mm gun for the Advanced Tactical Fighter to provide increased terminal effectiveness against aerial and armored targets at greater standoff ranges than are currently available with existing systems. Complete development of a Sabot Diverter program to allow the advanced 30mm API projectile to be fired from the GPU-5 gun pod and A-10 aircraft.

(U) Advanced Explosives Technology: Continue development of low cost insensitive explosive (EA) for use in shared charge and submunition warheads, and hard target penetrating warheads. Initiate program to begin qualification of EA in general purpose bombs as replacement for tritonal.

5. (U) Program to Completion: This is a continuing technology base program.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1981 Budget Data: Not applicable.

Project: 670B
Program Element: #63601F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Air-to-Surface Guided Weapons Technology
Title: Conventional Weapons Technology
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This project is a continuing effort to provide the technology base necessary to support future development of improved air-to-surface guided weapons. The objectives are to develop and demonstrate technologies to improve the Air Force's air-to-surface guided weapons capability. Emphasis is on technologies which provide for affordable, standoff, adverse weather guided weapons. This project is divided into two tasks: Midcourse Guidance Technology and Air-to-Surface Terminal Guidance Technology. Midcourse Guidance Technology - The primary objective of this task is to provide a significant improvement in cost for tactical weapon avionics. There are basically three thrust areas within this task: (1) Low Cost Inertial Guidance Development; (2) Core Avionics; and (3) update systems which provide initialization and bound the errors of the total system. Air-to-Surface Terminal Guidance Technology - The primary objective of this task is to develop and demonstrate terminal guidance seekers which can achieve hit-to-kill accuracies against armored vehicles and high value fixed targets. Autonomous (lock-on-after-launch) and non-autonomous (lock-on-before-launch) modes of operation for the guidance seekers shall be considered. Autonomous techniques for acquiring and tracking Radio Frequency emitting threats, especially enemy communications facilities and jammers, are stressed. Efforts under this task are structured to investigate technical alternatives which lower risk associated with ongoing system development programs and develop a firm technical base required to support proposed system development programs.

(U) RELATED ACTIVITIES: This project demonstrates tactical air-to-surface guided weapons advanced technology initially investigated in Air Force exploratory development Conventional Munitions (PE 62602F) or Aerospace Avionics (PE 62204) programs. Coordination is maintained with Air Force advanced development programs: Advanced Avionics for Aircraft (PE 63202F), NAVSTAR/GPS (PE 64778F), and with the Ordnance Technology Project 670A and Air-to-Air Technology Project 670E of this program element. Outputs from this project are primarily into Advanced Attack Weapons (PE 63609F); past "graduates" have also transitioned into the Close Air Support Weapons System (PE 64603F) and Surface Defense Suppression (PE 64733F) programs. Tri-Service coordination is accomplished through the Joint Technical Coordinating Group for Munitions Development, the Joint Service Guidance and Control Committee established by DOD Instruction 5154.26 and other joint specialized committees formed in specific technology sub-areas. Task areas/work units which are funded/sponsored jointly between the Air Force Armament Laboratory and Air Force Avionics Laboratory include: Millimeter Wave Guidance supporting technology, Global Positioning System Midcourse Guidance, and Low Cost Inertial Midcourse Guidance. Joint-Service funded/sponsored efforts include digital guided weapons technology, millimeter wave guidance technology and Synthetic Aperture Radar seeker technology. International cooperation and coordination is effected under auspices of the Technical Cooperation Program and several specific country-to-country data exchange agreements.

(U) WORK PERFORMED BY: The Air Force Armament Laboratory, Eglin AFB, FL, is the responsible technical activity for this project. Laboratory facilities of the Air Force Armament Laboratory and the Air Force Avionics Laboratory are involved in the work. Test facilities at the Armament Division, Eglin AFB, FL; the Arnold Engineering Development Center, Arnold Air Force Station, TN; and the Central Inertial Guidance Test facility, Holloman AFB, NM, support this project. Major contractors on work units included in this project are. Honeywell, Inc, Hopkins, MI; Hughes Aircraft

Project: 670B
Program Element: #63601F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Air-to-Surface Guided Weapons Technology
Title: Conventional Weapons Technology
Budget Activity: Advanced Technology Development, #2

Corporation, Canoga Park and Culver City, CA; Texas Instruments, Dallas, TX; Teledyne Systems Co, Northridge, CA; Lear Seigler, Grand Rapids, MI; Computer Science Corporation, Huntsville, AL; Martin Marietta, Orlando, FL; McDonnell Douglas, Huntington Beach, CA; General Dynamics, Pomona, CA; and Sperry, Orlando, FL. Five other contractors hold additional contracts, for a total of 21 contracts in this project.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Millimeter-wave contrast guidance seekers for autonomous lock-on-after-launch terminal guidance against armor were successfully demonstrated over a wide variety of targets and clutter background. The millimeter-wave seekers achieved a technological breakthrough for high target detection probabilities in low to moderate clutter. The Z8000 instruction set was accepted for use in defense computer systems to enable the Air Force to use the same assembly language for many types for missiles computers. The Global Positioning System (GPS) was successfully laboratory demonstrated as a technique for updating tactical missile inertial systems in a jamming environment and paves the way for the development of a lightweight, low-cost GPS receiver for integration into the Midcourse Guidance Demonstration (MGD) program. The preliminary design for the MGD has been approved which will demonstrate, through captive and free-flight tests, low-cost midcourse guidance technologies which have potential application to USAF cruise missiles and tactical missile programs such as Medium Range Air-to-Surface Missile (MRASM).

2. (U) FY 1982 Program: Development of a flight weight Tactical Global Positioning System Class M receiver will be continued to provide an advanced tactical midcourse guidance subsystem for the Midcourse Guidance Demonstration (MGD) program. Development of technology for all-weather guidance, standoff delivery, and low cost digital subsystems for tactical guided weapons will continue under the MGD program, including the Industry Lower Cost Inertial Guidance Subsystem, the Digital Integration Subsystem, the Unaided Tactical Guidance software, and the high order language development (Ada), for terrain correlation in cruise missiles. Development of Tuned Rotor Gyro technology will be initiated under the MGD program. The Joint Navy/Air Force Millimeter Wave/Synthetic Aperture Radar technology development will be continued for guidance application in standoff missiles to provide autonomous search, acquire, and track capability to defeat high value targets such as ships, airfields, POL, and bridges. Emitter Homing Technology will be initiated to develop a new seeker design for the Remote Piloted Vehicle specifically oriented for use against early warning/ground control intercept radars, noise modulated continuous wave jammers, and ground based satellite jammers. Initiate advanced development of the Infrared High Value Target Acquisition program to design, fabricate, and captive flight test brassboard hardware for a low cost autonomous infrared seeker for terminal guidance in attacking high value fixed targets with conventional tactical weapons. Initiate advanced development of a Carbon Dioxide (CO_2) Laser Technology Guidance Unit which will demonstrate the capability to accomplish midcourse update, feature following, terrain following/terrain avoidance/obstacle avoidance, autonomous real time 3-D target detection/classification, and submunition dispenser cueing with a CO_2 laser radar sensor and associated signal processing algorithms.

Project: 670B Title: Air-to-Surface Guided Weapons Technology
Program Element: #63601F Title: Conventional Weapons Technology
DOD Mission Area: Engineering Technology (ATD), #553 Budget Activity: Advanced Technology Development, #2

3. (U) FY 1983 Planned Program: The development of a lightweight Tactical Global Positioning System Class M receiver will be completed and flight tested to evaluate its utility as part of an advanced tactical midcourse guidance subsystem in the Midcourse Guidance Demonstration (MGD) program. Development of technology for all-weather guidance, standoff delivery, and low cost digital subsystems for tactical guided weapons will continue under the MGD program. Development of Tuned Rotor Gyro technology will be completed as part of the MGD program. The Joint Navy/Air Force Millimeter Wave/Synthetic Aperture Radar technology development for guidance application in standoff missiles will be completed to provide autonomous search, acquire, and track capabilities to defeat high value targets such as ships, airfields, POL, and bridges. Emitter Homing Technology will continue in support of developing a new seeker design for the Remote Piloted Vehicle program for use against early warning/ground control intercept radars noise modulated continuous wave jammers, and ground based satellite jammers. The Infrared High Value Target Acquisition program will continue with brassboard fabrication and captive flight testing to demonstrate the feasibility of attacking high value fixed targets with conventional tactical weapons utilizing a relatively low cost autonomous infrared seeker for terminal guidance. Development of a Carbon Dioxide (CO_2) Laser Technology Guidance will continue which demonstrates the capability to accomplish midcourse update, feature following, terrain following/terrain avoidance/obstacle avoidance, autonomous real time 3-D target detection/classification and submunition dispenser cueing with a CO2 laser radar sensor and associated signal processing algorithms.

4. (U) FY 1984 Planned Program: Complete development of technology under the Midcourse Guidance Demonstration program for an all-weather, standoff delivery, low cost, digital guidance subsystem for tactical guided weapons. Continue development of Emiter Homing Technology for a new seeker for the Remote Piloted Vehicle program for use against early warning/ground control intercept radars, noise modulated continuous wave jammers, and ground based satellite jammers. Complete development of the Infrared High Value Target Acquisition program with brassboard fabrication integration, and performance of captive flight testing to demonstrate the feasibility of attacking high value fixed targets with conventional tactical weapons utilizing a relatively low cost autonomous infrared seeker for terminal guidance. Development of a Carbon Dioxide Laser Technology Guidance Unit will continue which demonstrates the capability to accomplish midcourse update, feature following, terrain following/terrain avoidance/obstacle avoidance, autonomous real time 3-D target detection/classification and submunition dispenser with a CO_2 laser radar sensor and associated advanced development program for application to defense suppression missiles and advanced dispenser concepts. Initiate development of the Advanced Optical Rotation Sensor program, a gyro advanced development program utilizing laser technology, which has potential use in current or follow-on conventional cruise missiles.

5. (U) Program to Completion: This is a continuing technology base project.

6. (U) Milestones: Not Applicable

7. (U) Resources: ($ in thousands):

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDT&E	13,206	12,297	8,900	8,800	Continuing	Not Applicable

Project: 670B
Program Element: #63601F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Air-to Surface Guided Weapons Technology
Title: Conventional Weapons Technology
Budget Activity: Advanced Technology Development, #2

(U) 8. Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDT&E	13,206	12,297	13,400	11,900	Continuing	Not Applicable

Project 670B funds in FY 1983 and FY 1984 have been reduced to accomplish higher priority developments with the program element.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63603F
DoD Mission Area: Directed Energy Technology, #554

Title: Space Laser Program
Budget Activity: Advanced Technology Development, #2

(U) RESOURCE (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	NONE	20,000*	40,561	37,104	123,779	221,444
2848	System Definition and System Technologies	NONE	9,700	19,636	17,818	76,255	123,409
2849	Laser Technologies and Target Vulnerabilities	NONE	10,300	20,925	19,286	47,524	98,035

*In Program Element 64406F, Project 2135, Advanced Systems.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is designed to determine the feasibility of space-based laser weapon systems. It is a joint DoD (AF/DARPA) program which will utilize existing technology programs where possible, especially DARPA TRIAD. The program will address requirements for the following missions: ballistic missile defense, CONUS and fleet air defense, satellite defense, anti-satellite operations, interdiction of airborne targets, and precision strikes against ground targets.

BASIS FOR FY 1983 RDT&E REQUEST: The combined system definition/technology risk reduction program is oriented toward a multi-mission, [ ]space laser weapon system. Work begun in FY 82 will be continued in the following areas: (1) system definition, (2) damage and vulnerability, (3) maintenance of mission effectiveness in the presence of countermeasures, (4) utility analysis, (5) supporting laser and optics technology, and (6) system technology and growth (short wavelength) technologies.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not applicable. Program Element is a new line in FY 1983. Program start will be done under Program Element 64406F in FY 1982, with the $20M specifically provided by Congress in the FY 82 appropriations bill in the Space Defense Systems Program for this effort.

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: # 63603 Title: Space Laser Program

DOD Mission Area: Directed Energy Technology, #554 Budget Activity: Advanced Technology Development, #2

DETAILED BACKGROUND AND DESCRIPTION: The DoD has invested heavily in High Energy Laser (HEL) technology over the past fifteen years. This technology base is reaching sufficient maturity to examine the feasibility and possible applications of a laser weapon system. Space-based laser weapon systems could possibly be used for a variety of missions including ballistic missile defense, air defense, satellite defense, anti-satellite operations, interdiction of airborne targets, and precision strikes against selected ground targets. There are a number of questions, however, which remain unanswered. How effective would a space-based laser be for each of these missions? Could it perform multiple missions? How effective would be the space-based laser compared with more conventional weapon systems? Can we develop an acquisition, tracking, and pointing system capable of extremely accurate pointing coupled with very high slew rates? These are only some of the critical uncertainties, both in system design and supporting technology, which must be resolved before commitment is made to full scale development and deployment. The DARPA TRIAD Program will provide the nucleus for the technology risk-reduction program, with its development of the components for a [ ] laser. The technology development in this program will be aimed at improving key components of the TRIAD, and developing other components which have not been considered to date, which are necessary to build [ ] the baseline for a multi-mission system. If successful, this program will provide sufficient information by FY 87 to allow an informed decision whether to proceed with the development and deployment of a space-based laser weapon system.

The program is divided into two projects: Project 2848, System Definition and System Technologies, and Project 2849, Laser Technologies and Target Vulnerabilities. Under Project 2848, the total system concept definition will include the space laser platform; surveillance; communications, command, and control (C^3); and launch and servicing segments. The definition of the space laser platform will include the laser weapon; the acquisition, tracking, and pointing subsystem; the cryogenic storage system; and possibly some portions of the surveillance and C^3 systems. Consideration must be given to the proper interaction of the various elements of the system to insure it will perform a specified mission. An initial concept of operations must be developed which addresses the required degree of autonomy: for example, there may be no time, once a missile attack has been verified, for human intervention. Utility analyses will be performed for a variety of missions including ballistic missile defense, anti-satellite operations, satellite defense, and air defense. These analyses will include assessment of the cost and effectiveness of system alternatives for each mission application. The space-based laser weapon system--including supporting elements such as space- and ground-based surveillance--must not only survive, but remain mission effective in the presence of active and passive countermeasures. The Program Office must analyze the possible operational and technical responses to passive countermeasures, directed against one or more segments of the system, which could disrupt or destroy completion of the mission. The mix of operational procedures and hardware providing cost-effective survivability enhancements against active countermeasures (directed at spacecraft, data/communications links, or ground elements) should be identified. The Program Office will conduct risk/uncertainty reduction efforts on surveillance and C^3 technologies required for overall battle management. Spacecraft subsystem component technologies unique to the space-laser platform, such as concepts for vibration isolation, thermal management and long-term reactant storage, will be developed. In Project 2849, the Program Office will develop laser and optics technology to support a [ ] laser. The Program Office will also conduct vulnerability analysis and testing to increase the confidence in assessment of vulnerability and hardening potential for targets identified in the system mission effectiveness analyses.

Related Activities: The nucleus for technology development of a space-based laser weapon system is the DARPA TRIAD

Program Element: # 63603 Title: Space Laser Program
DOD Mission Area: Directed Energy Technology, #554 Budget Activity: Advanced Technology Development, #2

Program funded in Program Element 62711E, Projects EE-7, EE-8, and EE-12. Program Element 62711E, Project EE-7 contains the development for the Acquisition, Tracking and Pointing Experiment - TALON GOLD. The objective of this program is to develop and test in space the long range acquisition, target tracking, and precision pointing [ ] Project EE-8, Program Element 62711E, is the High Power Chemical Laser Ground-Based Experiment - ALPHA. The objective of this effort is to demonstrate a multi-megawatt high-efficiency chemical laser in a ground-based facility to establish the feasibility of system performance levels required for space weapon application. Program Element 62711E, Project EE-12, is the Large Optics Demonstration Experiment - LODE. This project will establish and demonstrate the performance level that can be obtained from a beam control optics system designed to operate in space in conjunction with a large aperture, light-weight, laser mirror. Program Element 62301E, Project ST-3, High Energy Laser Technology, supports the DARPA TRIAD Program. The objective of this project is to develop the basic technology to provide improvements in laser device efficiency, wavelength and waveform, as well as advances in required optical components and ultra-precise beam pointing.

(U) WORK PERFORMED BY: The Air Force Systems Command's Space Division, Los Angeles, CA, has overall management responsibility for the Air Force part of this program. Space Division will perform directly those tasks involving system definition and utility analysis (including consideration of active and passive countermeasures), studies and analyses determining how to maintain mission effectiveness, surveillance/ C^3 technology, and spacecraft technology. The Air Force Systems Command's Air Force Weapons Laboratory, Albuquerque, NM, is responsible for laser, optics, and beam control technology development, and target vulnerability and hardening countermeasures.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable. Program Element is a new line in FY 1983. Program start will be done under Program Element 64406F in FY 1982, with the $20M specifically provided by Congress in the FY 82 appropriations in the Space Defense Systems Program for this effort.

2. FY 1982 Program: During the third quarter of FY 1982 a Program Management Plan will be submitted to Congress. The Air Force Weapons Laboratory will expand their analyses of the lethality of laser weapons against various classes of targets. In conjunction with this, they will assess hardening which might be employed against a laser weapon system and what effect this might have on the laser weapon design and operations. The Air Force Weapons Laboratory will also begin development of key [ ] Space Division will begin the system definition which will include the space laser platform; surveillance; command, control and communications (C^3); and launch and servicing segments. Space Division will assess the space laser weapon alternatives against a range of potential missions including the cost effectiveness. For each space-laser weapon system alternative, Space Division will perform a system-level analysis to identify potential vulnerabilities of the weapon system and various countermeasures which might be employed against enemy attack. They will begin contractual efforts to resolve uncertainties in technology supporting survivability; surveillance; communications, command and control; and space laser platform subsystems.

3. (U) FY 1983 Planned Program: Work begun in FY 1982 under Program Element 64404F will be continued in Program

Program Element: # 63603 | Title: Space Laser Program
DOD Mission Area: Directed Energy Technology, 554 | Budget Activity: Advanced Technology Development, #2

Element 63603F. Space Division, working with HQ USAF and the major commands, will finalize systems requirements, and continue development of the most promising system alternatives. Space Division will complete a system architecture for each alternative which addresses maintenance of mission effectiveness when confronted with active and passive countermeasures.

4. FY 1984 Planned Program: Space Division will continue all projects begun in FY 1982 and complete efforts to define the most promising system alternatives. They will begin an extensive iterative process combining the analyses of utility and maintenance of mission effectiveness in the presence of countermeasures of these systems. Air Force Weapons Laboratory will perform a damage and vulnerability test [ ] Space Division will complete development of performance/cost models of the selected alternatives. The most promising growth technology (shorter wavelength) components will be selected for further development. Air Force Weapons Laboratory will decide which specific optical aperture design to pursue at the end of FY 1984.

5. Program to Completion: All projects begun under this Program Element will be completed by the end of FY 1987. Air Force Weapons Laboratory will conduct damage and vulnerability measurements [ ] Space Division will supervise the demonstration of space-qualified cryogenic containers, used to store the laser chemical reactants, in FY 1987. [ ] a decision will be made whether to proceed to engineering development of a full scale space-based laser weapon system.

6. Milestones:

Milestone	Date
A. Program Management Plan to Congress	3rd Qtr FY 1982
B. Milestone 0	FY 1984
C. Milestone 1 Decision	[ ]

7. (U) Resources: Not applicable

8. (U) Comparison with FY 1982 Budget Data: Not applicable.

Project: # 2848
Program Element: # 63603
DOD Mission Area: Directed Energy Technology, #554

Title: System Definition and System Technologies
Title: Space Laser Program
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Space-based laser weapon systems may offer significant advantages over conventional weapon systems. These advantages include world-wide delivery of large amounts of destructive energy at the speed of light to accomplish ballistic missile, space, and air defense missions. There are, however, a number of system and technical uncertainties which must be resolved before serious consideration can be given to the development and deployment of any space-based laser weapon system. We must (1) determine which missions are most appropriate for this kind of system, (2) define in detail the most promising laser weapon alternatives (including their costs), and (3) determine how to maintain the required level of mission effectiveness in the presence of reasonably expected active and passive countermeasures.

This project will seek to resolve these critical issues. Space Division will develop detailed conceptual designs which include the laser weapon, all supporting on-board components, and the spacecraft. They will also develop total system concepts which include the space laser platform; surveillance; communications, command, and control; and launch/servicing vehicle segments. They will perform utility analyses over a range of conflict levels up to and including general nuclear war. Associated with the system concept definition analyses, Space Division will prepare a development plan for a potential program leading to operational deployment of a space-based laser weapon system. The maintenance of mission effectiveness for the system must be considered for a wide range of threats and scenarios. [

Extensive studies and analyses must be successfully accomplished to devise methods of maintaining mission effectiveness against these and other active and passive countermeasures. The Program Office must also develop the critical supporting technologies for the laser weapon, spacecraft, surveillance system, and command, control, and communications system. Successful testing of these technologies, and the technology supporting the laser weapon, will demonstrate the feasibility of the space-based laser weapon system and allow proceeding into the development of a fully integrated, space-capable demonstration model.

(U) RELATED ACTIVITIES: NONE

(U) WORK PERFORMED BY: The Air Force Space Division manages this effort. The Aerospace Corporation, El Segundo, CA, provides general systems engineering and technical integration.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable. Program Element is a new line in FY 1983. Program start will be done under Program Element 64406F in FY 1982, with the $20M specifically provided by the Congress in the FY 82 appropriations bill in the Space Defense Systems Program for this effort.

2. (U) FY 1982 Program: Space Division will begin in-house and contractual efforts in four major areas: (1) system

Project: # 2848 Title: System Definition and System Technologies
Program Element: # 63603 Title: Space Laser Program
DOD Mission Area: Directed Energy Technology, #554 Budget Activity: Advanced Technology Development, #2

definition and utility analysis, (2) maintenance of mission effectiveness when confronting countermeasures, (3) surveillance/command, control, and communications technology, and (4) spacecraft technology. Technology efforts will address only those items unique to a space-based laser weapon system such as reactant chemicals storage in space over prolonged periods of time.

3. (U) FY 1983 Planned Program: Space Division, in conjunction with HQ USAF and the MAJCOMs, will review the requirements for the space-based laser. They will complete development of an architecture defining what is required to maintain mission effectiveness in the presence of countermeasures. Work will continue on utility analysis, and technology efforts which support the surveillance, command, control and communications, and spacecraft segments.

4. (U) FY 1984 Planned Program: The Space Division Program Office will complete initial definition of the most promising space-based laser weapon system concept definitions begun in FY 1982 and refined in FY 1983 after systems requirements are finalized. The Program Office will make an assessment of the utility analyses begun in FY 1982, and will provide guidance to in-house and contractual personnel on what additional studies are necessary. The Program Office will continue supporting technology efforts peculiar to a space-based laser weapon system.

5. Program to Completion: The Space Division Program Office will select a single system alternative for the space-based laser [ ] The system definition of this alternative will provide the basis for full scale engineering development if a decision is made to develop and deploy an operational space-based laser system. The Program Office will continue to modify and reassess the analyses addressing system utility and maintenance of mission effectiveness [ ] Key technology development components to support the C^3, surveillance, and spacecraft segments will be completed [ ]

6. Milestones:

	Milestones	Date
A.	Program Management Plan to Congress	3rd Qtr Fy 1982
B.	Milestone 0	FY 1984
C.	Milestone 1 Decision	[ ]

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	NONE	9,700*	19,636	17,818	76,255	123,409

*In Program Element 64404F.

8. (U) Comparison with FY 1982 Budget Data: Not applicable.

Project: # 2849 Title: Laser Technologies and Target Vulnerabilities
Program Element: #63603 Title: Space Laser Program
DOD Mission Area: Directed Energy Technology, #554 Budget Activity: Advanced Technology Development, #2

DETAILED BACKGROUND AND DESCRIPTION: A space-based laser weapon system will require development of certain key technologies before it is feasible for system development and deployment. For the laser weapon itself, significant improvements must be made in acquisition, tracking, and pointing systems. The power output of the laser must be Beam-forming optics systems must be developed which can handle the thermal stresses associated with multi-megawatt power output. Methods for storing highly reactant, cryogenically-cooled chemicals in space over long periods of time must be found.

(U) Prior to its selection for system development, any proposed space-based laser must be thoroughly evaluated for its expected lethality against the projected target types. Experiments and analyses must also be conducted to determine feasible target hardening techniques, and methods to counter these.

RELATED ACTIVITIES. DARPA is developing the TRIAD under Program Element 62711E. Project EE-7 (Acquisition, Tracking and Pointing Experiment - TALON GOLD) includes development and space testing of the first-generation device for long-range acquisition, target tracking, and precision pointing Project EE-8 (High Power Chemical Laser Ground-Based Experiment - ALPHA) includes demonstration of a multi-megawatt, high-efficiency chemical laser in a ground-based facility to establish feasibility of system performance. Project EE-12 (Large Optics Demonstration Experiment - LODE) will demonstrate beam control optics designed to operate in space in conjunction wth a large aperture light-weight laser mirror. DARPA Program Element 62301E , Project ST-3, High Energy Laser Technology, includes development of basic technology to provide improvements in laser device efficiency, wavelength and waveform, optical components, and ultra-precise beam pointing.

(U) WORK PERFORMED BY: The Air Force Weapons Laboratory manages this effort under the direction of Space Division.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments. Not applicable. Program Element is a new line in FY 1983. Program start will be done under Program Element 64406F in FY 1982, with the $20M specifically provided by Congress in the FY 82 appropriations bill in the Space Defense System Program for this effort.

2. FY 1982 Program. The Air Force Weapons Laboratory will begin in-house and contractual efforts to resolve uncertainties in key technology areas They will initiate plans for damage and vulnerability/hardening demonstrations against projected targets; for example, aircraft and launch boosters. The Program Office will begin examination of potential growth technologies for shorter wavelength devices.

3. (U) FY 1983 Program. Air Force Weapons Laboratroy will continue technology development supporting a multi-megawatt chemical laser. They will alter development, if necessary, to accommodate finalized system requirements.

4. FY 1984 Planned Program. Air Force Weapons Laboratory will continue technology development. They will demonstrate the damage and vulnerability of a laser The most promising growth technologies will be identified by end of year.

Project: # 2849
Program Element: #63603
Dod Mission Area: Directed Energy Technology, #554

Title: Laser Technologies and Target Vulnerabilities
Title: Space Laser Program
Budget Activity: Advanced Technology Development, #2

5. Program to Completion. All technology development will be completed [ ] Nozzle efficiency measurements will be completed [ ] and mirror coating tests accomplished [ ]

6. Milestones: Date

	Milestone	Date
A.	Program Management Plan to Congress	3rd Qtr FY 1982
B.	Milestone 0	FY 1984
C.	Milestone 1 Decision	

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	None	10,300*	20,925	19,286	47,524	98,035

*In Program Element 64406F.

8. (U) Comparison with FY 1982 Budget Data. Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63605F Title: Advanced Radiation Technology
DOD Mission Area: Directed Energy Technology (ATD), 554 Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	58,237	75,516	95,120	92,400	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is the Air Force program for demonstrating the technical and engineering feasibility of using high energy lasers as directed energy weapons in USAF weapon systems. In general, the program includes broad based technology development in all aspects of laser weaponry plus airborne demonstrations of laser weapon technology. In particular, the[capability addressed by the Air Force Mission Element Need Statement for Space Defense.

BASIS FOR FY 1983 RDT&E REQUEST: Compared to the FY 82 program, the FY 83 program involves increases in the support of High Energy Laser technology development]applications. Fo [ ] high energy laser systems, the Mid Range Applied Technology program involves significant investments in the completion of subsystem upgrades and the start of laser system integration,[ ] The FY 83 program also involves the completion of the Airborne Laser Laboratory upgrades[ ]the cylindrical chemical laser integration/test program, and the expansion of the technology base for airborne laser weapons. The increase in funding from FY 81 to FY 82 and from FY 82 to FY 83 reflects a commitment to[ ]technology demonstration and provides for the[

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

Project Number	Title	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		58,481	82,729	101,746		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63605F Title: Advanced Radiation Technology
DOD Mission Area: Directed Energy Technology (ATD), 554 Budget Activity: Advanced Technology Development, #2

DETAILED BACKGROUND AND DESCRIPTION: The Air Force projects a continuing requirement to defend aerospace systems against attack. The demonstration of the gas dynamic laser concept in 1966 and the subsequent development of flowing gas laser systems provided the first laser devices with sufficient energy to be effective as directed energy weapons. Extensive studies indicated that a high energy laser can be effective against targets such as air-to-air and surface-to-air missiles, ballistic missiles, aircraft, and spacecraft. Some characteristics which make this effectiveness possible are (1) speed of light delivery with minimum lead correction and virtually no opportunity for evasive maneuver by the target; (2) rapid engagement of multiple high speed targets; (3) wide field of fire; (4) energy delivery to specific target areas with little collateral damage; (5) large magazine; (6) reusability which permits hands-on training. Successful operational laser weapon systems will have a major impact on the overall offensive and defensive strategies of US military forces. This is a broad-based technology program to demonstrate the technical and engineering feasibility of using high energy lasers as directed energy weapons in Air Force tactical and strategic combat environments. The first demonstration of laser weapon in an airborne environment will be accomplished by the Airborne Laser Laboratory. The Airborne Laser Laboratory includes a gas dynamic laser at 10.6 micrometers wavelength installed aboard a modified NKC-135 aircraft. The Airborne Laser Laboratory will demonstrate effectiveness at short range against aircraft or missile targets. Prompted by the increasing maturity of this technology, the High Energy Laser Technology Applications Study, completed in July 1978, has evaluated near-term technology and a range of potential laser weapon applications. Specific high-payoff missions identified by this analysis include

The Airborne Laser Technology program addresses the feasibility of near-term high energy laser technology for aircraft defense applications. This includes evaluation of repetitively-pulsed laser system concepts which offer enhanced propagation and target interaction capabilities. At intermediate ranges (up to laser systems operating at shorter wavelengths become more advantageous and greater pointing and tracking precision is required. The cylindrical deuterium fluoride chemical laser at about 4 micrometers wavelength shows promise of achieving efficient operation at the higher power (up to required for intermediate range missions, and the subsystems technology for more precise pointing and tracking systems is being pursued to meet the requirements for intermediate range beam control systems. The development of the Airborne Laser Laboratory-II will be based on this technology to demonstrate the feasibility of airborne laser weapons in intermediate range aircraft defense missions

The technology required for long range applications is being pursued on a conceptual basis, including laser devices with and associated beam control systems. In particular, this includes increasing emphasis on the technology for applications from space platforms. Finally, in order to define and evaluate Air Force applications, a program in system modelling and mission application studies, propagation, and effects and vulnerability of targets is being pursued.

Program Element: #63605F Title: Advanced Radiation Technology
DOD Mission Area: Directed Energy Technology (ATD), 554 Budget Activity: Advanced Technology Development, #2

(U) RELATED ACTIVITIES: This program element (PE) is part of a Department of Defense program which is coordinated by the Under Secretary of Defense for Research and Engineering, and which includes work in: Defense Advanced Research Project Agency PE 62301E, Strategic Technology, and PE 62711E, Experimental Evaluation of Major Innovative Technology; Army PE 62307A, Laser Weapon Technology, PE 63314A, High Energy Laser Components, and PE 65806A, DOD High Energy Laser Systems Test Facility; Navy PE 62735N, High Energy Laser Technology, and PE 62768N, Directed Energy Technology; and Air Force PE 62601F, Project 3326, Laser Applications, and PE 63603F, Space Laser Program. Coordination occurs through annual apportionment reviews and quarterly High Energy Laser Review Group meetings attended by the Army, Navy, Air Force, and DARPA laser program managers and representatives of the Department of Energy and the National Aeronautical and Space Administration. Coordination with Department of Energy is also effected by attendance at the Department of Energy laboratory technical program reviews, exchange of technical reports, and cooperative efforts at the working level.

(U) WORK PERFORMED BY: The Air Force Weapons Laboratory, Kirtland Air Force Base NM is responsible for managing this program. The ten major contractors in FY 1981 were: Rockwell/Rocketdyne, Canoga Park CA; Hughes Aircraft, Culver City CA; General Dynamics, Fort Worth TX; BDM, McLean VA; University of Dayton Research Institute, Dayton OH; R&D Associates, Marina Del Rey CA; Dynalectron, Albuquerque NM; Ford Aerospace, Newport Beach CA; Westinghouse, Baltimore MD; International Laser Systems, Orlando FL. The contracts totaled $39.2 million; in addition to the above, there were 25 additional contractors with contracts totaling $5.5 million. In-house test facilities involved in this work include the Advanced Radiation Technology Facility at Kirtland Air Force Base NM.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The research and development of high energy laser technology can be broadly characterized as the development of the technology base, the demonstration of the feasibility of using laser systems as weapons, and the study of potential applications for laser weapons. In laser device technology high power operation has been demonstrated in the carbon dioxide gas dynamic laser, the repetitively-pulsed carbon dioxide electric discharge laser, the carbon monoxide electric discharge laser, and the hydrogen fluoride/deuterium fluoride chemical laser; the oxygen-iodine chemical laser has been identified for scaling to high power; and other concepts for short wavelength laser devices have been investigated. In beam control technology, highly accurate beam control systems have been developed and demonstrated at low power aboard the Airborne Laser Laboratory in realistic airborne environments; the feasibility of [ ] pointing and tracking systems has been demonstrated in laboratory experiments and in ground-based field tests against [ ] targets; first-generation adaptive optics correction systems have been developed and successfully tested; and work has begun on advanced adaptive concepts to significantly improve overall laser system performance on target. Fire control technology has been investigated and a radar fire control system was developed and successfully ground tested [ ] The demonstration of weapons feasibility [ ] is an objective of the Airborne Laser Laboratory program; the Airborne Laser Laboratory high energy laser system has been integrated and successfully tested on board the Airborne Laser Laboratory aircraft, an NKC-135, and initial flight testing against an AIM-9B missile target [ ] has been completed.

] The

Program Element: #63605F Title: Advanced Radiation Technology
DOD Mission Area: Directed Energy Technology (ATD), 554 Budget Activity: Advanced Technology Development, #2

Mid Range Applied Technology program has been established to demonstrate the technology for high energy laser system. System studies and application analyses have been undertaken to provide direction to the technology base development and demonstration, and to establish potential laser weapon effectiveness.

2 FY 1982 Program: In the Airborne Laser Laboratory program:

In the Airborne Laser Technology program: the evaluation of repetitively-pulsed laser systems for aircraft defense applications; the deuterium fluoride cylindrical chemical laser and annular resonator optics and alignment system; define critical issues and develop the conceptual definition of shorter wavelength laser systems for both short and intermediate range (up to aircraft defense. In the Mid Range Applied Technology program:

In Advanced Development/Support activities: Continue the development and expansion of the technology for high energy lasers, including the investigation of concepts for laser systems and complete system studies and application analyses to identify critical technology for space-based lasers.

3. FY 1983 Planned Program: In the Airborne Laser Laboratory program:

In the Airborne Laser Technology program: the annular resonator and alignment system with the gain generator deuterium fluoride cylindrical chemical laser; evaluate the potential of the oxygen-iodine chemical laser device for airborne applications and begin the development of a continue investigations of critical beam control technology; continue technology development and effects/vulnerability investigations to evaluate repetitively-pulsed laser systems for aircraft defense applications. In the Mid Range Applied Technology program:

In Advanced Development/Support activities: Continue the development and expansion of the technology for high energy lasers, including the investigation and development of concepts for laser systems.

The current FY 83 resource estimate reflects a decrease of $3.8 million from the previous estimate. In the Airborne Laser Laboratory program,

in addition, a revision to this test series is being considered to incorporate additional technology and test scenarios. This revision would use the Airborne Laser Laboratory in a more extensive role to evaluate technology and provide engineering data

Program Element: #63605F Title: Advanced Radiation Technology
DOD Mission Area: Directed Energy Technology (ATD), 554 Budget Activity: Advanced Technology Development, #2

] In the Mid Range Applied Technology program, an extensive investigation of demonstration options led to the re-direction of the program to [ ] will use available laser device and beam director hardware which will be upgraded and integrated [

4. FY 1984 Planned Program: In the Airborne Laser Laboratory program: [ ] In the Airborne Laser Technology program:] evaluation of pulsed and continuous wave laser system technologies for [ ] aircraft defense applications; continue laser device and beam control technology investigations for intermediate range applications. In the Mid Range Applied Technology program: [ ] In Advanced Development/Support activities: Continue the development and expansion of the technology for high energy lasers, including component development/scale-up of [ ] laser system concepts.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Budget Data: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63723F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Civil and Environmental Engineering Technology
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3,839	3,885	4,502	5,163	Continuing	Not Applicable
2103	Environmental Quality/Facilities Energy Technology	770	700	800	913		
2104	Civil Engineering Technology	2,869	2,900	3,302	3,800		
2672	Special Terrestrial Power	200	285	400	450		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides technology base to ensure air base survivability and enhance force readiness. Includes efforts to: develop an improved Post Attack Launch and Recovery capability; optimize airfield surfaces maintenance, repair, and new construction techniques; provide technology for more effective tactical deployment, air mobility, and base survivability; ensure compatibility with Federal, Department of Defense (DOD), and local environmental policies and regulations during peace time and adapt Department of Energy (DOE) technology to reduce Air Force energy consumption and petroleum-fuel dependence.

(U) BASIS FOR FY 1983 RDT&E REQUEST: In support of Tactical Air Forces' need for Post Attack Launch and Recovery, a civil engineering effort will continue to develop rapid runway repair materials and techniques, develop aircraft surface roughness criteria and finalize alternate surface designs. Recycling techniques will be developed for airfield pavements to meet Air Force requirements and requirements of the Resource Conservation and Recovery Act of 1974. In environmental quality technology, cleanup and treatment techniques will be developed to handle AF hazardous wastes. Fuel cell power systems will be developed using DOE technology for AF remote site, emergency, and mobile applications. The cost estimates were derived using analogous contract manhour, material, and overhead charges adjusted for program complexity, risk and inflation.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY ($ in thousands):

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	3,860	4,100	4,700		Continuing	Not Applicable
Military Construction			3,700			

(U) OTHER APPROPRIATION FUNDS ($ in thousands): Not Applicable.

Program Element: #63723F
DOD Mission Area: Engineering Technology (ATD), #553

Title: Civil and Environmental Engineering Technology
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: One of the most important problems affecting the Air Force in the areas of civil engineering is the launch and recovery of aircraft after an enemy attack. The Tactical Air Forces Statement of Operational Need (SON) 319-79, Post Attack Launch and Recovery, states that to support the Tactical Air Forces' mission to conduct sustained combat operations, the Air Force requires an improved capability to launch and recover aircraft from its own and allied air bases following a conventional air attack. Although the Tactical Air Force is primarily concerned with its main operating bases because they support the primary in-place forces, a similar capability is required for those bases which will be supporting the augmenting forces and resupply airlift. Efforts in this program element address the technology for rapid assessment and repair of bomb damage, the identification of alternate surfaces to support launch and recovery, and the establishment of roughness criteria for aircraft operations over repaired or alternate surfaces. A second problem is stated in Air Force Engineering and Services Center Statement of Operational Need 01-80, Recycling Air Force Pavements: The Air Force Civil Engineer is responsible for maintaining over 250 million square yards of airfield pavement throughout the world. This represents over $9.5 billion in capital replacement costs, of which 90% has exceeded its 20 year design life. Increasing construction cost and continued deterioration of those pavements are limiting the quality of runways, taxiways, and aprons the Air Force has to support strategic defense and offense, airlift and counter-air mission areas. If current methods are used to maintain and repair pavements in the future, they will continue to deteriorate because of Operations and Maintenance dollar constraints. Only by developing and employing recycling technology can the Air Force maintain servicable airfield pavements under current funding policies. Efforts within this program element are aggressively attacking this problem. Other problem areas supported in this program element include environmental pollution and energy conservation.

(U) RELATED ACTIVITIES: The efforts within this program are of significant interest to the other services and are specifically coordinated through the Joint Services Civil Engineering Research and Development Coordinating Group, which is responsive to the Department of Defense. This group ensures efforts are not duplicated across the services and that maximum technology transfer is obtained. In addition, the group has an airbase survivability panel which reviews Post Attack Launch and Recovery efforts. Efforts of civilian or national interest are coordinated as appropriate with the Federal Aviation Agency, National Aeronautics and Space Administration, Environmental Protection Agency, and Department of Energy; and joint programs have been established with those agencies. Other agency research programs in energy and environment are periodically assessed by the Air Force to take advantage of those technologies at little or no cost. This program directly funds related engineering development projects that transition into Program Element 64708F, Other Operational Equipment. Additionally, Program Element 62601F, Advanced Weapons, directly funds exploratory development in Environmental Quality and Civil Engineering technology.

(U) WORK PERFORMED BY: This program is managed by the Director of Laboratories, Air Force Systems Command and is executed by the Engineering and Services Laboratory, Air Force Engineering and Services Center, Tyndall Air Force Base, FL. Ten percent of this program's work effort is accomplished in-house while the remainder is accomplished under contract. In-house laboratory facilities include the capability for: subscale and limited full scale protective construction and pavement weapons effects testing, design and testing of airfield pavement materials and construction techniques, computer facility and utility design analysis, and environmental chemistry research. In 1981, the top

Program Element: #63723F | Title: Civil and Environmental Engineering Technology
DOD Mission Area: Engineering Technology (ATD), #553 | Budget Activity: Advanced Technology Development, #2

contractors were: BDM Corporation, McLean, VA; University of California, Berkeley, CA; University of New Mexico, Albuquerque, NM; Science Applications Incorporated, La Jolla, CA; CENTEC, Reston, VA; University of Texas, Austin, TX; College of William and Mary, Williamsburg, VA; Fairchild, Farmingdale, NY; Fire Research Corporation, Nesconset, NY; FEECON Corporation, Westborough, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1981 and Prior Accomplishments: In support of Post Attack Launch and Recovery, completed F-4 surface roughness criteria and using this criteria finalized procedure for manual selection of a minimum operating strip. Also transitioned the aerial damage assessment system to ASD. Completed a comprehensive recycling test plan to address airfield pavement recycling SON. Completed design of an advanced panel for mobile shelters. In environmental engineering, the spill assessment model is now available for use as a management tool to assess spills of hydrazine fuels and other hazardous materials into water bodies. Techniques for biological treatment of phenolic wastes and solvent removal from groundwater were developed. Developed a range planning hazard analysis model which applies state-of-the-art risk analysis techniques to weapons delivery in weapons tests and aircrew training. Initiated special terrestrial power project by beginning adaption of DOE fuel cell technology to AF applications.

2. (U) FY 1982 Planned Program: Continue support of TAF SON 319-79, Post Attack Launch and Recovery with following efforts: In bomb damage repair, continue development of advanced crater repair materials and techniques and develop near term repair methods using fiber reinforced polyester mats. Complete development of validated surface roughness criteria for the C-130 and C-141 and continue development of F-15, F-16, A-10, C-5, DC-10 and 747 surface roughness criteria. Complete evaluation of alternate surface conceptual designs and select a specific design for field testing. Complete development of a manual damage assessment system. Establish criteria for heavy load, high tire pressure recycled airfield asphaltic pavements. In environmental engineering, continue efforts to define the toxic corridor associated with either a planned or accidental release of toxic fuels. Evaluate the performance of an aerated trickling filter bioreaction in treating paint stripping wastewater. Also, continue development and testing of hardware to control trace level contamination of trichloroethylene in groundwater. Continue adaption of DOE fuel cell technology to AF applications by design and fabrication of hardware.

3. (U) FY 1983 Planned Program: Continue support of Post Attack Launch and Recovery through specific efforts: Continue development of repair techniques using advanced materials and develop equipment for handling of these materials. Complete F-15, C-5A, DC-10, and 747 roughness criteria. Complete aircraft/soil interaction study and finalize alternate surface and damage resistant runway designs. Complete minimum operating strip selection criteria for multiple aircraft. Address SON on airfield pavement recycling by initiating study to recycle portland cement concrete for heavy load airfield pavements. Continue hardened structure overlay development and initiate airbase survivability assessment for 1990's threat. In the area of environmental engineering, develop methods for cost effective investigation and cleanup of AF contaminated groundwater. Provide recovery, reduction and treatment technology to handle AF hazardous wastes. Continue adaption of DOE technology for a 5 and 40 kilowatt fuel cell power system able to use AF fuels at remote site applications.

Program Element: #63723F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Civil and Environmental Engineering Technology

Budget Activity: Advanced Technology Development, #2

4. (U) FY 1984 Planned Program: The planned program will continue to emphasize technology development of advanced materials, techniques, and procedures which enhance the Post Attack Launch and Recovery Capability, ability to recycle airfield pavements, airfield pavement performance and facilities operation and maintenance. Complete F-16 and A-10 roughness criteria and continue efforts on foreign object damage protection to aircraft passing over repaired craters. Initiate pilot testing of in-place destruction of hazardous spills. Continue development of advance technologies for understanding and reducing smoke visibility in aircraft engine exhaust plumes and for reducing smoke from aircraft test facilities. Continue testing of remote sensing equipment for aircraft pollutants, toxic vapor clouds and chemical warfare agents. Evaluate 5 and 40 kilowatt, 40% efficient fuel cell power systems under operational conditions. Begin development of a multi-fuel combustor for a Stirling cycle heat engine to be used in AF remote site and tactical mobile applications.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63728F
DOD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Computer Technology
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	4,438	4,782	4,957	5,816	Continuing	Not Applicable
2527	Software Life Cycle Tools	0	0	700	700	Continuing	Not Applicable
2528	Software Data Collection and Analysis	622	520	0	0	0	1,998
2529	Computer Architecture Applications	453	600	500	800	Continuing	Not Applicable
2530	Distributed System Technology	621	2,022	2,200	2,816	Continuing	Not Applicable
2531	Software Engineering Tools and Methods	1,186	630	0	0	0	3,816
2532	High Order Language Discipline	1,556	1,010	1,557	1,500	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops and demonstrates technologies to reduce the mushrooming costs of developing and modifying military computer software. Thrusts include automating the software development process, introducing a prudent amount of standardization into the process, and providing management tools to control the process. This program is also responsive to the fact that weapons system complexity and the availability of low cost microprocessors are driving military embedded computer systems toward the concept of distributed data processing. Our objective is to exploit advances in distributed processing technology and develop techniques to satisfy critical military requirements such as fault tolerance, reliability, and survivability in the battlefield environment.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The major thrust is to continue development of techniques to decentralize the control of military distributed processing systems in order to eliminate the central control processor as a potential single point failure element. Methods of fault sensing, data sharing and automatic reconfiguration, critical to increased system reliability and survivability in the distributed environment, will be developed and evaluated against Command Control system requirements. In cooperation with the Army, we will continue the emulation and evaluation of the Nebula instruction set architecture based on Air Force requirements for a standard 32 bit processor. We will also continue development of compilers and a programming support environment to support implementation of Ada as the new DOD standard computer programming language in FY 1984. The cost estimates were derived using analogous contract manhour, material, and overhead charges adjusted for program complexity, risk and inflation.

Program Element: #63728F
DOD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Computer Technology
Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	4,650	4,900	5,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63728F
DOD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Computer Technology
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: All major weapons systems contain embedded computers performing critical functions such as guidance, navigation and the processing of data gathered from a variety of sensors and sources. This technology base program was established to develop and demonstrate the broad spectrum of design techniques, programming tools and models required to improve the performance and reduce the life cycle cost of computer hardware and software embedded in Air Force weapons systems. Scarcity of skilled software manpower and rapidly increasing software costs within DOD have caused special program emphasis to be placed on improving the software development process for embedded computer systems. A DOD-wide computer resource technology program was established as outlined in the Defense Computer Resources Technology Plan. This plan ties the programs of all services together to achieve maximum benefits from invested funds by eliminating duplicative efforts and by identifying areas where additional emphasis is needed. Program Element 63728F, along with related exploratory and engineering development programs, implements the Air Force portion of the DOD program and has thrusts in several areas: (1) Software Life Cycle Tools - to develop automated aids for generating software specifications from user requirements and to develop tools, along with a structured methodology, to aid in software design, testing and modification; (2) Computer Architecture Applications - to evaluate state-of-the-art computer architectures against potential military applications and to provide the technology base to support standardization efforts in computer hardware; (3) Distributed System Technology - to develop tools, techniques and the necessary simulation capability to analyze, specify and evaluate distributed computer systems and to provide solutions to the military unique problems of high reliability, survivability, and rapid reconfigurability; (4) High Order Language Discipline - to support implementation of Ada, the DOD standard language, including development of compilers to be hosted on and targeted for Air Force computer systems and development of other programming support tools for Ada.

(U) RELATED ACTIVITIES: This program supports and is responsive to the DOD Defense Computer Resources Technology Plan and the DOD sponsored Software Technology Initiative. It is related to other programs which constitute the DOD Software Science and Technology Program: 62725A, Computer and Information Sciences; 63723A, Tactical Automation; 62721N, Command and Control Technology; 63526N, Advanced Computer Technology, 64574N Tactical Embedded Computer Program; 62708E, Distributed Information Systems; 62702F, Command, Control and Communications; 62204F, Aerospace Avionics; 63226F, DOD Common Programming Language; and 64740F, Computer Resources Management Technology. Air Force thrusts generally transition into this program from 62702F and are coordinated through technical reviews at the staff and engineering levels. Coordination with other services is achieved through the Research and Development Technology Panel of the Management Steering Committee for Embedded Computer Resources, annual DOD apportionment reviews and the Ada Joint Program Office.

(U) WORK PERFORMED BY: Rome Air Development Center, Griffiss AFB NY has management responsibility for this program. Contractors include: Massachusetts Computer Associates, Wakefield MA; General Systems Group, Salem NH; Bolt, Baranek and Newman, Cambridge MA; Softech, Waltham MA; Illinois Institute of Technology Research Institute, Chicago, IL; Pattern Analysis and Recognition, Rome NY; TRW, Redondo Beach CA; and Intermetrics, Cambridge MA.

Program Element: #63728F
DOD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Computer Technology
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Developed a compiler for the Air Force JOVIAL J73 computer language which is hosted on the IBM 360/370 machine. Completed development of additional programming support and verification tools for Air Force implementation of the J73 language. Completed National Software Works enhancements required to fully exploit a joint demonstration involving Air Force Systems Command and Air Force Logistics Command. Provided 600,000 dollars direct support to the DOD managed Ada implementation effort.

2. (U) FY 1982 Program: Begin development and evaluation of techniques to improve fault sensing, resource sharing and automatic reconfiguration in tactical distributed data processing systems. Complete National Software Works program by demonstrating the networking of geographically separated programming tools within the laboratory and logistics communities (Concludes Project 2531). Transition the Data Analysis Center for Software to the Defense Technical Information Center (Concludes Project 2528). Continue development of Ada compilers and the Ada Programming Support Environment (APSE).

3. (U) FY 1983 Planned Program: Complete demonstration of the distributed processing simulation capability. Use this capability to continue development of resource sharing and reconfiguration techniques for military distributed processing systems. Complete development of initial Ada compiler for the IBM 370 series computer and begin development of follow-on Ada compilers for other Air Force computer systems. Continue development of the total integrated APSE necessary to effectively use the Ada language in Air Force systems. Continue evaluation of the Nebula 32 bit instruction set architecture as an Air Force standard. The 900,000 dollar reduction in the FY 1983 planned program will delay the development of a J73-to-Ada language translator and the demonstration of a reconfigurable distributed computing system by one year.

4. (U) FY 1984 Planned Program: Complete demonstration of distributed processing configurations to allow resource sharing and automatic system reconfiguration. Complete APSE development and validate Ada compilers for use in software development programs. Begin demonstration of Nebula on selected Command Control applications. Begin demonstration of an automated software requirements analysis tool.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63743F Title: Electro-Optical Warfare
DOD Mission Area: Electronic & Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	10,657	10,261	15,927	22,636	Continuing	Not Applicable
431G	Electro-Optical Warfare	8,957	8,261	11,027	15,970	Continuing	Not Applicable
2222	Advanced Electro-Optical Countermeasures	1,700	2,000	4,900	6,666	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides advanced development, risk reduction and feasibility/military worth demonstration of countermeasures against visually, electro-optically, or infrared aimed or guided surface-to-air and air-to-air weapons. Current Soviet antiaircraft artillery (AAA) and radar directed surface-to-air missile (SAM) systems use some form of optics as a backup to the radar. In addition, shoulder fired SAMs and air launched missiles have been developed to home on engine radiation. Both strategic and tactical aircraft that operate over or near hostile territory may be exposed to these weapons.

BASIS FOR FY 1983 RDT&E REQUEST: Efforts in FY 1983 will accelerate advanced development work addressing existing and predicted critical technology voids for countering Soviet air defenses. These efforts include a flare concept to decoy infrared (IR) missile threats with flare rejection circuitry, flare techniques to counter missile threats using signal tracking, all aspect missile warning for strategic aircraft and an electro-optical countermeasures system to provide self protection for tactical aircraft. flare designs for the A-10 and F-15 will be completed and transitioned to full scale development. The cost estimate is based upon the number of different development areas, technological risk associated with these areas and previous experience.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	11,290	10,500	18,700		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63743F   Title: Electro-Optical Warfare

DOD Mission Area: Electronic & Physical Sciences (ATD), #551   Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The enemy air defense network is made up of electronic and electro-optical devices that locate, monitor, guide, and control the offensive and defensive elements. Denial of enemy use of these elements is directly related to the survivability of our aircrews and the number of weapons delivered to the target. Initially, enemy air defense systems operated only in the communications and radar frequencies (approximately 20 mega hertz to 18 gigahertz). However, as weapon systems became more sophisticated, enemy threat systems began to use optical and infrared (IR) types of devices as a backup or as a primary means to enhance their capability. Recognizing this increased emphasis in electro-optics, Program Element 63743F was established in 1972 to develop and demonstrate countermeasures to these enemy systems.

The program consists of two projects. Project 2222 funds development of active countermeasures and warning/location systems against optical tracking devices used to guide antiaircraft fire and surface-to-air missiles. Project 431G funds development of both active and passive countermeasures against the entire electro-optical threat. Active countermeasures include IR guided weapons jammers as well as counters to weapons. Passive counters include aircraft camouflage, IR signature suppression, flares to decoy IR missiles, and receiver systems to warn aircrews and activate countermeasures to approaching missiles.

RELATED ACTIVITIES: The efforts in this program are closely coordinated with other Air Force electro-optical, electronic warfare, and reconnaissance and target acquisition programs, as well as the advanced development work in similar areas by the Army and the Navy through joint reviews conducted by the Joint Technical Coordinating Group. Maximum utilization of common optical hardware and techniques is stressed; equipment developed under other programs is modified only enough to perform those functions peculiar to the countermeasures problem. New developments are undertaken only when the technology base does not exist to satisfy the specific function required. Exploratory development efforts are phased into this program from Program Element 62204F, Aerospace Avionics. Completed electro-optical efforts are transitioned into engineering development under PE 64710F, Reconnaissance Equipment; PE 64738F, Protective Systems; and PE 64739F, Tactical Protective Systems. Joint Air Force/Navy efforts include the Advanced Electro-Optical Countermeasure Pod, COMPASS HAMMER; a low cost tail warning receiver development; and aircraft infrared signature reduction. Joint Air Force/Army efforts include and visual countermeasures effects and an infrared The F-15 contrast reduction effort is jointly sponsored with DARPA.

(U) WORK PERFORMED BY: Testing is performed at the Air Force Armament Division, Eglin AFB, FL and China Lake, CA. The Air Force Avionics Laboratory, Wright-Patterson AFB, OH, manages the program. The major contractors are: Raytheon Corporation, Bedford, MA - analysis and simulation; AVCO Corporation, Wilmington, MA - flare material and dispensers; HYCOR Corporation, Woburn, MA - flares; MB Associates, San Ramon, CA - flare research and testing; Quest Research, Wash, DC - electro-optical countermeasure technique analysis; Perkin-Elmer Corporation, Wilton, CT - optical receivers; Hughes Aircraft Corporation, Culver City, CA - infrared jammers and optical sensors; Honeywell Inc., Lexington, MA - missile warning system; Martin-Marietta Corporation, Orlando, FL - optical countermeasures; Westinghouse Corporation, Baltimore, MD - optical countermeasures and lasers; and SAI, Albuquerque, NM - optical countermeasures effectiveness evaluation.

Program Element: #63743F   Title: Electro-Optical Warfare
DOD Mission Area: Electronic & Physical Sciences (ATD), #551   Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Accomplishments include demonstration and transition of an improved per- performance, lower cost, and higher availability [ ] flare decoy to protect the B-52 against advanced threat missiles. Camouflage paint schemes were developed and are now used on the F-16, A-10 and E-3A. A missile tail warning system was developed and is now in production for strategic and tactical aircraft (ALQ-153). Improved flares for the B-52 and F-111 are now in production. Both COMPASS HAMMER optical countermeasure pods completed fabrication and began testing. Concepts for countering [ ] were analyzed for follow-on hardware development.

2. FY 1982 Program: New starts in FY 1982 include a reliability improvement demonstration for flare decoy dispensers, a technique to passively discriminate between optical threats and decoys, an advanced [ ] warning receiver sensor to warn aircrews and activate expendable decoys against [ ] guided threats, and a system to reduce the visual contrast [ ] Continued efforts include [ ] flares for the A-10 and F-15 to improve survivability and reduce flare procurement costs, threat [ ] and weapon cuing system to suppress enemy air defenses, and efforts to reduce the size, weight, and cost of optical [ ] countermeasures used to provide a self protection capability against optically guided threats. Scheduled for completion are a pyrophoric flare design for the F-4 and F-16, flight testing of a dual mode (infrared/pulse doppler) tail warning system for close air support aircraft (required because of the very short response time at low altitude), and flight testing of the COMPASS HAMMER electro-optical countermeasure (EOCM) system designed to provide protection against EO guided weapons.

3. FY 1983 Planned Program: The FY 1983 program represents a significant increase in funding in order to accelerate critical technologies. New starts include a [ ] flare concept to decoy infrared missile threats with flare rejection circuitry; flares techniques to counter advanced missile threats using [ ] signal tracking; multispectral coatings and paints to reduce optical, [ ] and infrared aircraft signature, thereby reducing detection range; development of an infrared [ ] jamming source to [ ] counters to [ ] weapons; all-aspect missile warning system for strategic aircraft; and efforts to improve the performance, reliability/maintainability, and power efficiency of EOCM systems to provide more acceptable self protection systems for tactical aircraft. Continued efforts include expendable [ ] decoys, infrared countermeasures effects on missile seekers, and [ ] warning sensors. Scheduled for completion are A-10 and F-15 [ ] flares, optical threat detection and cuing designs, optical decoy discrimination and an improved [ ] jamming transmitter to reduce the size and cost of EOCM systems. Funds in FY 1983 were reduced to fund higher priority Air Force requirements.

Program Element: #63743F Title: Electro-Optical Warfare
DOD Mission Area: Electronic & Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

4. FY 1984 Planned Program: The FY 1984 program includes a major new start to develop a next generation infrared countermeasure system for strategic aircraft. Continued areas of emphasis include flares to counter advanced missile seekers, optical and electro-optical signature reduction, counters to [ ] weapons, [ ] warning systems and all-aspect missile warning for both strategic and tactical aircraft.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

Project: 431G | Title: Electro-Optical Warfare
Program Element: #63743F | Title: Electro-Optical Warfare
DOD Mission Area: Electronic & Physical Sciences (ATD), #551 | Budget Activity: Advanced Technology Development, #2

(DETAILED BACKGROUND AND DESCRIPTION: Project 431G was established to demonstrate advanced development countermeasures to enemy air defense guidance systems which operate in the optical spectrum [ ] Examples of such systems are IR heat seeking missiles which home in on aircraft jet engines and television cameras which can track airborne targets and provide guidance to enemy anti-aircraft guns or surface-to-air missiles. Improvements in these systems and development of new weapons using [ ] parts of the optical spectrum require continuing development to gain and maintain an advantage over the threat.

(U) Efforts in Project 431G include the following: (1) a supporting analysis and simulation effort that guides the allocation of funding through the evaluation of new concepts and techniques; (2) camouflage to prevent or delay detection of US Air Force aircraft; (3) receiver systems on aircraft to warn crew members and activate countermeasures; (4) decoys and jammers to counter enemy air defense weapons; and (5) optical intelligence collection devices to gain information about enemy weapons.

RELATED ACTIVITIES: The efforts in this program are closely coordinated with other Air Force electro-optical, electronic warfare, and reconnaissance and target acquisition programs, as well as the advanced development work in similar areas by the Army and the Navy through joint reviews conducted by the Joint Technical Coordinating Group. Maximum utilization of common optical hardware and techniques is stressed; equipment developed under other programs is modified only enough to perform those functions peculiar to the countermeasures problem. New developments are undertaken only when the technology base does not exist to satisfy the specific function required. Exploratory development efforts are phased into this program from Program Element 62204F, Aerospace Avionics. Completed electrooptical efforts are transitioned into engineering development under PE 64710F, Reconnaissance Equipment; PE 64738F, Protective Systems; and PE 64739F, Tactical Protective Systems. Joint Air Force/Navy efforts include the low cost tail warning receiver development and aircraft infrared signature reduction. Joint Air Force/Army efforts include optical target discrimination and visual countermeasure effects and infrared [ ] The F-15 contrast reduction effort is jointly sponsored with DARPA.

(U) WORK PERFORMED BY: Testing is performed at the Air Force Armament Division, Eglin AFB, FL and China Lake, CA. The Air Force Avionics Laboratory, Wright-Patterson AFB, OH, manages the program. The major contractors are: Raytheon Corporation, Bedford, MA - analysis and simulation; AVCO Corporation, Wilmington, MA - flare material and dispensers; HYCOR Corporation, Woburn, MA - flares; MB Associates, San Ramon, CA - flare research and testing; Quest Research, Wash, DC - electro-optical countermeasure technique analysis; Perkin-Elmer Corporation, Wilton, CT - optical receivers; Hughes Aircraft Corporation, Culver City, CA - infrared jammers and optical sensors; Honeywell Inc., Lexington, MA - missile warning system; Martin-Marietta Corporation, Orlando, FL - optical countermeasures; Westinghouse Corporation, Baltimore, MD - optical countermeasures and lasers; and SAI, Albuquerque, NM - optical countermeasures effectiveness evaluation.

Project: 431G Title: Electro-Optical Warfare
Program Element: #63743F Title: Electro-Optical Warfare
DOD Mission Area: Electronic & Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Accomplishments include demonstration and transition of an improved performance, lower cost, and higher availability [ ] flare decoy to protect the B-52 against advanced threat missiles. Camouflage paint schemes were developed and are now used on the F-16, A-10 and E-3A. A missile tail warning system was developed and is now in production for strategic and tactical aircraft (ALQ-153). Improved flares for the B-52 and F-111 are now in production. Concepts for countering [ ] were analyzed for follow on hardware development.

2. FY 1982 Program: New starts in FY 1982 include a reliability improvement demonstration for flare decoy dispensers, a technique to passively discriminate between optical threats and decoys, an advanced laser warning receiver sensor to warn aircrews and activate expendable decoys against [ ] guided threats, and a system to reduce the visual contrast [ ] Continued efforts include [ ] for the A-10 and F-15 to improve survivability and reduce flare procurement costs, and threat optical detection and weapon cuing system to suppress enemy air defenses. Scheduled for completion are a [ ] flare design for the F-4 and F-16 and flight testing of a dual mode (infrared/pulse doppler) tail warning system for close air support aircraft (require because of the very short response time at low altitude).

3. FY 1983 Planned Program: The FY 1983 program represents a significant increase in funding in order to accelerate critical technologies. New starts include a [ ] flare concept to decoy infrared missile threats with flare rejection circuitry; flares techniques to counter advanced missile threats using [ ] signal tracking; multispectral coatings and paints to reduce optical, [ ] and infrared aircraft signature, thereby reducing detection range; development of an infrared [ ] missile seekers counters to [ ] weapons; all-aspect missile warning system for strategic aircraft; and efforts to improve the performance, reliability/maintainability, and power efficiency of Electro-optical countermeasures (EOCM) systems to provide more acceptable self protection systems for tactical aircraft. Continued efforts include expendable [ ] decoys, infrared countermeasure effects on missile seekers, and [ ] warning sensors. Scheduled for completion are A-10 and F-15 [ ] flares, optical threat detection and cuing designs, optical decoy discrimination and an improved [ ] jamming transmitter to reduce the size and cost of EOCM systems.

4. FY 1984 Planned Program: The FY 1984 program includes a major new start to develop a next generation infrared countermeasure system for strategic aircraft. Continued areas of emphasis include flares to counter advanced missile seekers, optical and electro-optical signature reduction, counters to [ ] weapons warning systems and all-aspect missile warning for both strategic and tactical aircraft.

Project: 431G | Title: Electro-Optical Warfare
Program Element: #63743F | Title: Electro-Optical Warfare
DOD Mission Area: Electronic & Physical Sciences (ATD), #551 | Budget Activity: Advanced Technology Development, #2

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to completion	Total Estimated Costs
RDT&E	8,957	8,261	11,027	15,970	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	9,590	8,300	13,300		Continuing	Not Applicable

(U) FY 1983: Funding in FY 1983 represents a $2,273 thousand decrease. Overall program element funding was reduced in order to fund higher priority Air Force readiness issues. The impact of this decrease will delay efforts in integration electro-optical and radar countermeasures and warning systems for new aircraft.

FY 1983 DESCRIPTIVE SUMMARY

Program Element: #63750F
Title: Counter-Countermeasures (CCM) Advanced Development
DOD Mission Area: Electronic & Physical Sciences (ATD), #551
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5,948	1,893	7,041	11,425	Continuing	Not Applicable
2333	Ground Radar Electronic Counter-Countermeasures	1,000	700	1,700	2,900	Continuing	Not Applicable
2334	Airborne Radar Electronic Counter-Countermeasures	2,498	400	2,200	2,800	Continuing	Not Applicable
2335	Communication & Navigation Electronic Counter-Countermeasures	1,250	700	2,000	2,615	Continuing	Not Applicable
2347	Optical Counter-Countermeasures	1,200	093	1,141	3,110	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This technology base program element is the only Air Force advanced development program element developing generic counter-countermeasures for ground radar, very high frequency and high frequency communications, airborne radar and electro-optical weapons and sensors. Individual Air Force programs are responsible for developing counter-countermeasures into their systems, however, this technology base program element is vitally needed to assist these programs in providing generic counter-countermeasures that can be incorporated into both developmental and fielded systems. Technologies developed under this program feeds directly to fielded systems and also establishes a data base for future systems.

BASIS FOR FY 1983 RDT&E REQUEST: Ground radar passive correlation techniques for improved electronic counter-countermeasures will be continued. Development of a radar main beam noise canceller will continue. The low cost anti-radiation missile decoy for [ ] will be delivered to the SPO for Full Scale Engineering development. The countermeasures resistant very low frequency and high frequency communications adaptive antenna will be transferred to engineering development. The troposcatter communications system with a full duplex capability will be transferred to engineering development. Adaptive low cost data link development will continue.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
6,700	2,000	8,800			22,482

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63750F — Title: Counter-Countermeasures (CCM) Advanced Development

DOD Mission Area: Electronic & Physical (ATD), #551 — Budget Activity: Advanced Technology Developments #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element (PE) was established to counter an increasing countermeasure (CM) threat as documented by requirements arising from Southeast Asia, the Middle East, and threat projections for Central Europe. Some current US electronic equipment requires discrete counter-countermeasures (CCM) modifications to keep pace with the threat and to extend their useful operational life in jamming, deception, chaff, clutter or suppression environments; thereby avoiding more expensive system replacement programs. Future radar, radio, and optical equipment will benefit from early, systematic, and economical incorporation of state-of-the-art CCM capabilities during their design stage. Programmable processing that will allow changes via software will allow future systems to more readily keep pace with the threat. However, a continuing program to develop new software and in some cases, hardware, will be required if the Air Force is to operate effectively in a hostile electromagnetic combat environment.

(U) Program Element #63750F contains four projects: #2333, Ground Radar Electronic Counter-Countermeasures; #2334, Airborne Radar Electronic Counter-Countermeasures; #2335, Communications & Navigation Electronic Counter-Countermeasures; and #2347, Optical Counter-Countermeasures. Tasks scheduled under these projects will cross-apply appropriate, demonstrated technologies to develop wide application of CCM techniques for existing and developmental systems. The following general task areas will be used: simulation and analysis, waveform generation, signal radiation and reception, signal discrimination and enhancement, survivability enhancement technology, electro-optical (E-O), laser, and infrared vulnerability assessments.

(U) RELATED ACTIVITIES: This program will affect strategic offense and defense and general purpose force activities, and responds to a wide range of requirements. Technical coordination will be effected with laboratories and commands of the other services, as well as in-house Air Force technical agencies and facilities and the operational commands. PE 64201F, Aircraft Avionics Equipment Development, is developing advanced software for aircraft radars with programmable signal processors (e.g., F-15). PE 63750F, Project 2334 will feed that effort.

(U) WORKED/PERFORMED BY: Rome Air Development Center, Rome NY has program management responsibility and project responsibility for ground radar and communication/navigation CCM; the Air Force Avionics Laboratory, Wright-Patterson AFB, OH has project responsibility for airborne radar CCM and optical CCM. Specific tasks will be performed by Air Force computer simulation facilities or other agencies possessing necessary expertise or resources. Some tasks will be performed under contract. The low cost decoy effort is on contract to Brunswick Corp., Costa Mesa, CA; the Tropo Communication Antenna and Processor is on contract to CNR Incorporated, Needham, MA. The very low frequency antenna receive system is on contract to AIL division of Eaton Corp.; and the Air-to-Air Radar Baseline Technology contract is with Hughes Aircraft Corp., Los Angeles, CA. Optical CCM contracts are to Mead Technology Laboratories Dayton, OH; Science Applications Corp., La Jolla, CA; Hughes Aircraft, Culver City, CA; Honeywell Corp., Boston, MA; and Systems Research Laboratory, Dayton, OH.

Program Element: #63750F
DOD Mission Area: Electronic & Physical Sciences (ATD), #551

Title: Counter-Countermeasures (CCM) Advanced Development
Budget Activity: Advanced Technology Development, #2

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments:

(U) Project #2333: A signal processor using spread spectrum technology for a Digitally Coded Radar was developed in conjunction with Program Element PE 63789F, command, control, and communications advanced development. Development of The Ultra Low Sidelobe Antenna and Anti-Radiation Missile Alarm Sensor has been transferred to PE 27412F, Tactical Air Control System Improvements for Engineering Development.

(U) Project #2334: Development began on the air-to-air counter-measures (CM) technology baseline to determine electronic CCM techniques applicable to modern pulse doppler digital radars and to establish quantitative engineering baseline data. Radar test units were instrumented. Enemy electronic countermeasures threat scenarios have been developed.

Project #2335: Design of a Phased Array Receive Antenna and Adaptive Signal Processor for Troposcatter Communication was completed and testing was initiated. The system is to provide] Design of a very low frequency/high frequency adaptive antenna receiver system for] was completed and testing was initiated. The design of Troposcatter Communications Adaptive Antenna and co ,'omentary Adaptive Signal Processor was completed. Development of a sidelobe canceller as near term fix ' was begun. Fabrication of an Adaptive Antenna Processor] Tactical Troposcatter Communications was initiated.

Project #2347: Tasks were initiated to reduce the vulnerability of imaging electro-optical (E-O) receivers to flares and spoofers; develop a mathematical model of the acquisition/tracking system for laser guided weapons and develop new techniques for [modulation and 'coding, use of [ ] reduction; conduct a vulnerability assessment of E-O receivers and illuminators; compare optical target and decoy signatures; reduce to defeat laser countermeasures; and develop second generation coding schemes for laser signal discrimination and rejection of [, jammers. A wide dynamic range receiver processor development and target discriminating receiver demonstration were initiated.

2. (U) FY 1982 Planned Program:

(U) Project #2333: Continue development of the low cost Anti-Radiation Missile Decoy. Continue testing of main beam noise cancellation capability.

(U) Project #2334: Complete roofhouse testing of instrumented F-15 radar in electronic countermeasures environment.

Program Element: #63750F Title: Counter-Countermeasures (CCM) Advanced Development
DOD Mission Area: Electronic & Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

Project #2335: Complete test and evaluation of the troposcatter communication antenna and signal processor and transition to Full Scale Engineering Development (FSED). Complete development of sidelobe canceller and initiate field testing. Continue development of very low frequency/high frequency adaptive antenna. Start development of a new Troposcatter Communications System with a full duplex capability. Initiate the development of a family of low cost data links for weapon applications.

(U) Project #2347: Complete laser guided weapon counter-countermeasures alternatives development. Continue target discriminating receiver demonstration and development. Initiate imaging receiver susceptibility reduction.

3. (U) FY 1983 Planned Program:

(U) Project #2333: Complete testing of the low cost Anti-Radiation Missile decoy. Continue development of the main beam noise canceller. Initiate development of passive correlation techniques for improved electronic counter-countermeasures.

(U) Project #2334: Complete roof-top and flight testing of the instrumented AN/APG-63 radar against various ECM.

(U) Project #2335: Complete testing of VLF/HF terminal and antenna, transition to full scale engineering development. Complete Troposcatter Communication System development and transition to FSED. Initiate development of millimeter wave low probability of intercept air communication.

(U) Project #2347: Continue development of counter-countermeasures for aircraft/weapons. Continue the analysis of COSTARS.

(U) FY 83 request was reduced from FY 82 request due to higher priority efforts.

4. (U) FY 1984 Planned Program:

(U) Project #2333: Complete development of the main beam noise canceller and passive correlation techniques.

(U) Project #2334: Initiate the new innovative ECCM technique - Adaptive Agile Radar ECCM concept.

(U) Project #2335: Complete design of low probability of intercept communications.

(U) Project #2347: Complete target descriminating receiver development. Complete imaging receiver susceptibility reduction task.

5. Program to Completion: This is a continuing program. Project #2333 will complete development of main beam noise cancellers for ground radars and initiate development of a programmable multiple threat generator to simulate a

Program Element: #63750F Title: Counter-Countermeasures (CCM) Advanced Development
DOD Mission Area: Electronic & Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

variety of threat systems. Project #2334 will identify electronic countermeasures (ECCM) vulnerabilities and techniques for airborne surveillance, fire control, and air-to-air missile radars and will apply spread-spectrum waveform processing and radar beam quality enhancements to coherent (Pulse Doppler) airborne radars. Air-to-Surface radar ECCM will be developed. Project #2335 will complete development of a Very Low Frequency (VLF) Adaptive Antenna Processor by fabricating and testing system for demonstrating the feasibility of high power and high speed frequency switching across the band. The goal is to achieve switching times on the order of between two frequencies at extreme ends of the band. Also, work will be initiated to develop ECCM capabilities for high frequency communications, Tactical Air Navigation, and the MARK XII Identification-Friend or Foe system. Project #2347 will complete vulnerabilities testing of optical systems to all countermeasure threats and initiate development of counter-countermeasure technology in 17 task areas currently identified.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 82 Descriptive Summary: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63751F Title: Innovations in Education and Training
DOD Mission Area: Environmental and Life Sciences (ATD), #552 Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1,676	2,491	3,073	6,309	Continuing	Not Applicable
1959	Advanced Systems for Human Resources Support of Weapon System Development	119	200	0			2,000
2359	Pilot Performance Measurement	300	400	500	900	500	2,700
2361	Maintenance Training Simulation	780	700	500	500	0	5,500
2362	Computer-Based Maintenance Aids	277	391	700	700	1,200	3,900
2557	Integrated Training Management System (ITS)	200	800	1,373	1,662	9,650	13,750
2744	Unified Data Base Application (formerly Human Factors Data Bank for System Design and Use)				1,223	8,700	10,000
2745	Logistics for Combat Readiness Maintenance (formerly Computer Based File of Tech Information on Human Resources)				1,324	10,600	12,000

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force must develop innovative ways of lowering training costs while actually improving training and the skill level of Air Force personnel. This program is designed to develop technology and procedures needed to improve the value of flight simulators in pilot training through application of automated measurement of aircrew performance; increase technical training productivity through the use of training simulators rather than operational equipment; improve on-the-job training methods and improve the quality of technical school graduates; increase the productivity of maintenance technicians through the development of a computer-based technical data system; decrease life cycle costs and improve logistics planning by including human factors considerations early in the design of weapon systems.

Program Element: #63751F Title: Innovations in Education and Training
DOD Mission Area: Environmental and Life Sciences (ATD), #552 Budget Activity: Advanced Technology Development, #2

(U) BASIS FOR FY 1983 RDT&E REQUEST: A significant effort will be initiated to develop a new integrated management and evaluation system for Air Force on-the-job training programs. It will provide improved scheduling of personnel and facilities, decrease administrative workload, tailor the training to individual needs and improve quality control of training. Actual development, originally scheduled to start in FY 82, was rescheduled for FY 83 to allow for a more detailed cost-benefit analysis. The hardware and software for a computerized maintenance data system will be developed. This program will convert aircraft maintenance data from a paper-bound system to a computerized format that can be used by technicians on the flight line. The development of an airborne automated aircrew performance measurement (APM) system for the C-5 aircraft will be continued. When this is used in conjunction with the C-5 flight simulator APM system already developed, it will provide important data on the transfer of training from simulators to aircraft. The development of several avionics maintenance simulators varying in fidelity (fidelity refers to the degree to which the simulation device resembles the actual operational equipment) to the operational equipment will be completed. Studies will then be conducted to determine how much fidelity is required for effective training. Since fidelity and cost are closely related this will have a significant impact on the cost of future maintenance simulators.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	1,680	2,600	2,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63751F Title: Innovations in Education and Training
DOD Mission Area: Environmental and Life Sciences (ATD), #552 Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The current program contains three basic categories of research and development; (1) HUMAN FACTORS (LOGISTICS) - Project 1959 demonstrates techniques for predicting and controlling manpower and training costs of weapon system ownership as a function of weapon system design characteristics. Project 2744 integrates the many separate data bases currently used to track the logistics support requirements of major systems. Project 2745 will develops computer simulation models and other analytical tools for managers to use in assessing the combat capabilities of their maintenance organizations. Project 2362 provides a prototype computer-based maintenance aid which includes an interactive computer terminal that interfaces with a computer-based technical data system. The system substantially reduces technical data search and retrieval time by the technicians, and improves aircraft systems' repair quality and time to completion. (2) EDUCATION AND TRAINING - Project 2557 develops a computer-based system for administration, management, and delivery of instruction in technical training applications. Emphasis is on the identification of low cost approaches for the delivery and management of individualized instruction in On-the-Job Training and Field Training Detachments; and (3) TRAINING DEVICES AND SIMULATORS - Project 2359 develops automated pilot/aircrew performance measurement techniques to optimize the effectiveness of flight simulators. This aids training managers to assess the effectiveness of their flight simulation training program. Project 2361 demonstrates applications of computer-based simulation technology for training Air Force maintenance personnel. Demonstration of the F-111 avionics test station simulator is demonstrated and alternate devices are evaluated to provide a comprehensive assessment of simulator fidelity requirements. User handbooks (guides) and model specifications for applications in acquisition of new simulators are developed. A flight simulator troubleshooting trainer is developed, which will be capable of teaching troubleshooting stategies to all flight simulator technicians.

(U) RELATED ACTIVITIES: Related Air Force program elements are 61102F, Defense Research Sciences; 62205F, Training and Simulation Technology; and 63227F, Advanced Simulator Technology. Navy and Army Program Elements are 62757N, Human Factors and Simulation Technology, 63701N, Human Factors Engineering Development; 63720N, Education and Training; 63727N, Navy Technical Information Presentation System; 62722A Manpower, Personnel and Training; 63743A, Education and Training. There is a Memorandum of Agreement with the Military Airlift Command (MAC) that outlines responsibilities for development of the Pilot/Aircrew Performance Measurement System. The Air Force Human Resources Laboratory is working directly with Air Training Command in the demonstration and evaluation of the simulators for maintenance training. A triservice working group is assessing the total Department of Defense effort in technology development of simulation for maintenance training. The Navy Personnel Research and Development Center is conducting a Research and Development effort to support HARDMAN which considers human resources in weapon system design. The Air Force Human Resources Laboratory manager for Project 1959 has coordinated efforts with the Navy's HARDMAN Research and Development manager as well as the Army Research Institute, which is planning a related effort. The Air Force Human Resources Laboratory has a Memorandum of Agreement with the Deputy for Avionics Control Board, Aeronautical Systems Division, Wright-Patterson Air Force Base OH, for evaluation of Project 1959. Naval Training and Equipment Center, Orlando FL, is conducting an effort to develop computerized technical data as a job aid for maintenance technicians. Several joint studies with the Navy will be performed in FY 82 to solve common human factors problems.

Program Element: #63751F
DOD Mission Area: Environmental and Life Sciences (ATD), #552

Title: Innovations in Education and Training
Budget Activity: Advanced Technology Development, #2

(U) WORK PERFORMED BY: The program is managed by the Air Force Human Resources Laboratory, Brooks Air Force Base TX, through the Logistics and Technical Training Division, Wright-Patterson Air Force Base OH; and Operations Training Division, Willaims Air Force Base AZ. These divisions are collocated with their primary Air Force customer so as to provide maxiumum technology transfer. The major contractors in FY 1981 were: Logicon, Incorporated, San Diego CA; Honeywell, Minneapolis MN; Denver Research Institute, Denver CO; Westinghouse, Baltimore MD; SAI Comsystems, Memphis TN; Burtek Incorporated, Tulsa OK; Boeing, Seattle WA; and McDonnell-Douglas, St Louis MO.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: An automated aircrew performance measurement system for use in flight simulators was developed. A system of models and other techniques for predicting and controlling manpower, personnel, and training costs of weapon systems as a function of weapon system design characteristics has been completed. Formats were developed for computerized maintenance data, and keyboards were designed for data input. Two prototype maintenance simulators, differing in level of fidelity and cost, were developed and are undergoing training effectiveness evaluations. The design for a flight simulator troubleshooting trainer was completed and fabrication initiated. Several new approaches to providing on-the-job training were defined, and one of these approaches was selected for a detailed cost/benefit analysis.

2. (U) FY 1982 Program: Development of a computerized technical data system will continue with human factors studies to determine the resolution required of the cathode ray tube (CRT) display and the level of detail needed in the graphics. The development of an automated aircrew performance measurement system will be completed, and it will be installed on a C-5 simulator to determine its value to Military Airlift Command (MAC) for aircrew training and evaluation. Training effectiveness evaluations of a medium fidelity avionics maintenance trainer will be completed. The development of a flight simulator troubleshooting trainer will be finished, and it will be installed in a technical school for evaluation. A technology transfer package will be developed to assist system procurement offices in reducing the life cycle cost of new equipment by including human factors considerations early in the design of weapon systems. The transfer package will consist of user guides to aid in the use of the techniques developed and a training course for system procurement managers. A cost/benefit analysis for a new On-the-Job Training (OJT) management and evaluation system will be completed.

3. (U) FY 1983 Planned Program: The hardware and software for an automated technical data system will be developed. The conversion of maintenance data to a computerized format for use in the system will be initiated. This system will improve aircraft maintenance technician performance and mission readiness by providing updated technical data that can be retrieved rapidly. The development of an airborne automated pilot/aircrew performance measurement system for use on the C-5 aircraft will be initiated. Evaluation studies of the utility to MAC of a similar system developed for the C-5 flight simulator will continue. This project provides objective data to determine our simulator training effectiveness. The development of a low fidelity avionics maintenance simulator using computer graphics will be completed. The development of

the flight simulator troubleshooting trainer will also be completed. The Air Force has no data to determine the type and degree of simulation needed for avionic maintenance training devices. This program will give the Air Force specifications and guides to successfully procure the appropriate type of trainers. The development of a new management and evaluation system for on-the-job training programs will be initiated. Over 70% of Air Force training occurs on-the-job (OJT); this system will alleviate the administrative workload of our On-the-Job Training managers and trainers and leave more time for actual training.

4. (U) FY 1984 Planned Program: An evaluation of how closely maintenance simulators must resemble operational equipment to provide effective training will be completed. This evaluation will have a significant impact on the future cost of maintenance simulators procured by the Air Force. The development of an airborne automated pilot/aircrew performance measurement system for the C-5 aircraft will be completed. The conversion of maintenance data into a computerized format for use in an automated technical data system will be completed. The development of a new management and evaluation system for on-the-job training will continue. Work will be initiated on modeling the critical requirements for successful accomplishment of the war zone maintenance mission. Work will also begin on developing a unified maintenance data base for each major weapon system. This would integrate the many separate data bases currently maintained and increase the efficiency of maintenance support functions.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62789F
DOD Mission Area: Electronic & Physical Sciences (ATD), #551
Title: Command, Control & Communications Advanced Development
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	11,100	10,162	18,295	21,286	Continuing	Not Applicable
2314	Tactical Air Surveillance	2,292	3,000	9,000	9,900		
2315	Automated Tactical Intelligence	4,097	3,462	4,595	6,086		
2317	Tactical Info Proc & Distribution	2,756	2,800	3,600	4,000		
2321	Advanced Systems Concepts	958	100	300	300		
2478	Tactical C^3I Architecture	997	800	800	1,000		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This advanced development program provides solutions to selected command, control, communications and intelligence operational needs and validated operational requirements. This involves the evaluation of technology, conceptual system design, system engineering, and fabrication of advanced development models for test and demonstration. In addition, this program provides for the transition from exploratory development to engineering development for those emergent projects that have demonstrated the potential to satisfy Air Force requirements.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds to continue the advanced development of a jam-resistant tactical air surveillance radar for the Tactical Air Forces, project 2314; demonstration of a near-real-time ground target location display and the automation and integration of multi-source intelligence data, project 2315; advanced development and demonstration of a high-capacity, processor-controlled communications subsystem to distribute information within tactical command and control centers, project 2317; the demonstration of new technology, techniques, procedures and equipments which have the potential to satisfy Air Force requirement, project 2321; and time-phased implementation planning and architecture for future tactical command, control, communications and intelligence systems, project 2478. Budget estimates are based on ongoing contracts and previous costs for similar efforts.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	10,868	10,200	22,200		Continuing	Not Applicable
Procurement	Not Applicable					

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63789F
DOD Mission Area: Electronic & Physical Sciences (ATD), 552

Title: Command, Control & Communications Advanced Development
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this advanced development program is to demonstrate solutions to tactical command, control, communications, and intelligence operational needs and validated requirements. This objective is accomplished by the evaluation of technology, conceptual system design, system engineering, demonstrations, and test of procedures and equipment needed to correct operational deficiencies and satisfy requirements. This program includes five projects. Three of these projects apply new technology in the tactical air surveillance, intelligence, and information processing and distribution areas. These projects provide for the development of a tactical air surveillance ground radar including activities which support the incorporation of positive aircraft identification techniques; the automation and integration of multi-source intelligence information for the combat operations intelligence centers and near real time ground target display; and the development of tactical information processing and distribution equipment for the Tactical Air Control System. The Advanced Systems Concepts Project determines whether new technology, techniques, procedures, and equipments have a high potential for increasing Air Force capabilities. A tactical architectural project provides the time-phased implementation planning required for future tactical command, control, communications and intelligence systems.

(U) RELATED ACTIVITIES: Related Program Elements include: 62702F, Command Control and Communications, and 63742F, Combat Identification Systems, for emergent technology; 27412F, Tactical Air Control System, and 27422F, Tactical Air Control System Communications, 27431F, Tactical Air Intelligence Systems and 64321F, Joint Tactical Fusion Program, for engineering development of demonstrated solutions to operational requirements. Applicable technology developed by other sources is utilized to satisfy requirements for future engineering development and acquisition activities. Projects within this program element are coordinated with the Army, Navy and Marine Corps.

(U) WORKED PERFORMED BY: The program is managed by Air Force Systems Command, Andrews Air Force Base, MD, with project effort being conducted by the Electronic Systems Division, Hanscom Air Force Base, MA, and Rome Air Development Center, Griffiss Air Force Base, NY. Current contracts are with the MITRE Corporation, Bedford, MA; RCA, Burlington, MA; TRW, Redondo Beach, CA; RCA, Moorestown, NJ; Sperry Gyroscope Corporation, Great Neck, NY; Pattern Analysis and Recognition Corporation, Rome, NY; Bunker Ramo Corporation, Westlake Village, CA; Synectics Corporation, Rome, NY; Martin Marietta Aerospace, Denver, CO; and General Dynamics Corporation, Fort Worth, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A demonstration of high frequency swept spectrum communications to determine the capability for providing survivable communications during trans/post attack was accomplished. Development of an experimental model of a tactical air surveillance radar was initiated in FY 1977 and initial tests were successfully conducted in FY 1980, project 2314. Technology development to support incorporation and demonstration of techniques which provide radars the capability to perform near-real-time positive identification of hostile, friendly and neutral aircraft was initiated in FY 1978, project 2314. Automated integration of tactical intelligence information was initiated in FY 1977, project 2315. Development and demonstration of an experimental penetration analysis support system to assist fighter aircraft mission planning was completed in FY 1981, project 2315. Development and demonstration of a

near-real-time ground target location display was initiated in FY 1979, project 2315. Initial engineering designs for a tactical information processing and distribution system were completed in FY 1979, project 2317. An architectural effort for future tactical command, control, communications and intelligence systems was initiated in FY 1978, project 2478.

2. (U) FY 1982 Planned Program: The development of a tactical air surveillance radar will continue with the award of a contract to design and fabricate an advanced tactical surveillance radar, project 2314. The automation and integration of multi-source data for tactical intelligence operations will be continued, project 2315. Development of the capability to provide a near-real-time ground target location display will be continued, project 2315. High-capacity information distribution equipment will be fabricated for test and demonstration, project 2317. The demonstration of high speed communications between Tactical Air Control Party and the Air Support Operations Center for the close air support mission will be completed, project 2321. Time-phased implementation planning and architecture for future tactical command, control, communications and intelligence systems will be continued, project 2478.

3. (U) FY 1983 Planned Program: Continued design and initiation of the fabrication of the tactical air surveillance radar will take place, project 2314. Efforts to demonstrate accurate and timely classification and identification of aircraft will be continued, project 2314. These efforts are closely coordinated with the broader based activities under the Tri-Service Combat Identification System Program. The automation and integration of multi-source intelligence data for tactical intelligence operations will continue, project 2315. The capability to identify, track and display mobile ground targets based on the simulated operation of advanced sensor systems will be demonstrated, project 2315. The design, fabrication and initial test of a high-capacity, processor-controlled communications subsystem for the Tactical Air Control System will be completed, project 2317. The demonstration of new technology, techniques, procedures and equipments which have the potential to satisfy Air Force requirements will be continued, project 2321. The time-phase implementation planning and architecture for tactical command, control, communications and intelligence systems will be continued, project 2478. The FY 1983 planned program has been reduced to provide funds for higher priority needs within the Air Force.

4. (U) FY 1984 Planned Program: Continue development of the advanced tactical radar and initiate demonstration of advanced concepts for integration of multi sensor data for aircraft identification employing value driven algorithms, project 2314. Design specifications for the automation and integration of multi-source data for tactical intelligence operations will be completed, project 2315. The demonstration of new technology, procedures, and equipment which have the potential to satisfy Air Force requirements is being continued, project 2321. Tactical command, control, communications and intelligence architecture will continue, project 2478.

5. (U) Program to Completion: This is a continuing program to provide for the transition of selected command, control, communications and intelligence technology projects to engineering development.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

Project: #2314 Title: Tactical Air Surveillance
Program Element: #63789F Title: Command, Control & Communications Advanced Development
DOD Mission Area: Electronics & Physical Sciences (ATD), #551
Budget Activity: Advanced Technology Development, #2

(U) DETAIL BACKGROUND AND DESCRIPTION: This project will develop and demonstrate the technology required to upgrade the air survellance and control portion of the tactical air control system. Required improvements include greatly increase mobility, survivability, endurance, increased surveillance and track capacity, automated operation, and efficient operator interface. The technologies under development include a phased array radar, wide-band imaging radar, modular surveillance sensor data processing, and improved operator interface and display.

(U) RELATED ACTIVITIES: PE 62702F, Command, Control, and Communications provides the technology base for this advanced development project. This project provides advance development models which have applications in PE 27412F, Tactical Air Control System, and PE 63742F, Tactical Identification Sytems.

(U) WORKED PERFORMED BY: The project effort is being conducted by the Rome Air Development Center, Griffiss Air Force Base, NY. Current contracts are with: Syracuse University Research Corp, RCA, Sperry Gyroscope Co., Westinghouse Corp., and Litton Systems Inc. Bidders for the Advanced Tactical Radar include: General Electric Co., Raytheon Co., RCA, Sperry Gyroscope Co., Hughes Aircraft Co., ITT Gilfillan, and Westinghouse Corp.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 Prior Accomplishments: The completion of the Digitally Coded Radar and its successful tests. Demonstration of two limited performance agile beam antennas. Development of advance signal processing techniques and completion of the specifications for an advanced surveillance tactical radar.

2. (U) FY 1982 Program: The award of a contract to fabricate the advanced tactical radar will take place in the latter part of the fiscal year. Plans also include the completion of fabrication of the advanced tracker module and its interface to the AN/TPS-43 radar.

3. (U) FY 1983 Planned Program: Plans are to continue development of the advanced radar. Completion of laboratory demonstrations of a basic surveillance network using the advanced tracking module with AN/TPS-43 radars. Development and evaluation of a priority system for the management of communications data flow in a netted surveillance system.

4. (U) FY 1984 Planned Program: Continue development of the advanced radar scheduled for testing in FY 1985/86. Initiate demonstration of advanced concepts for integration of multi sensor data into the surveillance network. Evaluate an interface of the E3A and the Army Air Defense System into the experimental surveillance network.

5. (U) Program To Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

Project: #2314 Title: Tactical Air Surveillance
Program Element: #63789F Title: Command, Control & Communications Advanced Development
DOD Mission Area: Electronics & Physical Sciences (ATD), #551
Budget Activity: Advanced Technology Development, #2

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Cost
RDT&E	2,292	3,000	9,000	9,900	Continuing	Not Applicable
Procurement	Not Applicable					

8. (U) Comparison With FY 1982 Descriptive Summary

RDT&E	3,100	2,300	8,600		Continuing	Not Applicable
Procurement	Not Applicable					

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63258F
DOD Mission Area: Airborne Strike, 113

Title: Common Strategic Rotary Launcher
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT		22,400	64,078	63,176	Continuing	Not applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Common Strategic Rotary Launcher (CSRL) is being developed for potential use on the B-52H, B-1B and the Advanced Technology Bomber (ATB). Previously the B-52 program was developing an additional launcher for ALCMs; the B-1B was developing three individual launchers for SRAMs, bombs, and ALCMs; and ATB concepts envisioned a multipurpose launcher. In addition to these five launcher developments, possibly a sixth launcher would have to be developed for Conventional Standoff Capability missiles for those aircraft that will perform the CSC role. The CSRL will be capable of carrying all the current certified weapons for all three bombers as well as those that are planned to be certified. The potential exists to reduce the development programs to two or three. The B-1B bomb and/or SRAM launcher development efforts may have to be retained for use in the aft bay. In that event, procurement could be reduced by roughly two thirds of that originally planned.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request would continue activity for both the B-52H and B-1B and it would initiate very low level activity to maintain commonality with ATB concepts.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not applicable.

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63258F
DOD Mission Area: Airborne Strike, 113

Title: Common Strategic Rotary Launcher
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: This program was initiated as a result of the Air Launched Cruise Missile Roadmap Study completed by the Air Force in the fall of 1981. The study showed that the Air Force could pursue as many as five or more launcher development and modification programs. By adopting a multipurpose, modular concept launcher, the potential existed for reducing the launcher developments to two or three programs. The CSRL offers a modular concept design compatible with the B-52H, B-1B, and ATB concepts. Additionally, the support equipment for the CSRL will be essentially common for all three bombers with unique adaptors required in some cases (e.g., the lift height for the B-1B requires an adaptor for the Munitions Load Trailer (MLT), but the basic MLT will be common to all three bombers). The CSRL will include the capability to incorporate growth versions of the ALCM-B as well as advanced cruise missile designs of up to 316 inches in length and approximately 25-30 inches in diameter.

(U) RELATED ACTIVITIES: Procurement funds are contained in B-52 Squadrons PE 11113F and B-1B PE 11126F.

(U) WORK PERFORMED BY: Responsibility for this program is being assigned to the Aeronautical Systems Division of the Air Force Systems Command at Wright-Patterson Air Force Base, Ohio. Contractors involved are the three basic airframe designers: The Boeing Company, Wichita, Kansas; Rockwell International, Los Angeles, California; and The Northrop Corporation, Los Angeles, California. CSRL designers are to be determined.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable.

2. (U) FY 1982 Planned Program: Acquisition strategy will address the risks and benefits of a competitive development program. If competitive development is selected, most of the FY 1982 effort will be directed to selection of the developer in the fall of 1982. Development schedule will be maintained by funding competition in parallel until selection. If a sole source is selected at the outset, a baseline aircraft will be established and design work will be initiated in the March 1982 time frame. Activities will include establishment of interface control documents, software development, design and fabrication, and initial nuclear certification activities.

3. (U) FY 1983 Planned Program: CSRL development for all three bombers will be continued or initiated. Full scale development activities include fabrication and assembly of the preproduction kit and weapon bay mod kits. Additionally, software design and nuclear certification will be continued, instrumentation and mod of the B-52 flight test aircraft will be continued, and flight testing initiated.

4. (U) FY 1984 Planned Program: Full scale development activities will continue with software design, instrumentation, and mod of the B-1B, and flight testing of both the B-52H and B-1B. CSRL deliveries begin in Oct 85.

5. (U) Program to Complete: Full scale development completed. Nuclear certification completed and first production delivery in Oct 85.

6. (U) Milestones: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63311F
DOD Mission Area: Land Based Strike, #111

Title: Advanced Strategic Missile Systems (ASMS)
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	96,531	99,624	49,737	61,841	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This remains the only Air Force program for advanced ballistic missile development and the single Department of Defense agency for intercontinental range flight testing of exploratory reentry vehicles and penetration aid systems for the three Services. The Advanced Strategic Missile Systems (ASMS) program includes reentry systems development previously pursued in the former Advanced Ballistic Reentry Systems (ABRES) program, as well as advanced development for improvements to the current force, for future ballistic missiles, and for advanced basing modes. Early development work is pursued to gain confidence in engineering feasibility of new technologies to insure their readiness for rapid weapon development. Soviet throwweight advantages, their capability to field advanced anti-ballistic missile defenses[ ] their continuing program to upgrade Soviet offensive effectiveness (e.g., increased missile accuracy), their increased pace in projecting Soviet force, all point to a need for the United States to be prepared to upgrade the missile force with offsetting advanced weapons. As an added potential benefit of this program, publicly acknowledged demonstrations of advanced weapons can serve to divert Soviet spending toward costly countermeasures which are less threatening to the United States than corresponding Soviet investments in increased numbers of offensive systems.

(U) BASIS FOR FY 1983 RDT&E REQUEST: These funds primarily support advanced development of a ballistic missile defense penetration system for M-X, applicable to Minuteman III. Readiness of such a system has increased in importance, given the advanced state of Soviet development on ballistic missile defenses and the current strong US interest in defending our own M-X and Minuteman missiles. Other work includes analysis of US defended Intercontinental Ballistic Missiles from a Soviet offense orientation; early development of economical, dormant laser missile guidance which can make long enduring and mobile ICBM concepts more affordable and effective; reentry vehicle ground testing and cost/benefit studies of tailored reentry weapons for hard and special targets. All contract costs for this program were estimated as of November 1981, based on Government experience and contractor data on similar advanced development programs.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	103,800	50,000	92,100		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63311F
DOD Mission Area: Land Based Strike, #111

Title: Advanced Strategic Missile Systems (ASMS)
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: This program applies technology and conducts early stages of development for advanced strategic ballistic missiles, basing and supporting systems. The program name, Advanced Strategic Missile Systems (ASMS), reflects a broadened scope to give attention to all elements of ballistic missile systems and to gain the highest payoff in weapon system survivability, endurance, and effectiveness. The program is also intended to provide priority support to upgrade operational missile systems, and to provide technology expertise for intelligence assessments and strategic defensive programs. Systems are being developed which will address deficiencies in United States ICBM capability for survivability, endurance and effectiveness of operational missile forces currently limited in numbers by factors including cost, basing constraints and existing and contemplated Strategic Arms Limitation agreements. The current concept definition and development efforts include: ballistic reentry vehicles; arming, fuzing, and guidance subsystems; penetration aids; aerodynamic tests of reentry vehicle aeroshell components; and testing via laboratory, underground nuclear, sounding rocket and ballistic missile flight tests.

(U) RELATED ACTIVITIES: The program is coordinated with the Army's Systems Technology Program and Ballistic Missile Defense Advanced Technology Center; the Navy's Strategic Systems Program Office; the Defense Advanced Research Projects Agency; the Defense Nuclear Agency; the Department of Energy, Military Applications; Government laboratories and testing facilities; and other agencies associated whith ballistic missiles, reentry technology, and assessment of basing modes for high survivability and endurance. Efforts are coordinated with the M-X Program (PE 64312F) and the Minuteman Program (PE 11213F) for development of advanced reentry vehicles, penetration aids systems, advanced missile guidance, evaluation of defended basing and demonstration launches. Tri-Service and intra-Air Force coordination is achieved through annual program reviews and working level exchanges. Army and Navy personnel are assigned to the program office as a part of the management structure. Effective coordination and avoidance of duplication with the M-X and Minuteman programs is achieved through joint management and colocated program offices within the Ballistic Missile Office.

(U) WORK PERFORMED BY: The responsible Air Force agency is the Ballistic Missile Office, Norton Air Force Base, CA. The ASMS Program maintains contracts with over 50 contractors and makes extensive use of Government laboratories. Major contractors include: AVCO Corporation, Wilmington and Everett, MA - flight test vehicles, penetration aids, launch support; Boeing Aerospace Company, Seattle, WA - Minuteman I booster launch services; MIT Lincoln Laboratory, Lexington, MA - systems engineering and penetration aids; General Electric Company, Philadelphia, PA - reentry vehicles; General Dynamics, Convair, San Diego, CA - missile studies; TRW Systems Group, San Bernardino, CA - systems engineering support and flight test targeting; Raytheon Company, Missile Systems Division, Bedford, MA - guidance; Honeywell, Inc., St Petersburg, FL - guidance; Charles Stark Draper Laboratory, Cambridge, MA - guidance; Tracor Aerospace, Austin, TX - penetration aids.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. FY 1981 and Prior Accomplishments: The Advanced Strategic Missile Systems program and its predecessor the Advanced Ballistic Reentry Systems program, produced the technology base from which past reentry systems have been derived and from which future Air Force ballistic missile systems will emanate. Accomplishments with major impact on existing and future missile forces include: development of high performance slender body reentry vehicles; development of the technology base development of small ballistic reentry vehicle technology leading to Multiple Independently Targetable Reentry Vehicles such as the Navy MK 4; development and engineering feasibility demonstration of maneuvering reentry vehicles; development of decoy concepts development and underground demonstration of reentry materials hardened to

Program Element: #63311F
DOD Mission Area: Land Based Strike, #111

Title: Advanced Strategic Missile Systems (ASMS)
Budget Activity: Strategic Programs, #3

nuclear effects; demonstration of the capability of the Minuteman III missile to deliver up to seven reentry vehicles, and; development of carbon-carbon nosetips used on Minuteman III and M-X reentry vehicles. The Advanced Ballistic Reentry Vehicle (ABRV), carried through advanced development and three successful flight tests, has been chosen as the M-X missile reentry vehicle.

To list other accomplishments, inertial guidance subsystems development was begun in 1970, leading to the current design of a Dormant Inertial Navigation System for maneuvering reentry vehicles which incorporates ring laser gyro technology and is well adapted to field operations. The Precision Guided Reentry Vehicle system design study, completed in 1976, established maneuvering system and subsystem requirements and led to the Advanced Maneuvering Reentry Vehicle (AMaRV) program; three successful AMaRV flight tests have been completed which included two tests of the Dormant Inertial Navigation System. Aircraft feasibility tests of terminal update guidance sensors for maneuvering vehicles and missile guidance were conducted in 1979 and 1980. Candidate and devices for the Navy MK500 Evader maneuvering reentry vehicle were flight tested on sounding rockets and two Minuteman I missiles in 1980 and 1981, as was the Continuously Dispensed Masker penetration aid. Multiple experiments for heatshields, nosetips, aerodynamics, vehicle radar transmission, arming and fuzing and penetration aids were flight tested via the Technology Development Vehicle and Advanced Nosetip Test Vehicle programs. A specially configured full scale reentry vehicle was successfully flight tested and recovered for analysis. In 1980, the fourth reentry vehicle and decoy flight test was conducted for the Army's Systems Technology Reentry Experiments Program, successfully completing this ballistic missile defense technology flight series.

2. (U) FY 1982 Program: This year's program has begun a major advanced development effort to make ready a defense penetration system option for M-X, applicable to Minuteman III. The work includes design and ground testing of radar and optical decoys and deployment systems, and assessment of specialized defense suppression weapons. Other efforts include: transition of the ABRV into the M-X full scale development program; development of defended and deceptive ICBM basing concepts; Soviet offense oriented analysis and testing to insure realism of Army approaches to defense of Air Force ICBMs; continued development and ground testing of dormant ring laser gyro guidance systems for missiles and maneuvering reentry vehicles; a missile and basing component requirements study to emphasize low power consuming, affordable subsystems tailored to long enduring, deceptively based, or mobile ICBMs; assessment of a small missile for the far term; continued ground testing of reentry vehicles; low level laboratory testing of homing sensors for maneuvering reentry vehicle guidance; cost and benefit studies of tailored reentry weapons for hard and special targets; and Minuteman I flight test support (2 flights) for the Army Ballistic Missile Defense advanced development program.

3. (U) FY 1983 Planned Program: The major share of FY 1983 funds will be applied to continuing advanced development of the M-X defense penetration system in preparation for a series of five ICBM flight tests beginning in FY 1984. Low level efforts will continue in: offense analysis of defended ICBMs; development of dormant missile guidance and assessment of other low power consuming subsystems needed for economical advanced basing; reentry vehicle ground testing and weapon cost/benefit studies; and flight test support of two Army missile defense development tests.

The 1983 Budget Request for the Advanced Strategic Missile Systems program has been reduced from last year's estimate by $41.8 million, from $92.1 to $50.3 million. This reduction is primarily due to a 1 year deferral of Minuteman I flight testing until Air Force M-X penetration aids test articles are ready in 1984. Remaining fund reductions are due to an Air Force decision to defer further major development of an early pending completion of a cost and benefit assessment and completion of planning in progress for affordable future missile force improvements.

Program Element: #63311F
DOD Mission Area: Land Based Strike, #111

Title: Advanced Strategic Missile Systems (ASMS)
Budget Activity: Strategic Programs, #3

4. (U) FY 1984 Planned Program: Funds will be applied to two M-X defense penetration decoy development flight tests on Minuteman I in 1984 and further development of payloads for 1985-86 penetration system flight tests on Minuteman I and M-X missiles.

5. (U) Program to Completion: The third Minuteman I development flight test of M-X decoys will be conducted in 1985. Two penetration system flight tests will be conducted on M-X missiles in 1986. Follow-on Minuteman I flight tests will be conducted in the outyears for upgrades to the M-X and Minuteman III penetration system options, to meet the evolving Soviet defensive threat. Advanced development of other missile subsystems and tailored weapons will be reinitiated as the M-X penetration system readiness program nears completion in 1986. This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63319F
DOD Mission Area: Airborne Strike, 113

Title: Advanced Cruise Missile Technology
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	15,468	34,887	26,782	20,537	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Advanced Cruise Missile Technology program develops the technology for advanced cruise missiles with improved propulsion systems, reduced observables (radar and infrared), and uprated avionics. The technology development could lead to a follow-on cruise missile or improvements to existing cruise missiles. Program pace will be a function of the evolving Soviet defensive threat to the cruise missile launch aircraft, the cruise missile enroute to the target over enemy territory, and in the target area where terminal defenses may be most severe. Additionally, program pace could be a function of cost-effective technological opportunities. This program will maintain the momentum of United States cruise missile development efforts and provide a high confidence option to develop an advanced missile.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request would continue work in two key development thrusts: propulsion systems and airframe design/evaluation. The highest priority efforts will focus on engine development to improve thrust and reduce fuel consumption. An improved engine could be used to power advanced vehicles as well as to significantly improve the performance of the current cruise missile. The engine development effort is the higher priority task, since engine development lead times exceed those of any other element in the program. Airframe development will continue with ground demonstration of designs developed earlier in this and other programs. The combination of improved propulsion systems and advanced airframes is intended to improve carrier survivability through longer range missiles (increased carrier standoff distance) and missile survivability through better performance characteristics and reduced observables - both radar and infrared signatures. Cost estimates for program funding were derived from contractor estimates and previous experience from the Air Launched Cruise Missile program.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY.

FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
14,000	31,500	105,300		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63319F
DOD Mission Area: Airborne Strike, 113

Title: Advanced Cruise Missile Technology
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: This program is based upon studies and anlayses completed by the Air Force, advanced development efforts underway at the Joint Cruise Missile Projects Office, and exploratory development programs at the Defense Advanced Research Projects Agency (DARPA). The Advanced Technology Cruise Missile studies began in August 1977 and were completed in September 1979. This major study effort evaluated the future threat to cruise missiles against a variety of cruise missile mission concepts (subsonic, subsonic with dash, supersonic, and hypersonic), justified the concept that was most cost and mission effective, and outlined a technology roadmap needed to develop an advanced missile capable of defeating the evolving Soviet defensive threats both in the air (look-down/shoot-down interceptors) and from the ground (advanced surface-to-air missiles). The work at the Joint Cruise Missile Projects Office includes development of an improved cruise missile engine based upon the evolutionary growth of the current cruise missile engine. At DARPA, work has centered on the development and initial testing of advanced airframe designs (TEAL DAWN). The Air Force is conducting a characterization study of a product improved version of the AGM-86B. The new version will undergo RCS testing at RATSCAT and wind tunnel evaluation. DARPA will continue the TEAL DAWN program and conduct a similar vehicle characterization demonstration. With these efforts as a foundation, the program will provide for the advanced development of a new or improved cruise missile through successive demonstration, refinement, and upgrade with options to proceed into engineering development as the threat and requirements evolve.

(U) RELATED ACTIVITIES: The DARPA efforts in advanced airframe, material, structure, and propulsion systems are performed under the Strategic Technology (62301F) program, while the current and prior development work under the Air Launched Cruise Missile (64361F) program is the vehicle baseline effort.

(U) WORK PERFORMED BY: Responsibility for this program is assigned to the Aeronautical Systems Division of the Air Force Systems Command at Wright-Patterson Air Force Base, Ohio. Contractors now involved in the program include: The Boeing Company, Seattle, Washington; Williams Research Corporation, Walled Lake, Michigan.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: As a new program start in fiscal year 1980, the initial funding was used to initiate contractual efforts in the areas of engine development and airframe evaluation and design. In the engine area, the Joint Cruise Missile Project Office began work to develop an uprated cruise missile engine as an evolutionary upgrade to the current engine. Development objectives were to increase thrust by a minimum of 28% and reduce fuel consumption by a minimum of 5% over the current F-107 engine. The Strategic Systems Program Office began a separate, competitive contractual effort to evaluate an alternative engine with a development objective of a 50% increase in thrust of 15% reduction in fuel consumption over the current cruise missile engine. These parallel efforts were intended to secure the greatest possible capability improvement in the current engine at low schedule and cost risk, as well as provide an alternative engine approach with higher payoff for advanced missile airframes. Contractual efforts were also initiated to perform an engineering and requirements analysis of a longer range cruise missile based upon the current missile with configurations as long as 315 inches. DARPA continued their contractual efforts on advanced, low observable airframes in preparation for eventual transfer of their work to the Air Force. Contractual efforts for development of an improved F-107 engine continued with the number of competing contractors/engine designs being reduced. The system engineering evaluation of a longer

range cruise missile continued with the intent of either proceeding into advanced development work or continuing systems engineering studies. The impacts involved in longer cruise missile configurations must be carefully assessed to balance reduced missile carriage and greater drag against the payoff in greater carrier survivability because of the potential for increased standoff range. The work underway in DARPA on advanced, low observable airframes was to continue and gradually transition to the Air Force as development moved into the ground/flight demonstration phase.

2. (U) FY 1982 Planned Program: Engine development will continue as the highest priority task in the program. The engine effort will include initial design, fabrication, and development of engine components. Core and rig testing are planned for component development. By the end of the fiscal year, sea level static and limited simulated flight tests will be underway using full scale engines. In airframe development, ground testing of the advanced configuration airframe will begin, and planning for flight evaluation of a full scale airframe will be initiated.

3. (U) FY 1983 Planned Program: Work will continue on engine and advanced airframe development beyond HAVE POINT efforts and funding in PE 64361F. By this time, program pace and scope will be a function of the Air Force decision to proceed on an advanced or growth cruise missile. The development decision will be a function of a continuing assessment of the Soviet defensive threat to cruise missile and their launch platforms. Additionally, efforts will be initiated on fuels and guidance systems. Previous FY 1983 funding estimate was based on proceeding with a full scale engineering development decision by that time. Currently, PE 64361F contains funding for FSED efforts if missile improvements should continue into that stage.

4. (U) FY 1984 Planned Program: Work in 1984 will be an extension of the FY 83 program.

5. (U) Program to Completion: Develop a new cruise missile or improve the current cruise missile to replace or supplement the current cruise missile. The missile will feature an improved propulsion system, reduced observables, and uprated avionics with development pace geared to the evolving Soviet threat.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63424F
DoD Mission Area: Strategic Surveillance and Warning, # 332

Title: Missile Surveillance Technology
Budget Activity: Strategic Programs, #3

(U)RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	10,058	13,848	9,745	7,674	Continuing	Not Applicable

(U)BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element is directed to the collection and analysis of infrared phenomenology associated with the earth (as a background), the surrounding atmosphere, and specific targets such as strategic and tactical missiles and aircraft. Data from this program will directly support design considerations for a survivable/enduring strategic missile warning and attack assessment system that will support National Command Authorities response option selection during a nuclear missile attack.

(U)BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program will contribute infrared phenomenology data to support system design and technology development considerations associated with a proposed improvement in performance, survivability, and endurance of the existing space based missile warning system. Data will be collected with high altitude balloon flights, aircraft, and laboratory experiments. These projects will be coordinated with other government agencies (i.e. Defense Advanced Research Projects Agency (DARPA), Army) to assure maximum utilization of resources in support of infrared data requirements. As a result of the Advanced Warning System Defense Systems Acquisition Review Council I Secretary of Defense Decision Memorandum, funding in this line may be used to validate infrared technologies developed in the joint USAF/DARPA technology development program.

(U)COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	12,300	14,200	10,200		Continuing	N/A

(U)OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: # 63424F

DoD Mission Area: Strategic Surveillance and Warning, # 332

Title: Missile Surveillance Technology

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: Projected threat level increases in the Soviet Intercontinental Ballistic Missile (ICBM) and Sea Launched Ballistic Missile (SLBM) technology will stress the capability of current surveillance systems which provide tactical warning and very limited attack assessment. New ICBM and SLBM deployment and could reduce the effectiveness of our existing missile surveillance systems. The requirement to provide missile attack characterization beyond an inference that the U.S. missile, bomber, and command and control resources may be threatened demands that the space sensor have the sensitivity to detect the foreign missiles when launched and [The impact footprint will be predicted to [This will provide the National Command Authorities the data necessary to select appropriate response options and the opportunity to conduct effective strategic force management and enhance the United States deterrent posture. Additionally, the need for improved force effectiveness dictates a survivable and enduring system capable of providing data during trans and post attack phases of a nuclear war.

The efforts funded under this program element will support design and development of an improved capability missile warning system which will observe all portions of missile powered flight. The spectra of primary interest are Short Wavelength Infrared and Medium Wavelength Infrared from 2 to 7 microns. The technical objective is to support development of a missile surveillance system with survivable and enduring warning and attack assessment capabilities.

RELATED ACTIVITIES: [ ] is the current space-based missile early warning system. An Air Force/DARPA Memorandum of Agreement is currently in effect for laboratory infrared measurements.

(U)WORK PERFORMED BY: Hq Space Division (SD), Los Angeles, CA, is responsible for the management of this P.E. The Air Force Geophysics Laboratory manages the MultiSpectral Measurements Program (MSMP) and Balloon Altitude Mosaic Measurement (BAMM) tasks for Hq SD. Government agencies supporting the Multi-Spectral Measurements Program include White Sands Missile Range, NM, and Air Force Materials Laboratory, Wright-Patterson AFB, OH. MSMP contractors include Martin Marietta Corporation, Denver, CO, (ultraviolet sensors), Honeywell Radiation Center, Lexington, MA, (spectral radiometers), and Aerodyne Inc., Burlington, MA, (computer data analysis). Visidyne Inc., Burlington, MA, provides balloon payload and field services support to the Balloon Altitude Mosaic Measurements task.

Program Element: # 63424F
DoD Mission Area: Strategic Surveillance and Warning, # 332

Title: Missile Surveillance Technology
Budget Activity: Strategic Programs, # 3

)PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Development of the optics and focal planes for two sensor configurations were completed. Advanced sensor system concepts for improved surveillance capabilities were studied. Sensor system concept studies were concluded. Aircraft, probe and satellite measurements were performed under Project 2123. Potential sensor and reporting network configurations were defined for a nuclear detonation reporting system using current and future sensors and communications. Contract work demonstrating the capability to fabricate hardened high performance optical devices for use in missile detection systems was completed. Technology efforts were continued in the use of mercury cadmium telluride detectors, charge coupled devices and design of mosaic staring sensor arrays for increased infrared sensor capability. A Mission Analysis for Missile and Nuclear Detonations Surveillance was performed in FY 1975. The Mission Analysis revealed that engineering modifications to the [ ] would provide an improved interim capability until a well focused technology program could provide the survivability and performance required of a missile surveillance system by the mid 1980's. Goals and requirements for a follow-on [ ] were then identified. Under Project 2122 efforts for the development of a mosaic staring sensor and advanced technology for the use of charge coupled devices in missile detection systems were pursued. In Project 2123, spectral background and scintillation collection efforts, applicable to missile surveillance, were initiated using balloons and rocket probes. Aircraft [ ] were completed in FY 1978 with Army funding. Mosaic staring sensor validation efforts initiated in FY 1977 led to two unique approaches in staring sensor design and fabrication. These efforts continued during FY 1979, with $1.9 million RDT&E funding approved by Congress at a reprogramming hearing in March 1979. Infrared measurements of earth background scintillation continued, using balloons. Measurements of background and engine plumes in space were to be collected using ARIES rockets for launch vehicles. Following a series of delays, a very successful launch was accomplished in May 1980, with data collected from a .00 pound thrust target engine. A Defense Systems Acquisition Review Council I for the Advanced Warning System was held in December 1979 and a technology development program plan was subsequently prepared which, after Congressional approval, supported a technology risk reduction program involving Air Force and Defense Advanced Research Projects Agency mosaic technologies in FY 1981. Earth background scintillation measurements and data analysis continued in support of mosaic sensor design concepts. Infrared and ultraviolet measurements also continued in addition to planning and preparation for high performance target engine measurements, using excess Minuteman (Upper Stage) boosters for launch vehicles beginning in FY 1983. A third Target Engine Measurement (TEM-3) rocket probe launch is planned for late in FY 1982, employing a 1000 pound thrust target engine.

Program Element: # 63424F
DoD Mission Area: Strategic Surveillance and Warning, # 332

Title: Missile Surveillance Technology
Budget Activity: Strategic Programs, # 3

2.(U)FY 1982 Planned Program: Balloon background, rocket probe, and laboratory measurements will be continued to support system design considerations. Preparation for technology validation projects will be continued, with the high altitude balloon to be used as a platform to demonstrate mosaic array performance, including background suppression.

3.(U)FY 1983 Planned Program: Primary emphasis during this year will be launch of the High Probe Target Engine Measurement flights to measure target engine infrared signatures at operating altitudes comparable to those achieved during a nominal strategic missile trajectory (200-400 kilometers). The technology validation on the high altitude balloon platform will also be completed.

4.(U)FY 1984 Planned Program: Analysis of all infrared measurement data will be completed during this year. Results will be evaluated for any impacts on infrared system design.

5.(U)Program to Completion:
The infrared data collection project will be terminated in Fiscal Year 1985 if no further data is required.

6.(U)Milestones: Not Applicable.

FY 1983 RDT&F DESCRIPTIVE SUMMARY

Program Element: #63425F
DoD Mission Area: Strategic Surveillance and Warning, #332

Title: Advanced Warning System
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		0	9,962	20,808	48,738	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is development of infrared technologies (i.e., mosaic sensor arrays, large capacity data processors, lightweight optics, tunable spectral filters, and passive/active thermal coolers), relevant to the strategic missile warning and attack assessment mission, to achieve confidence for a decision to proceed with development of an enduring tactical warning/attack assessment system capable of performing the missile warning functions throughout a protracted nuclear war. The capability to support additional missions such as technical intelligence, tactical theater operations, and air vehicle detection and tracking will be investigated with this program.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 RDT&E program will continue the joint Air Force/Defense Advanced Research Projects Agency infrared technology development program which was initiated in FY 1981. This includes development of broad band infrared mosaic sensors (2-10 microns), compact data processors with large data capacity, a spectrally tunable filter, and further evaluation of metal and glass lightweight optical components. Emphasis will be given to manufacturing methods for mosaic array and data storage chip fabrication. Program cost estimates were prepared by the Air Force and DARPA, based on costs associated with previous technology programs.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	0	12,400	12,600		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63425F   Title: Advanced Warning System
DoD Mission Area: Strategic Surveillance and Warning, #332   Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: In 1974 the Air Force initiated the Missile Surveillance Technology program to develop the technology necessary for future missile warning requirements. This was based on the anticipated need for a significant improvement in the missile surveillance and attack assessment capability by the mid 1980's. Advances in micro-processing and charge coupled device technologies resulted in selection of the mosaic staring infrared sensor as the leading candidate to replace the existing missile surveillance system, the [ ] The principal advantage of the mosaic was the opportunity for on-board processing of the sensor data to reduce the data down-link and ground processing load. In addition, there was the possibility for significant improvement in sensitivity, which would be essential for the attack assessment role. The Mosaic Sensor Program was established as a project within the Missile Surveillance Technology program with the goal of developing and demonstrating the specific technologies required for a follow-on system. It was structured to achieve the goal of a launch to demonstrate the technologies by mid 1984. The demonstration of the technologies plus on-orbit test results were to be the basis for a decision to proceed with prototype sensor development in FY 1985. During review of the FY 1980 defense budget Congress cancelled the Mosaic Sensor Program, based on the absence of a firmly established DoD requirement, and established a new program, the Advanced Warning System. Congressional support for the new program would be obtained pending a Defense Systems Acquisition Review Council (DSARC) review of the requirement to improve the [ ] system, identification of which new technologies should be pursued to achieve that objective, and DoD presentation of cost and schedule estimates to Congress. The DSARC decision was to develop a more survivable system and continue development of relevant technologies via a joint Air Force/DARPA technology development program to provide a solid basis for reconsidering the start of engineering development for a survivable and enduring system in a few years. A joint Air Force/DARPA program plan was prepared and was formally approved in June 1981. There were no Air Force funds approved for FY 1981, however, DARPA initiated technology development contracts in support of the joint program in FY 1981.

RELATED ACTIVITIES: The [ ] is the existing space-based missile early warning system. Infrared background and target measurements are conducted in PE 63424F, Missile Surveillance Technology.

(U)WORK PERFORMED BY: Air Force Systems Command is responsible for overall management of this program element. DARPA provides technical guidance through the joint program plan. Space Division, Los Angeles, CA, Rome Air Development Center, Griffiss AFB, NY, and Aeronautical Systems Division, Wright-Patterson Air Force Base, OH are responsible for management of technology development projects associated with the joint development program.

Program Element: #63425F
DoD Mission Area: Strategic Surveillance and Warning, #332

Title: Advanced Warning System
Budget Activity: Strategic Programs, #3

(U)PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U)FY 1981 and Prior Accomplishments: Development of mosaic infrared technologies had been in progress since 1976 in PE 63424F. The Air Force complied with Congressional direction to terminate the Mosaic Sensor Program in FY 1980. Based on DSARC direction, a joint Air Force/DARPA technology development program plan was prepared and briefed to the Office of the Under Secretary of Defense, Research, and Engineering in May 1980. Verbal concurrence was received pending submission of the plan for formal approval. The plan was formally approved by the Air Force and DARPA in June 1981. DARPA continued to fund contracts for development of some of the infrared technologies, including lightweight optical components, infrared materials for mosaic array sensors, and a tunable spectral filter.

2. (U)FY 1982 Planned Program: Funding for technology development by DARPA and the Air Force is programmed in this year. Development of the technologies outlined in the joint program plan will be continued, with emphasis on system architecture studies to support survivable/enduring concepts.

3. (U)FY 1983 Planned Program: Technology development will continue during this year, to include a detailed evaluation of progress toward preparation for the planned decision milestone in FY 1987. The increase over last year in FY 1983 program funding reflects the resources required to continue a limited technology development program to support an FY 1987 decision milestone to proceed with engineering design of a survivable/enduring missile warning system.

4. (U)FY 1984 Planned Program: Manufacturing technology will be emphasized during this year to prepare for a planned milestone review of the requirement and the potential for proceeding with development of a survivable and enduring space-based missile warning system. The program will be structured to continue further technology development if a decision to proceed with engineering development is not achieved.

5. (U)Program to Completion:
Planning will be initiated to conduct a milestone review in FY 1987, with a proposal to proceed with engineering development of a system that will incorporate survivable/enduring design features.

6. (U)Milestones: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63426F Title: Post Attack Reconnaissance
DOD Mission Area: TIARA for Tactical Air Warfare, 327 Budget Activity: Strategic Programs, 3

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT			9,919	24,449	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Post Attack Reconnaissance program will accomplish concept studies to identify requirements, technical alternatives, and cost versus utility for a total reconnaissance capability sufficent to support

Development of key new technologies and systems/ modifications will be accomplished.

BASIS FOR FY 1983 RDT&E REQUEST: The projected concept studies are expected to define a balanced

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable. This is a FY 1983 new start.

(U) OTHER APPROPRIATION FUNDS: Not applicable

Program Element: #63426F　　　　　　Title: Post Attack Reconnaissance
DOD Mission Area: TIARA for Tactical Air Warfare, 327　　　　　　Budget Activity: Strategic Programs, 3

DETAILED BACKGROUND AND DESCRIPTION: The requirements for a Post Attack Reconnaissance capability have been defined by the Strategic Air Command (SAC) in a Statement of Operational Need, "Strike Assessment", dated 7 September 1979 and validated by Headquarters Air Force.

RELATED ACTIVITIES:

Surviving and enduring satellite communications are being addressed in the MILSTAR program, PE 33603F.

(U) WORK PERFORMED BY: The concept studies and technology development for a Post Attack Reconnaissance capability will be managed by Air Force Systems Command and involve several product divisions including Aeronautical Systems Division, Wright-Patterson Air Force Base (AFB), Ohio; Space Division, Los Angeles Air Force Station, California; and Electronics Systems Division, Hanscom AFB, Bedford, Massachusetts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable.
2. FY 1982 Program: In FY 1982, Air Force Systems Command, Strategic Air Command, and Air Force Communication Command will plan the initiation of concept studies and technology development for this new capability. Results of the
3. FY 1983 Planned Program:

   will be accomplished. Key technologies will be advanced and demonstrated.
4. FY 1984 Planned Program:
5. Program to Completion:
6. Milestones: Not Applicable.
7. (U) Resources: Not Applicable.
8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63428F — Title: Space Surveillance Technology
DoD Mission Area: Strategic Surveillance and Warning, #332 — Budget Activity: Strategic Programs, # 3

(U) RESOURCES (PROJECT LISTING) ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	25,585	23,711	40,285	46,609	Continuing	Not applicable
2698	System Development	24,185	22,111	36,500	42,060	Continuing	Not applicable
2699	Information & Network Development	1,400	1,600	3,785	4,549	Continuing	Not applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Soviets have an aggressive antisatellite and space program. SPACETRACK has very limited detection capability above 3000 nautical miles (nm), [ ] This program pursues near-term (early 1980's) and far-term (late 1980's) SPACETRACK improvements. Near-term improvements include technology to support a satellite attack warning and verification system, new capabilities for satellite mission assessment, and existing sensor upgrades. The efforts leading to a far-term capability are to convert SPACETRACK to a near real-time, totally responsive space-based system for satellite attack warning and [ ] with reduced dependence on overseas based sensors and with [ ] These efforts are specifically oriented toward the development of a space-based long wavelength infrared space object detection and tracking system. This program supports the Presidential and Secretary of Defense Directives for a [ ] Mission need is documented in ADCOM Statement of Need (SON) 3-79, Air Force Mission Element Need Statement (AFMENS) for Antisatellite capability (validated by SecDef) and AFMENS for Space Surveillance (validated by AF).

BASIS FOR FY 1983 RDT&E REQUEST: Near-term efforts continue the integration and improvement of assets for the tactical assessment of satellite missions, improved orbital processing network analysis, and continued upgrade to the initial operational capability for satellite attack warning and verification. The efforts supporting the far-term space-based systems are the continued collection of long wavelength infrared (LWIR) background data from probes, the development of long life cryogenic coolers for long wavelength infrared (LWIR) sensor operation, and the development of a Space Infrared Sensor (SIRE) for launch by shuttle on a free-flyer spacecraft mission. The SIRE and LWIR probe measurements are essential for both the [ ] and the space-based space surveillance (SBSS) system. Cost estimates are based on prior experience and contractual levels.

Program Element: # 63428F
DoD Mission Element: Strategic Surveillance and Warning, #332

Title: Space Surveillance Technology
Budget Activity: Strategic Programs, # 3

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	39,200	29,300	47,100	-	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable

Program Element: # 63428F Title: Space Surveillance Technology

DoD Mission Area: Strategic Surveillance and Warning, #332 Budget Activity: Strategic Programs, # 3

DETAILED BACKGROUND AND DESCRIPTION: The Soviets continue an aggressive antisatellite program. The SPACETRACK system provides [redacted] It also has a very limited detection capability above 3000 nautical miles (nm) and [redacted] The identification of new Soviet space launches cannot support [redacted] Because of limited ground sensors, it can take [redacted]

The Soviet dependence on space is increasing. The ability of Soviet systems to [redacted] is of paramount importance. Space allows them to operate globally with support systems which are currently free of threat from foreign land, sea, and air forces. Space systems provide a force multiplier that is unacceptable with the current force balance. The SPACETRACK limitations cited above have created a situation where [redacted]

This program is structured into near and far-term improvements. The near-term improvements are specifically oriented to satisfy critical deficiencies using off-the-shelf technology to modernize current capabilities. The remaining program provides for a far-term major upgrade. Initially, existing operational and research and development (R&D) sites were evaluated and consolidated with marginal R&D sites discarded. R&D was performed to increase the operational effectiveness of these sites and transition them to SPACETRACK. New ground-based surveillance systems are being developed where required and space-based surveillance systems are being examined to increase the SPACETRACK detection altitude to 22,000nm and beyond and provide near real-time operations to support the satellite attack warning/verification [redacted] A mathematical model has been developed for the SPACETRACK network to determine the most cost effective R&D and system deployment for correcting current and projected deficiencies.

(U) A major near-term effort has been the development of a satellite attack warning and verification (SAW/V) system. An initial capability was completed in FY 1979 with follow-on improvements in progress. Since Soviet attack against a

U.S. space system could indicate the initiation of a strategic or theater Soviet attack, it is essential that advance notification be provided to the National Command Authorities as soon as possible so that the attack can be assessed, forces can be alerted, and response actions can be taken.

(U) The program for the far-term includes developments leading to an advanced space-based long wavelength infrared surveillance system for space object detection and tracking. Near-term efforts in this program address the basic technical, background, system feasibility and utility issues to evaluate the basic system concept. These include: a measurements program that will provide indicative data on background levels and models; a major development effort on cryogenic coolers that will provide not only adequate performance, but also operate at least three years for system practicality; key sensor technology and data processing developments to evaluate the state-of-the-art; and a continuing systems evaluation including visible alternatives, and concept development to understand the system issues such as life cycle cost, deployment, survivability, performance and assess changes in the requirements (see Descriptive Summary on Project 2698 for details).

The space-based system can provide

Furthermore, this system offers increased survivability and is not subject to the difficulties and uncertainties of foreign basing.

RELATED ACTIVITIES: This program is part of a singly managed Space Defense Systems Program involving four functional areas: antisatellite, space surveillance, space system survivability, and command and control. Program Element (P.E.) 64406F, Space Defense System, provides an antisatellite system which

P.E. 63438F, Satellite Systems Survivability, develops the technology base for enhancing survivability of satellite systems including satellites, data links and ground systems. The Defense Advanced Research Projects Agency's Space Object Identification Program and the Tactical Assessment of Satellite Mission Program under the Space Surveillance Program are integrated and have common technical management agencies. P.E. 12424F, United States Air Force SPACETRACK, incorporates the research and development efforts of this program into the operational SPACETRACK system. P.E. 12311F, NORAD Combat Operations Center, provides the command and control for these programs.

(U) WORK PERFORMED BY: Headquarters, Space Division, Los Angeles, CA, is responsible for overall management of the program. A.D. Little Corporation, Cambridge, MA is developing a rotary reciprocating type cryogenic cooler. Hughes, Culver City, CA is developing a vuilleumier type cryogenic cooler and the SIRE long wavelength infrared sensor. Aerospace Corporation, El Segundo, CA and Lincoln Laboratory, Lexington, MA provide general systems engineering.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Cryogenic cooler efforts were conducted with life testing for the Vuilleumeir cooler and performance testing of a two-stage rotary reciprocating refrigerator. In FY 1976 both the tactical

assessment of satellite mission efforts and the long wavelength infrared probe efforts were initiated. The experimental prototype ground-based electro-optics site at White Sands Missile Range started operation in August 1975 and provided proof-of-concept for the Ground-based Electro-Optical Deep-Space Surveillance (GEODSS) system. Design studies were conducted for a ground-based radar system and a multimission space-based radar. A contract was awarded in Fiscal Year (FY) 1976 for development of a Satellite Attack Warning and Verification software system with initial system algorithms tested in FY 1978 and transition in FY 1979 to the Air Defense Center. Development testing was completed for calibrating existing SPACETRACK radars using the Navy Transit navigation system and for extending the tracking range of several radars to 22,000 nautical miles (nm) through the use of [ ]

Contracts were awarded for the Space Infrared Sensor and the program has produced hardware for testing. In FY 1979 the space sensor host spacecraft, developed by the Space Test Program, Program Element (P.E.) 63402F, was terminated and the space sensor program was converted to a Shuttle sortie mission. The sensor has been completed and has undergone initial testing. An expanded performance and reliability program on the Vuilleumeir cryogenic cooler was initiated for the space sensor. The sensors and probes for the long wavelength infrared measurement were procured. Four probes have been launched. Two failed due to rocket problems and two were completely successful. The HAYSTACK imaging radar development and transition were initiated. The ALCOR imaging radar transitioned in FY 1978. These radars provide [ ] The prototype ground-based electro-optical site was developed and conducted sensor reliability and other testing to support procurement of the operational system (P.E. 12424F, SPACETRACK). A mathematical model was developed to support the United States antisatellite targeting and satellite attack warning mission analysis. A near-term surveillance architecture for upgrading the SPACETRACK system was completed. A program was initiated to [ ] A new program office was formed integrating the surveillance, antisatellite, survivability and command and control functions to be more responsive to Presidential and Secretary of Defense directives.

2. FY 1982 Program: The Vuilleumeir cryogenic cooler performance reliability test program will continue. Fabrication of a rotary reciprocating three stage refrigerator and advanced Vuilleumeir cooler will be continued. Two long wavelength infrared probe launches are planned. The integration and improvement of assets for the tactical analysis of satellite missions will be continued. The Space Infrared Sensor (SIRE) testing will be completed along with continued data processing development and testing. Comparison of SIRE precursor and SBSS prototype alternatives will be made. The SPACETRACK model will be maintained to allow for trade-offs in system performance as changes occur. Orbital prediction improvements to support [ ] will be studied. A Space Surveillance Plan will be developed to address both evolving requirements and the preferred technologies to satisfy those requirements. Several activities will be continued at reduced levels including: tactical assessment of satellite mission improvements and transition; space-based surveillance system concept studies; software development for improved SPACETRACK targeting; and integration of [ ] into SPACETRACK. The FY 1982 funding was reduced due to other higher priority efforts. Congress identified $5 million as an offset for the Space Laser Program.

3. FY 1983 Planned Program: The program will continue and expand the near-term improvements. The space-based space surveillance sensor design will be updated to incorporate technology improvements in detectors and cryo-coolers.

Program Element: # 63428F
DoD Mission Area: Strategic Surveillance and Warning, #332

Title: Space Surveillance Technology
Budget Activity: Strategic Programs, # 3

The probe launches will be completed and the results analyzed and provided to the [ ]and for the surveillance system design. The space-based surveillance system design will be further refined [ ] FY 1983 funding was reduced during the Program Objective Memorandum cycle to fund other higher priority efforts.

4. FY 1984 Planned Program: Space-based surveillance system technology efforts will continue. [ ] Defense System Acquisition Review Council decision on the Space-Based Space Surveillance (SBSS) system has moved to FY 86 due to funding reductions in FY 81 and FY 82 and curtailment of the Space Infrared Sensor flight.

5. Program to Completion: The long wavelength infrared efforts will lead to a 1986 Defense System Acquisition Review Council decision on an [ ] satellite attack warning requirements and threat growth, coupled with the system development results, will provide the decision data base.

6. (U) Milestones Not applicable.

Project: 2698 — Title: Systems Development

Program Element: # 63428F — Title: Space Surveillance Technology

DoD Mission Area: Strategic Surveillance and Warning, #332 — Budget Activity: Strategic Programs, # 3

DETAILED BACKGROUND AND DESCRIPTION: The efforts under this project are those system-oriented tasks that are specifically designed to

Currently, satellites

These improvements are essential to support the new missions of

and satellite attack warning/verification and to improve the

Technology efforts support the development of a satellite system for the early 1990's to reduce the need for overseas and vulnerable remote bases, improve high altitude coverage and range for the whole celestial sphere, and to

so that high confidence warning of an attack on United States (U.S.) satellites can be provided in sufficient time to exercise a political or military response. This program will also provide

Current technology and background data are not available to develop or evaluate this system in the near-term. Technology is being pursued for the development of a space-based long wavelength infrared (LWIR) system that detects a satellite's emitted heat. Several systems were compared with this space-based LWIR system for performance, coverage and cost. The long wavelength infrared system was selected as the primary system for satisfying the needs.

(U) Preliminary satellite surveillance system concepts were developed during FY 1975. These preliminary studies provided a conceptual basis for the program and identified the specific technological and background issues and areas of concern, along with a preliminary development road map. The infrared background probe measurements program, cryogenic cooler and sensor developments, Space Infrared Sensor and a surveillance architecture program were formed to specifically address the critical path areas, provide for a system level demonstration and evaluate the system utility. Design concepts may be investigated at a low level under this project for advanced microwave, visible and alternate infrared systems as potential backups to support this mission and assure the program is current.

RELATED ACTIVITIES: Provides

Program Element 63438F, Satellite Systems Survivability, when integrated with this program, provides an integrated capability to warn of or verify an attack on a satellite. Defense Advanced Research Projects Agency's Space Surveillance Program is integrated with these efforts. Program Element 12424F, United States Air Force SPACETRACK, will deploy the five-site Ground-Based Electro-Optical Deep Space Surveillance system and other improvements based on technology from this project. The Space Infrared Sensor will be flown in conjunction with the Space Test Program (Program Element 63402F).

(U) WORK PERFORMED BY: Headquarters Space Division, Los Angeles, CA, manages this project. The Electronic Systems Division and Air Force Geophysical Laboratory, Hanscom AFB, MA, and Rome Air Development Center, Rome, NY, manage selected tasks within this project. The contractors for ground and space-based system development include Westinghouse Electric Corporation, Baltimore, MD; TRW, Redondo Beach, CA; Hughes, Culver City, CA; MIT, Lincoln Laboratory, Lexington

Project: 2698 | Title: Systems Development
Program Element: # 63428F | Title: Space Surveillance Technology
DoD Mission Area: Strategic Surveillance and Warning, #332 | Budget Activity: Strategic Programs, # 3

MA; Lockheed Missiles and Space Company Incorporated, Sunnyvale, CA; Rockwell International Corporation, Seal Beach, CA; MITRE Corporation Bedford, MA; Aerospace Corporation, El Segundo, CA, and Science Applications Incorporated, La Jolla, CA. The Aerospace Corporation and MIT Lincoln Laboratory provide general systems engineering.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The ground-based electro-optical site at White Sands Missile Range started operation on 30 August 1975. An advanced electro-optical tube was developed and tested. A 31-inch telescope and a 14-inch telescope were used in the prototype configuration. The development of the procurement package and specifications for the five site operational system was conducted in Fiscal Year 1977 and a contract was awarded in May 1978 under Program Element 12424F, SPACETRACK. During this period through Fiscal Year 1981 the ground-based electro-optical test site at White Sands Missile Range was dedicated to supporting the operational system procurement and developing improvements in software and sensors as potential block changes to the operational system. The test site supported operational site development in areas such as sensor reliability testing and system maintenance. This site also serves as the primary high altitude detection sensor for SPACETRACK until the first operational site becomes fully operational in FY 1982.

Several space-based system concepts employing a long wavelength infrared sensor were analyzed to determine background, target and technology data required to evaluate the concept. To meet these requirements and because adequate infrared data cannot be gathered on the ground, a three part technology and measurement program was initiated. The first effort is a background measurements program initiated in 1976. Three types of background data are needed including infrared data on stars (celestial data), the earth's atmosphere (earthlimb data) and the solar plane (zodiacal data). Seven probes were initially planned, later expanding to nine. Three different sensors were required and were developed starting in Fiscal Year 1976 using two modified sensors and one new sensor. This program was to provide early indicative data to bound system technology development and provide critical background data for the

Four probes have been launched. Two probes (celestial and earthlimb) failed due to rocket failures. Two zodiacal probes were completely successful.

The second effort is the Space Infrared Sensor (SIRE) program. The payload was initially scheduled as a one year satellite mission to be launched in Fiscal Year (FY) 1981; however, the satellite was terminated in FY 1979 and SIRE was restructured to the Shuttle sortie mission in FY 1983. This flight has been further slipped due to schedule and funding problems in the Space Test Program. SIRE is now compatible with either a free flyer spacecraft or captive shuttle sortie launch approach. The primary payload elements are: a modification of a state-of-the-art sensor; a high sensitivity, experimental focal plane; a cryogenic cooler; a gimbal system and heat rejection system. The design and fabrication were completed at the time of the satellite termination. This sensor will provide detailed systems background and extensive data for both the long wavelength infrared space-based space surveillance system and United States

Project: 2698 Title: Systems Development
Program Element: # 63428F Title: Space Surveillance Technology
DoD Mission Area: Strategic Surveillance and Warning, #332 Budget Activity: Strategic Programs, # 3

(U) The third program is satellite surveillance systems technology, primarily cryogenic coolers, although some other work is included. These surveillance systems are dependent upon detection sensors of high sensitivity which require cooling as low as ten degrees Kelvin. To obtain the requisite cooling, cryogenic coolers must be developed which provide adequate performance and are sufficiently long-lived to make an operational system cost effective. The objective of this effort is to develop and demonstrate the cryogenic cooler technology and reliability for the surveillance system. Cryogenic coolers for this application represent a significant departure from other Air Force cryogenic cooler work because they must operate near absolute zero (versus 50 degrees Kelvin), in space, and for at least three years without maintenance. This program also supports a near-term requirement for a space qualified cooler for the Space Infrared Sensor and the development of thermal management techniques for the system's three to five year requirement.

2. (U) FY 1982 Program: The prototype technology development activities will continue with limited long lead sensor developments using the results of the probe measurements. The cooler reliability testing and development will continue. Three additional probe launches are planned. System concept studies, including endurance tradeoffs, will continue. A Space Surveillance Plan will be developed for the period 1985 through 2000. Technology programs to support the operational system decision will continue at a low level. These include: cooler development and testing, probe measurements and component technology investigations. A comparison of Space Infrared Sensor precursor and space-based space surveillance (SBSS) prototype alternatives will be conducted.

3. FY 1983 Planned Program: Efforts will be expanded to proceed with improvements and transition of ground system upgrades and increase technology and system development work for an [ ] Space sensor design will be updated to incorporate sensor technology improvements in detectors and cryo-coolers. The probe program launches will be completed and data analysis will continue. The cooler program will be expanded to gain more data on reliability and evaluate alternate cooler hardware concepts.

4. FY 1984 Planned Program: Space-based surveillance system technology efforts will continue. [ ] Defense Systems Acquisition Review Council decision on an [ ] has moved to FY 86 due to funding reductions in FY 81 and FY 82 and curtailment of the Space Infrared Sensor flight.

5. Program to Completion: The near-term improvements to SPACETRACK will be completed in the mid 1980's. These results, coupled with the results of [ ] long wavelength infrared concept, technology and design results, and updated threat projections, will be the basis on which a far-term Space-Based Space Surveillance system design will be selected for prototype development.

Project: 2698 Title: Systems Development
Program Element: # 63428F Title: Space Surveillance Technology
DoD Mission Area: Stratgic Surveillance and Warning, #332 Budget Activity: Strategic Programs, # 3

6. (U) Milestones: Not applicable

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	24,185	22,111	36,500	42,060	Continuing	Not applicable

8. (U) Comparison with the FY 1982 Descriptive Summary:

RDT&E Funds	33,400	27,900	39,800		Continuing	Not applicable

FY 81 Funds were reprogrammed to fund shortfalls in the Antisatellite Program.
FY 82 Funds were reduced by Congress, without prejudice, to fund the Space Laser Program.
FY 83 Funds were reduced by the Air Force during the FY 83 Program Objective Memorandum cycle to fund other higher priority efforts.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #2188 Title: Air Force WWMCCS Architecture
Program Element: #63735F Title: World Wide Military Command and Control System (WWMCCS) Architecture
DoD Mission Area: Strategic C^2, #331 Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimate Costs
	TOTAL FOR PROGRAM ELEMENT	13,373	8,966	15,110	14,413	Continuing	Not Applicable
2188	Air Force World Wide Military Command and Control System Systems Engineering Planning and Support	13,373	8,966	15,110	14,413	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Air Force Worldwide Military Command and Control System (WWMCCS) Architecture program is our mechanism for insuring that more than 80 Strategic Command, Control, and Communications (C^3) programs fit together as a cohesive whole. These efforts amount to an overall system engineering activity, in support of user needs, for: identifying interoperability and intersystem deficiencies, proposing solutions for some selected current Air Force Strategic Command, Control, and Communications (C^3) systems, and conducting planning actions for Deputy Secretary of Defense directed WWMCCS Selected Architecture Programs.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds to continue system engineering and analysis efforts of Air Force strategic systems that contribute to the WWMCCS. Technical analysis and support will concentrate on: Command, Control, and Communications integration and survivability for warning information dissemination, communications survivability and electromagnetic pulse hardening for Air Force strategic systems; improved crisis management support for the theater Commanders-in-Chief; and WWMCCS initiatives directed by the Deputy Secretary of Defense. Cost estimate was formulated based on previous standard cost estimate for MITRE Corporation system engineering capability.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Cost
RDT&E	6,900	9,200	10,100		Continuing	Not Applicable

Project: #2188 Title: Air Force WWMCCS Architecture
Program Element: #63735F Title: World Wide Military Command and Control System (WWMCCS) Architecture
DoD Mission Area: Strategic C^2, #331 Budget Activity: Strategic Programs, #3

(U) OTHER APPROPRIATION FUNDS: PE 41115F (C-130 (3010)) FY 83 (4.0M) provides procurement funds to initiate the Antenna Hatchcover Modification (22 sets) for Joint Crisis Management Capability (JCMC) program. PE 33152F will transfer FY 83 RDT&E funds (.600M) to PE 63735F to support efforts for Air Force Sites concerning WWMCCS Information System impacts.

DETAILED BACKGROUND AND DESCRIPTION: The World Wide Military Command and Control System (WWMCCS) provides the means for the operational direction and the administrative support involved in command and control of U.S. Military Forces. The primary mission is to support the National Command Authorities, with a secondary mission to support the command and control systems of the Services and subordinate commands. Essentially, all Air Force strategic command, control, and communications and warning sensor systems are part of the WWMCCS. This program element serves two functions: intersystem engineering and WWMCCS architecture implementation. First, this program provides for an adequately integrated and standardized system of communications, command, and control centers and sensors for the United States' strategic forces. The second effort of this program concerns the improvements recommended in the WWMCCS Architecture directed by the Deputy Secretary of Defense in 1976. System engineering and other technical analysis are required to support these activities which will impact Air Force systems. Such tasks as Jam-Resistant Secure Communications (JRSC), Joint Crisis Management Capability (JCMC) and World Wide Military Command and Control System (WWMCCS) Information System are a few that impact directly upon Air Force systems. Implementation of these tasks will require analysis of command, control, and communications integration support from Air Force resources to effectively meet National as well as Air Force requirements. The Air Force JCMC initiative includes command, control, and communications integration for hatch-cover antenna modification and supports the Army, as the cognizant component, for accomplishing overall system integration activities. The JCMC is designed to satisfy the needs of the theater Commanders-in-Chief for an improved crisis management capability. Some of the JRSC terminals will support the JCMC.

Air Force WWMCCS efforts in support of these tasks will be directed at interoperability requirement and interface definition for the systems.

(U) RELATED ACTIVITIES: Air Force World Wide Military Command and Control System (WWMCCS) activities span the strategic command, control, and communications community. System engineering and analysis are initiated in support of some on-going product-oriented programs within the Air Force. These efforts are needed to integrate the various product-oriented programs/systems into the WWMCCS Warning, Display, and Command Systems. Analysis efforts will be conducted in support of missile tactical warning and attack assessment. Some specific program elements that relate to 63735F are: Command Center Processing and Display System, Program Element 12431F, Defense Support Program, Program Element 12431F, and the WWMCCS Information System Program, Program Element 33152F. The Air Force WWMCCS will provide the indicated support to the following efforts:

a. (U) Command Center Processing and Display System: propose and assess alternative technical approaches in system upgrades and participate on the User Executive System Management Group (a forum for obtaining community agreement on analyses efforts and recommendations). Command Center Processing and Display System responsibility begins at the communications processor and continues through display generation and display devices.

Project #2188 Title: Air Force WWMCCS Architecture
Program Element: #63735F Title: World Wide Military Command and Control System (WWMCCS) Architecture
DoD Mission Area: Strategic C^2, #331 Budget Activity: Strategic Programs, #3

b. [

c. (U) WWMCCS Information System (WIS) -- provides upgrade for WWMCCS ADP. The Joint Program Manager will define the WIS interface. Air Force efforts will focus on assessing the impact of the WIS activities on Air Force sites and supporting definition and interfaces at Air Force sites. RDT&E FY 83 Funding in PE 33152F will support PE 63735F in accomplishing schedules and planning efforts in support of Hq USAF programmatic and budgetary actions for Air Force sites. RDT&E programming for outyear funding in support of Air Force sites will be in PE 63735F.

All of the above tasks require systems engineering and interface definition for implementation of their programs at Air Force installations. The developmental effort for Joint Crisis Management Capability (JCMC), a Selected Architecture capability, is being accomplished under this PE; but the procurement for aircraft modification is supported by Program Element 41115F, (C-130).

(U) WORK PERFORMED BY: The Air Force WWMCCS Program Office, Electronics Systems Division, Hanscom Air Force Base, MA, conducts 90 percent of the work in-house with MITRE-Bedford technical support. A number of small systems engineering contracts have been used for the balance of the work. Contracts have been let with the following companies: Honeywell, Phoenix, AZ; Magnavox, Torrance, CA; TRW, Los Angeles, CA; BDM, McLean, VA; Polhemus Navigation Science Corp., Essex Junction, VT; Analytic System Engineering Corp., Burlington, Ma; Mitre Corp., Bedford Ma; Magnavox, Falls Church, Va; TRW, Washington, DC; System Analysis Inc., Lexington, Ma.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Completed system engineering and analysis efforts for: integration of command, control, and communications systems into intercontinental ballistic missile launch control centers; automated data processing communications fault isolation procedures; HQ USAF Command, Control, and Communications/Crisis Management within the Air Force Operations Center; COBRA DANE interface requirements documentation for program decisions and direction; PAVE PAWS interface requirements documentation; Joint Surveillance System/E-3A interface study; Minimum Essential Emergency Communications Network analysis (technical issues associated with survivable communications) and current operations concepts and plans; automated data processing communications error analysis; strategic/tactical command, control, and communications intersystems engineering; comparisons of airborne command, control, and communication systems and requirements such as Joint Airborne Communications Center/Command Post; Airborne Command and Control Center; crisis communications relay; FORWARD TALK Readiness Command replacement; and military satellite communications user subset architecture. The initial communication overlay input to the overall architecture for warning sensor system upgrade was completed in FY 1978. Assisted Ballistic Missile Office on M-X launch back-up communication from the World Wide Military Command and Control System. Accomplished preliminary design evaluation and checked-out the draft plan for Command Center Processing and Display System end-to-end test. Participated in the Chairman/Joint Chiefs of Staff study of strategic command, control, and communications connectivity. Performed preliminary costing and scheduling analysis for Joint Crisis Management Capability (JCMC) aircraft modification (Air

Force currently directed to provide only hatch-cover antenna modification) and supported the Army with development of JCMC system design. Participated in the development of a work plan for Jam-Resistant Secure Communication interface. Developed an architecture to guide upgrade of the Military Airlift Command's command and control system (complete in FY 82). Supported definition of (some Air Force Sites) system requirements to interface with WWMCCS Information System (WIS).

2. (U) FY 1982 Program: Intersystem efforts in FY 1982 will provide technical support for the System Integration Office (SIO) for the tactical warning/attack assessment area. Specific focus will be on identifying deficiencies involving transfer of warning data in the compressed mode and sensor to user communications impact. Additional activities in support of the tactical warning attack assessment area are to continue overall system engineering support and complete the development of an Intersystem Requirement Document. Command Center Processing and Display System support and coordination with the space defense architecture will continue. Support of Military Airlift Command, Strategic Air Command, and Aerospace Defense Command's strategic command, control, and communications improvement needs will be accomplished. Emphasis will be on achieving timely pre-attack alerting and data handling; providing survivable and enduring command, control, and communications capabilities for trans- and post-attack periods; facilitating reconstitution of command, control, and communications assets during post-attack periods; and accomplishing planning support to Air Force sites for interfacing with the WIS. Implementation activities for Selected Architecture initiatives will focus on the JCMC and JRSC. Continue planning and development efforts for JCMC to provide hatch-cover antenna modification for C-141 and C-130 aircraft in support of the Army, as the cognizant component, for the JCMC program. A limited effort for JRSC will be directed at the interoperability requirement and interface solution for terminal installation at Air Force WWMCCS element locations. JRSC will also support the JCMC and the survivable transfer of tactical warning/attack assessment information to the National Military Command Center and other command centers of the unified and specified commands. The JRSC effort will be changed, as described in the FY 83 Planned Program, due to lack of funding.

3. (U) FY 1983 Planned Program: Efforts will center on: (1) Continuation of intersystem tasks: (a) continue TW/AA improvement technical support to the System Integration Office (SIO). (b) Strategic Forces Command, Control, and Communications - support selected tasks for improving connectivity and responsiveness of strategic forces. (c) WWMCCS Information System - accomplishing schedule and planning efforts in support of Hq USAF programmatic and budgetary actions for Air Force sites. (d) Military Airlift Command (MAC), command and control (C^2) Support - provide technical support for implementing the MAC C^2 Architecture. (2) WWMCCS Selected Architecture Tasks: Implement only the Air Force portion of the JCMC program, hatch-cover antenna modification. The other Selected Architecture task (JRSC program) will be reduced in scope due to lack of funding. Only the integration effort supporting the mobile communication terminal with the mobile ground terminals will be accomplished. Budget increases in FY 1983 are a direct result of addressing an Office of the Secretary of Defense directed effort, the JCMC. This program supports an improved crisis management capability for the theater Commanders-in-Chief. The increased funding will be used to accomplish the required research development, testing, and evaluation efforts associated with accomplishing the hatch-cover antenna modification. Procurement funding is in PE 41115F, C-130.

Project: #2188 Title: Air Force WWMCCS Architecture
Program Element: #63735F Title: World Wide Military Command and Control System (WWMCCS) Architecture
DoD Mission Area: Strategic C^2, #331 Budget Activity: Strategic Programs, #3

4. (U) FY 1984 Planned Program: FY 1984 activities will include continuation of intersystem tasks (tactical warning, WWMCCS Information System, and Strategic Forces Command, Control, and Communications) and the Selected Architecture tasks (JCMC and the JRSC).

5. (U) Program to Completion: The Air Force WWMCCS Selected Architecture is a continuing program. Efforts will be in response to WWMCCS Architecture initiatives directed by the Office of the Secretary of Defense and Air Force Intersystem Engineering support for identifying interoperability and integration deficiencies and proposing solutions for some selected Air Force Command, Control, and Communications Systems.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Budget Data: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64226F — Title: B-1B

DOD Mission Area: Offensive Strike, # 113 — Budget Activity: Strategic Programs, # 3

(U) RESOURCES ($ in thousands):

Project Number	Title	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	B-1B	219,000	471,000	753,500	717,900	960,700	3,122,100

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The B-1B is a strategic multi-role weapon system which maximizes range and payload capabilities, and is able to perform the missions of conventional bomber, cruise missile launch platform and nuclear weapons delivery system in both the tactical and strategic roles. Production of the B-1B addresses U.S. requirements to increase our targeting flexibility, to redress the relative decline of our strategic capabilities, and to revitalize our strategic deterrent. The B-1B program will significantly enhance the manned bomber portion of the strategic TRIAD while preserving the vitally needed flexibility for non-nuclear force projection in response to unforeseen contingencies worldwide.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 Air Force Request for the B-1B program addresses the continuation of Full-Scale Development (FSD) activities and the initiation of flight test efforts. Major FSD efforts during FY 1983 include: structural design development and wind tunnel testing; weapons launcher development; avionics hardware fabrication, testing and integration; avionics software design, coding and testing; engine stress, performance and structural integrity qualifications; and integrated logistics support analysis/preparation. Major FY 1983 flight test activity includes: redesign, fabrication and subsystems integration and checkout of original B-1A prototype aircraft (B-1A Numbers 2 and 4) prior to flight test; initiation of the flight test program for B-1A Number 2; and continuation of engineering fabrication, and assembly of the first B-1B flight test aircraft. This Request correlates closely with the 1981 Air Force Independent Cost Analysis estimate and is required to maintain the B-1B program schedule and cost.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E (Aircraft) (PE #64226F)	260,124	302,000	235,900		TBD	TBD
Procurement (Aircraft) (PE #11126F) *	0	2,121,000	3,599,000		TBD	TBD

(U) OTHER APPROPRIATION FUNDS: (FY 83-87 FYDP)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
3010 (Procurement) (PE #11126F) *	0	1,621,900**	4,033,500	6,142,100	14,618,000	26,415,500

* Includes initial spares

** Initial spares unfunded in FY 1982 B-1B Appropriation

Program Element: # 64226F
DOD Mission Area: Offensive Strike, # 113

Title: B-1B
Budget Activity: Strategic Program, # 3

(U) DETAILED BACKGROUND AND DESCRIPTION:

(U) BACKGROUND: The 1981 Defense Authorization Act directed the Secretary of Defense to vigorously pursue the full-scale engineering development of a new strategic multi-role aircraft and to report on comparisons of various candidate aircraft. Furthermore, Congress directed that the multi-role aircraft to be developed must be capable of performing the missions of conventional bomber, cruise missile launch platform and nuclear weapons delivery system in the strategic and tactical roles. The Authorization funding for Research, Development, Test and Evaluation (RDT&E), and procurement of long lead production items totaled $375 million.

(U) In response to this Congressional direction, an Initial Full-Scale Development (IFSD) contract was awarded for the Long Range Combat Aircraft (LRCA) and a Joint Office of the Secretary of Defense (OSD) /Air Force Bomber Alternatives Study was initiated. Moreover, consistent with Congressional intent, residual direction and funding from the Cruise Missile Carrier Aircraft (CMCA) program, the Strategic Bomber Enhancement program, and Bomber Penetration Evaluation program were incorporated/transferred into the LRCA Program Element, 64226F, for initial development tasks common to all LRCA candidate aircraft.

(U) The 1981 Defense Appropriations Bill supported the full RDT&E funding authorized, but not the procurement funding. In addition, the 1981 Defense Appropriations Act contained an undistributed Air Force RDT&E reduction of $287.5 million. The LRCA program was reduced by $39 million as a partial offset to this directed funding reduction. A further reduction of $0.9 million was made to reflect new, lower Department of Defense inflation rates. Of the $260.1M remaining, $41.1M was used for the orderly conclusion of the Bomber Penetration Evaluation leaving $219M for B-1B RDT&E in FY 1981.

(U) The 1982 Defense Authorization Act supported the development and procurement of a new manned bomber with an Initial Operational Capability (IOC) no later than 1 July 1987, and authorized $302 million for RDT&E, $1801 million for weapon system procurement, and no monies for initial spares. In addition, this Act made the funds authorized for appropriation contingent upon the President submitting a written report to the Congress containing his decision on a specific program for the LRCA and the Secretary of Defense submitting a written report to the Armed Services Committees justifying the President's LRCA decision with a comparative analysis of alternatives. Moreover, Congress reserved the right to reverse the President's decision by a resolution of disapproval enacted by both Houses within 60 days of his LRCA decision.

(U) These Congressional requirements were subsequently satisfied. On 2 October 1981 the President announced his decision to produce 100 B-1Bs with an IOC in 1986. The Secretary of Defense submitted to Congress the Joint OSD /Air Force Bomber Alternatives Study Final Report, dated 2 October, 1981, which provided a detailed comparative evaluation of the various LRCA candidates. Both Houses of Congress overwhelmingly approved the President's decision to produce the B-1B.

(U) The FY 1982 Defense Appropriations Bill reduced the Administration's FY 1982 Request for the B-1B by $350.1 million. Most of this reduction was in critical front-end research and development funding. This reduction will require a realignment of funding within the FY 1982 B-1B appropriation to protect the established IOC and the total program acquisition cost of $20.5 billion (FY 1981$). In addition, the Nunn Amendment to the Appropriations Bill made the release of B-1B procurement funds contingent upon Presidential certification to Congress that it is feasible to accomplish the program

Program Element: # 64226F
DOD Mission Area: Offensive Strike, # 113

Title: B-1B
Budget Activity: Strategic Program, # 3

amount as the President certifies and explains to the Congress. Moreover, the procurement funds will remain available during any quarter in which the total program cost of 100 B-1B aircraft, as reported in the previous quarterly Selected Acquisition Report, does not exceed the $20.5 billion commitment.

(U) A formal reprogramming request has been forwarded through the OSD for submittal to Congress, and Selected Acquisition Report procedures have been initiated for the B-1B program. On 18 January 1982, the President sent a letter to Congress certifying that the acquisition of 100 B-1B aircraft is feasible within the $20.5B (FY 81$) budget estimate.

(U) The Office of the Secretary of Defense remains firmly committed to the 1986 B-1B IOC and the $20.5 billion (FY 1981$) total program acquisition cost. In keeping with the importance of this program, Deputy Secretary of Defense has directed rigorous cost control and management procedures for the B-1B program. Specifically, the acquisition costs for the B-1B, to include both external and internal cruise missile carriage, will not exceed $20.5 billion (FY 1981$) and no changes to the presently planned B-1B acquisition program or major changes in configuration will be made without Deputy Secretary of Defense approval.

(U) DESCRIPTION: The B-1B is a vital part of the President's comprehensive strategic modernization plan and reflects the near term necessity to correct the growing imbalance in strategic forces and consequent erosion of our deterrent posture. The plan calls for production of the modern B-1B to replace our aging fleet of B-52s.

(U) The objective of the B-1B program is to develop a strategic multi-role bomber which maximizes range and payload capabilities, and is able to perform the missions of conventional bomber, cruise missile launch platform, and nuclear weapons delivery system in both the tactical and strategic roles. The B-1B program retains the important military characteristics of the manned bomber by modernizing the element of the strategic TRIAD capable of seeking out and destroying imprecisely located, high value targets. The combination of B-1B's high penetration speed, low altitude terrain following flight, reduced radar cross-section, and advanced electronic countermeasures will make it capable of serving as an effective penetrating bomber well into the 1990s. Additionally, introduction of the B-1B provides an accurate, global, non-nuclear capability which preserves our flexibility to adapt to unforeseen contingencies with a timely and economic projection of power. The B-1B will be capable of performing the conventional bomber and cruise missile carrier mission well into the next century.

(U) The B-1B is a mature derivative of the original B-1A aircraft and is, therefore, able to capitalize on much of the RDT&E work accomplished prior to the production and deployment portion of that program being discontinued. However, valid RDT&E requirements for the current B-1B program remain and are directly attributable to two primary sources: RDT&E requirements that were incomplete/deferred until after production during the original B-1A program; and RDT&E efforts to develop, integrate, and test configuration changes that resulted from the B-1B's expanded multi-role capabilities and reduced radar cross-section.

(U) The incomplete/deferred items from the B-1A developmental effort remain valid RDT&E requirements for the B-1B program. Major items in the category include: weapons delivery development; nuclear certification; handbook performance data; and low speed handling, wing flutter/structural gust, and adverse weather testing. Under the B-1A (1977) plan certain costs such as producibility changes, cost redesigns, production engineering, avionics options, hardware qualification, and support engineering were deferred. Estimated value of these activities in 1981 dollars is $1.25 billion. These activities and their associated costs are included as an integral part of the current B-1B RDT&E program.

Additional design, development, and test efforts are required to successfully integrate system configuration changes to the B-1A airframe, engine, avionics and major subsystems to achieve the desired B-1B configuration. Major items in this category include: simplified overwing fairings, increased operating weight, and improved nuclear hardening to improve mission performance; redesigned nacelles and electronic countermeasures antennas, and incorporation of surface wave radar absorbing material to reduce radar cross-section; modified engines to accommodate more severe B-1B mission and to maintain durability, damage tolerance and performance retention; development of a movable forward weapons bay bulkhead, addition of external hard points and ALCM avionics to incorporate cruise missile capability; updated offensive and weapons delivery avionics to accommodate multi-role/multi-weapon B-1B flexibility; and new/revised reprogrammable defensive avionics which include

All these efforts require design, modification, integration and testing, and are necessary to achieve the desired B-1B capabilities.

(U) RELATED ACTIVITIES: The costs associated with the B-1B training devices have not been included in funding requests to date because the overall B-1B training concept has not been fully defined. Current plans call for a finalized training concept in early CY 1982 and a request for funding in the 1984 budget cycle. The Air Force anticipates $300 million (FY 1981$) to be the upper limit for training device costs. Once defined, the Air Force plans to develop the appropriate training devices under the separate program element for simulators, PE 64227F, managed by the Simulator Program Office.

(U) WORK PERFORMED BY: The B-1B program is in the Full-Scale Development/production phase. It is managed by the B-1B System Program Office, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio.

(U) Rockwell International, North American Aircraft Operations, Los Angeles, California is the B-1B airframe manufacturer. Rockwell is responsible for achieving aircraft design integrity. The B-1B System Program Office has overall integration responsibility for the development of the B-1B bomber. Boeing Military Airplane Company, Wichita, Kansas is the Avionics Subsystem Interface contractor responsible for integrating the B-1B avionics and for providing that avionics equipment which is not government furnished. AIL Division, Eaton Corporation, Deer Park, New York develops and builds electronic countermeasures components for the B-1B defensive avionics system. General Electric Company, Aircraft Engine Group, Cincinnati, Ohio is responsible for the design and development of the B-1B propulsion system.

(U) Several government agencies provide specialized assistance. For instance, the facilities at Holloman Air Force Base, New Mexico are be used to measure radar cross-section characteristics. The wind tunnels at the Arnold Engineering Development Center, Tennessee are used for comparative analyses. The Air Force Materials Laboratory and Air Force Avionics Laboratory at Wright-Patterson Air Force Base, Ohio are also used in the development effort.

(U) The majority of the flight test will be done at the Air Force Flight Test Center, Edwards Air Force Base, California, but several other Department of Defense test ranges are also used: White Sands Missile Range, New Mexico; Eglin Air

Program Element: # 64226F | Title: B-1B
DOD Mission Area: Offensive Strike, # 113 | Budget Activity: Strategic Program, # 3

Force Base, Florida; Point Mugu Naval Air Station, California; Utah Test and Training Range, Utah; China Lake Naval Test Center, California; Nellis Range Complex, Nevada; and others.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The B-1B program is an extension of the original B-1A effort. Approximately 90% of the B-1A airframe testing was completed during six years of flight test. Since the 1981 Defense Authorization Act, most of the LRCA funded efforts were devoted to the completion of the Bomber Penetration Evaluation flight test and to the support of the LRCA study, evaluation, and decision process.

(U) Initial Full-Scale Development (IFSD) contracts for the four primary contractors were prepared in FY 1981. Because the F101 engine (or its derivative) was to be used on all LRCA candidates, General Electric was awarded their IFSD contract in FY 1981. Rockwell, AIL, and Boeing IFSD contracts were awarded in FY 1982. The initial activities included taskings such as: aircraft configuration design definition, structural design and evaluation; interface definition; cost/performance/risk trade off analyses for major subsystems; specification preparation; and estimates of development/production costs, schedules, and aircraft performance.

(U) An Environmental Assessment was completed by the Environmental Protection Committee with a finding of no significant impact.

(U) The LRCA (B-1B) was approved by the President as a program of highest national priority. The program has been placed on the Master Urgency List (DX category) with Air Force precedence rating of 1-1 (FAD I).

(U) In accordance with the Office of Management and Budget Circular A-109, a Long Range Combat Aircraft Mission Element Need Statement was submitted for validation with the 1983-1987 Program Objective Memorandum. This document identifies deficiencies which a new manned aircraft could remedy. This document evolved from three Strategic Air Command Required Operational Capability/Statements of Need: Cruise Missile Carrier Aircraft (4-79), Near Term Manned Bomber (6-79), and New Strategic Manned Bomber (3-66 Revised).

2. (U) FY 1982 PROGRAM: An Interim Program Management Directive (PMD) initiating the B-1B program was developed and distributed. This directive provides the general guidance, requirements, and specific programmatic details within which the System Program Director will establish controls to adhere to the acquisition commitment. Fixed Price Incentive Contracts for FSD and production of Lots I (one aircraft) and II (seven aircraft) will be awarded to Rockwell International, Boeing and AIL. The FSD efforts will initially consist of general planning and design work necessary for weapon system development. Major activities in this area include: update and release of approximately 13,000 original engineering drawings and/or wiring lists to incorporate changes made in the B-1A program or changes required for new avionics installations, movable bulkhead, and external hardpoints; design and release approximately 5,000 new detailed drawings necessary to incorporate B-1B production designs for heavier weight, reduced radar cross-section, simplified overwing fairings, weapons launchers, and systems installations required by these new designs; and the development of the system specification, prime item specifications, environmental criteria specifications and support equipment speci-

cations. In addition, FY 1982 FSD activities will include: manufacturing design/planning; special tooling and test equipment design and fabrication; support equipment development; technical performance analysis; design and fabrication of critical Design Development Structural Test specimens; modification and testing of wind tunnel models; and engineering and fabrication work on prototype (B-1A Number 2) to prepare it for flight test activities.

(U) Major FY 1982 development tasks related to B-1B engines include: engine design release, exhaust nozzle and augmentor development verification testing, inlet distortion compatibility testing, first production F101-GE-102 verification testing, preliminary technical order preparation, and initiation of detailed maintenance and training planning.

(U) Avionics development in FY 1982 includes: design and fabrication of hardware for offensive, weapons and defensive systems groups; design and coding of software; and the start of special test equipment definition/design. In addition, the interface control documentation for automated wire lists between associate contractors equipment will be developed and flight test planning will begin.

(U) Integrated logistics support activities will begin in 1982 as well as work on the Facilities Requirement Plan and the initiation of contractor training.

(U) An Engineering Review, comparable to a Preliminary Design Review in a standard development program, will be conducted within four months of contract award.

(U) One B-1B aircraft will be procured in FY 1982 along with long lead materials for Lots II and III.

3. (U) FY 1983 PLANNED PROGRAM: Weapon system FSD will continue. Major airframe development during FY 1983 includes: continuation of the 41 Design Development Structural Tests (static and fatigue); initiation of fabrication of heavy weight landing gear test article; continuation of wind tunnel testing and design analysis; installation of production spoilers for the weapon bays; rerigging the flight control mechanism to correct for a potential hinge moment deficiency; remate and checkout of the crew capsule on B-1A aircraft; and engineering and fabrication of needed modifications on B-1A Number 4 in preparation for modification to B-1B configuration for flight testing.

(U) Engine design changes necessary to accommodate the more severe B-1B mission and to maintain durability, damage tolerance and performance retention will be made. In FY 1983, stress performance tests, endurance qualifications/demonstration and engine structural integrity programs will be completed on the first F101-GE-102 production engines. Additionally, the engine start system will be modified to include a cross-over system giving any one Auxiliary Power Unit or engine the ability to start all four engines. This provides increased alert performance, reliability and versatility.

Offensive and weapons delivery avionics will be completely updated to include a new (off-the-shelf) multi-role radar/terrain following radar (modified F-16), B-52 Offensive Avionics System units and other common Air Force avionics with updated controls and displays. In FY 1983, the design of hardware and software (Block 0) as well as the redesign of foward-looking radar and terrain-following radar systems, will be completed and integration of these systems will commence. In addition, the fabrication and ground testing of advanced and revised defensive avionics capabilities to include: [

] will be completed and installation/ integration will begin.

(U) Continued development, qualification and integration activities on major subsystems include: ground tests of weapons release racks (ejectors and launchers), development of movable bulkhead, development of cruise missile carriage capability (internal and external), and isolation and closed loop tests on the radome and antennas.

(U) Integrated Logistics Support activities continue as do contractor training and technical publications preparations.

(U) The FY 1983 flight test activities for the instrumented prototype (B-1A Number 2) include stability and control, vibration/acoustics, and dynamic response. Additional developmental work on diversified projects such as: evaluation of the life cycle benefits of military avionics standards, electrical multiplexing, and advanced central integrated test systems will be pursued.

(U) Seven B-1B will be procured in FY 1983 along with long lead materials for Lots III and IV.

4. FY 1984 PLANNED PROGRAM: Continued emphasis will be on FSD and production efforts. Major activities during this year include: completion of the Design Development Structural Tests; completion of wind tunnel testing; the continuation of offensive and defensive avionics installation, integration, and qualification; integration and checkout of Block 0 software; development/validation of Block 1 software; completion of weapons delivery system ground qualification testing; continuation of developmental testing on radome and antennas; and continuation of Integrated Logistics Support activity.

(U) The flight tests of B-1A Number 2 continue with the addition of propulsion, weapons carriage, and weapons separation work. With engineering, fabrication, pyrotechnic changeout, and avionics modifications completed and installed in FY 1984, B-1A Number 4 will begin its flight test program. Major flight test objectives include evaluation/flight check-out of production offensive and defensive avionics groups, aircraft development and adverse weather qualification.

(U) Ten B-1Bs will be procured in FY 1984 along with long lead materials for Lots IV and V.

5. (U) Program to Completion: B-1B system development will continue with major emphasis shifting to flight testing and the remaining cruise missile integration activities. Significant events during this period include the initiation of flight testing on B-1B aircraft Number 1 in April 1985, nuclear certification testing, and the continued development/validation of Block 2 and 3 software. The B-1B initial operational capability is projected for October 1986 when 15 B-1Bs are to have been delivered to the Strategic Air Command. Full operational capability will be achieved in December 1988 with the 100th aircraft being delivered to the Air Force.

Program Element: # 64226F
DOD Mission Area: Offensive Strike, # 113

Title: B-1B
Budget Activity: Strategic Program, # 3

6. (U) Milestones:

	DATE
A. (U) DSARC I	1 Jul 67
B. (U) DSARC II	4 Jun 70
C. (U) DSARC III	1 Dec 76
D. (U) Production Cancellation	30 Jun 77
E. (U) 1981 Defense Authorization	8 Sep 80
F. (U) Initial Full-Scale Development Contract Award (General Electric)	2 Feb 81
G. (U) President Reagan Bomber Modernization Plan	2 Oct 81
H. (U) Initial Full-Scale Development Contract Award (Rockwell, AIL, Boeing)	5 Oct 81
I. (U) FY 82 Appropriations Bill	29 Dec 81
J. (U) Full-Scale Development/Production Lot I Contract Award (Rockwell)	20 Jan 82
K. (U) Full-Scale Development Contract Award (General Electric)	1 Feb 82
L (U) Engineering Review	Apr 82
M. (U) Automated Wire List	Pre-Lot II Funding
N. (U) Configuration Review	Jan 83
O. (U) B-1A #2 Flight Test Start	Apr 83
P. (U) B-1A #4 Flight Test Start	Jul 84
Q. (U) B-1A Number 2 Flight Test Complete	15 Nov 84
R. (U) B-1B #1 Flight Test Start	Mar 85
S. (U) B-1B Number 1 Flight Test Complete	15 Sep 86
T. (U) IOC	Sep 86*
U. (U) FOC	Jun 88

* Assumes approval of FY 82 reprogramming and FY 83 budget request.

Program Element: # 64226F
DOD Mission Area: Offensive Strike, # 113

Title: B-1B
Budget Activity: Strategic Programs, # 3

(U) TEST AND EVALUATION DATA:

1. (U) Development Test and Evaluation: The Defense Systems Acquisition Review Council process was completed for the B-1A in December 1976. On October 2, 1981 President Reagan announced his decision to build 100 B-1Bs. Both Houses of Congress voted their approval of the B-1B program.

(U) The B-1B program will be managed by the B-1B System Program Office. This program is an extension of the original B-1A effort. Approximately 90 percent of the B-1A airframe testing was completed during six years of flight test. Because of significant improvements in its avionics components, the B-1B offensive and defensive avionics suites will require approximately 435 hours of additional flight test and integration. Examples of these tests are an examination of the 360 degree coverage of the ALQ-161 defensive suite, B-52 Offensive Avionics System integration, and the integration of a new modern terrain following/attack radar.

(U) The B-1B baseline test and evaluation program consists of 1000 hours of combined Development Test and Evaluation (DT&E)/Operational Test and Evaluation (OT&E) flight test using B-1 aircraft Numbers 2 and 4 and B-1B Number 1. The Air Force Test and Evaluation Center (AFTEC) will manage and conduct the OT&E portion of the combined DT&E/OT&E program. Personnel from the Strategic Air Command (SAC) and AFTEC will accomplish OT&E activities. B-1A Number 2, a fully instrumented aircraft, will be used for stability and control, vibration/acoustics, dynamic response, propulsion and weapon separation tests. B-1A Number 4 will be modified with the new offensive and defensive system groups. This aircraft will also be used for the heavy weight buildup and adverse weather testing. The first B-1B will be instrumented for flutter, airloads, stability and control, vibrations/acoustics, performance, avionics, weapons separation, and propulsion testing. After completion of its portion of the flight test, this aircraft will be delivered to the Strategic Air Command.

(U) The majority of the flight tests will be done at the Air Force Flight Test Center, Edwards Air Force Base, California, but several other Department of Defense test ranges will also be used: White Sands Missile Range, New Mexico; Eglin Air Force Base, Florida; Point Mugu Naval Air Station, California; Utah Test and Training Range, Utah; China Lake Naval Test Center, California; Nellis Range Complex, Nevada; and others.

(U) A Test and Evaluation Master Plan (TEMP) with its accompanying schedule, milestones, cost estimates, and thresholds is being developed and will be available in April 1982. On 17 August 1981 an environmental assessment was signed out with a finding of no significant impact.

2. (U) Operational Test and Evaluation: Operational Test and Evaluation (OT&E) will be accomplished in a 1000 hour combined DT&E/OT&E program and a Follow-on Test and Evaluation (FOT&E) managed by SAC. FOT&E will be conducted at the first operational SAC base.

(U) Direction for the combined DT&E/OT&E of the B-1B aircraft will be included in the forthcoming PMD and TEMP. The PMD and TEMP will specify the OT&E to be conducted and the responsibilities of the Strategic Air Command, Air Force Logistics Command, Air Force Systems Command, Air Training Command, and the Air Force Test and Evaluation Center for the conduct and support of this testing.

Program Element: # 64226F　　　　Title: B-1B

DOD Mission Area: Offensive Strike, # 113　　　　Budget Activity: Strategic Programs, # 3

3. (U) Systems Characteristics: The B-1A program achieved Defense System Acquisition Review Council III approval in December 1976. The B-1B contract specifications are being negotiated.

Characteristic	Goals	Thresholds	Demonstrated
(U) Technical:			
1. (U) Weight empty	186,000 lbs	TBD	TBD
2. Turnaround (Conventional)	[ ]	TBD	TBD
(U) Operational:			
1. Takeoff distance (Std day, SL)	[ ]		
Design gross weight (395,000)		TBD	TBD
Maximum gross weight (470,000)		TBD	TBD
2. (U) Sustained speed (Design Mach number)			
(U) High Altitude	0.70 Mach number	TBD	TBD
(U) Low altitude	0.85 Mach number	TBD	TBD
3. Range	[ ]		
Penetration mission [1]		TBD	TBD
Conventional mission [2]		TBD	TBD
4. (U) Payload			
(U) SRAM (Internal)	24	TBD	TBD
(U) ALCM (Internal/external) [3]	8/14	TBD	TBD
(U) MK-82 (Internal)	84	TBD	TBD
(U) Reliability/Maintainability:			
(U) Man Hours/Flying Hours	36	TBD	TBD

[1] Refueled: [ ] low level at [ ] Mach number; [ ] low level at [ ] number; [ ] recovery; 24 SRAM payload; maximum gross weight.

[2] Unrefueled: [ ] low level at [ ] Mach number; 84 MK-82 payload; maximum gross weight.

[3] (U) The maximum carriage capability final configuration will be in compliance with appropriate Strategic Arms Limitations agreements.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64233F
DOD Mission Area: 140, Strategic Support

Title: Tanker, Transport, Bomber, Training System (TTBTS)
Budget Activity: 3, Strategic Programs

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	-0-	-0-	560	1,557	TBD	TBD

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:
The Tanker-Transport-Bomber (TTB) aircraft was validated by ATC GOR 01-78 and is required to enable Air Training Command to implement Specialized Undergraduate Pilot Training (SUPT). The TTB will be an off-the-shelf, twin-engine aircraft which will be used to conduct the basic phase of pilot training for students selected for operational assignment to tanker, transport, or bomber aircraft.

(U) BASIS FOR FY 1983 RDT&E REQUEST:
The TTB program will commence with the release of a Request for Proposals (RFP) for Full Scale Development (FSD) in the first quarter of FY 1983. Contract award is planned for the fourth quarter FY 1983.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable.

(U) OTHER APPROPRIATION FUNDS:	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Aircraft) (PE 84741F)		-0-	-0-	4,600	TBD	TBD
(Quantity)				1	TBD	---

Program Element: # 64233F
DOD Mission Area: 140, Strategic Support

Title: Tanker, Transport, Bomber (TTB)
Budget Activity: 3, Strategic Programs

(U) DETAILED BACKGROUND AND DESCRIPTION: The Tanker-Transport-Bomber (TTB) aircraft was validated by ATC GOR 01-78 and is required to enable Air Training Command to implement Specialized Undergraduate Pilot Training (SUPT). The training provided with a TTB aircraft should improve the quality of pilot graduates, reduce the time and cost for operational aircraft checkout, and will delay the T-38 fleet insufficiency from the late 1980's to beyond the year 2000. An IOC (48 aircraft) in 1986 is required by Air Training Command. The TTB will be an off-the-shelf, twin-engine aircraft which will be used to conduct the basic phase of pilot training for students selected for operational assignment to tanker, transport, or bomber aircraft. It will have a high level cruise capability of 0.7M, a low level speed of at least 300KTS, seating for two students and one instructor, and a 3 hour mission profile with divert capability.

(U) RELATED ACTIVITIES: The Tanker, Transport, Bomber Training System, or TTBTS, is an aircraft and associated aircrew training devices required for the Air Force to implement a tailored pilot training system called Specialized Undergraduate Pilot Training (SUPT). The SUPT concept, approved by the Secretary of the Air Force in Jun 80, requires the acquisition of the TTBTS before it can be implemented.

(U) WORK PERFORMED BY: The Tanker, Transport, Bomber, Training System (TTBTS) aircraft test program will be managed by Air Force Systems Command/Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. The Air Force Test and Evaluation Center (AFTEC) will manage the Operational Test and Evaluation (OT&E) of the TTB Trainer Aircraft that is to be developed and acquired to implement the Air Training Command's (ATC) Specialized Undergraduate Pilot Training (SUPT) Program. A Request for Information (RFI) was released to industry on 30 Sep 81 to the following contractors: Gates-Learjet Corporation, Piper Aircraft Company, Beech Aircraft Corporation, Cessna Aircraft Company, Falcon Jet Corporation, Canadair Inc., Gulfstream American Corporation, British Aerospace, Rockwell International, Israel Aircraft Industries, Mitsubishi Aircraft International Inc., and E-Systems. Piper Aircraft and British Aerospace were the only aircraft manufacturers solicited that did not respond to the RFI prior to 15 December 1981.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A Systems Program Office was established in the Fall 1981 to begin preparing an RFP for FSD. A Request for Information (RFI) was released to industry on 30 Sep 81. TTB MENS approved Nov 81.

2. (U) PLANNED FY 82 PROGRAM: Responses to the RFI were received from ten companies in the first quarter of FY 1982. These responses will be evaluated and a program plan developed to support a TTB new start with RDT&E funds beginning in FY 1983.

3. (U) PLANNED FY 83 PROGRAM: An RFP for FSD will be released during the first quarter of FY 1983 with a contract award planned during the fourth quarter FY 83.

4. (U) PLANNED FY 84 PROGRAM: Test activity on the selected airframe and engines will commence.

5. (U) PROGRAM TO COMPLETION: Production deliveries will begin in FY 85 to support an FY 86 IOC. Deliveries of production aircraft will continue through FY 88.

Budget Activity: Tactical Programs #4
Program Element: 64233F Tanker, Transport, Bomber (TTB) Trainer Aircraft

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Tanker, Transport, Bomber, Training System (TTBTS) aircraft test program will be managed by Air Force Systems Command/Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. A comprehensive integrated test and evaluation program will be planned and accomplished on the TTBTS to support development efforts, establish capabilities with respect to design requirements, and determine operational effectiveness and suitability. These test results will provide data which, when combined with other program inputs, will form the basis for a Milestone III production decision.

(U) A combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) program is planned in which both contractor and Government test requirements will be incorporated in an integrated test plan. A combined test force will be used for DT&E/IOT&E flight testing. Aircrews will be mixed Air Force and contractor, with an Air Force Pilot in one or both of the pilot seats for all test flights. Maintenance crews will consist of both Air Force and contractor personnel.

(U) The TTBTS shall consist of off-the-shelf equipment. Substantial development testing has been conducted by some of the potential contractors. Contractor responses to a request for information issued in September 1981 should provide specific testing accomplished. This information will be updated prior to Milestone II.

(U) Ground testing will be conducted to verify design and minimize risks. Flight testing will be conducted to verify design, and assess system effectiveness and suitability.

(U) System components, specimens, and aircraft will participate in DT&E. Two instrumented aircraft are planned to participate in the combined flight test program.

(U) The primary objective of DT&E is to evaluate and verify that the design of the TTBTS is in compliance with the requirements as stated in the contractual specifications.

2. Operational Test and Evaluation (OT&E): The Air Force Test and Evaluation Center (AFTEC) will manage the OT&E of the Tanker, Transport, Bomber (TTB) Trainer Aircraft that is to be developed and acquired to implement the Air Training Command's (ATC) Specialized Undergraduate Pilot Training (SUPT) Program. The TTB aircraft is expected to be a modified, off-the-shelf multiengine aircraft that will be used to produce pilots with basic flying skills for performing tanker, transport, and bomber operational missions.

(U) IOT&E is planned to assess the following operational areas:

(U) Operational performance of the TTB aircraft.

Budget Activity: Tactical Programs #4
Program Element: 64233F Tanker Transport Bomber (TTB) Trainer Aircraft

(U) Capability of the TTB aircraft, with ancillary support, to effectively satisfy the tanker, transport, bomber training requirements of the Specialized Undergraduate Pilot Training (SUPT) program.

(U) Availability of the TTB aircraft (including reliability) to satisfy the Air Training Command's (ATC) SUPT training requirements.

(U) Operational maintainability and logistics supportability of the TTB aircraft.

(U) Initial testing is planned to be accomplished under a combined development test and evaluation/initial operational test and evaluation concept at Edwards Air Force Base, California. In addition, Operational Test and Evaluation is planned to be conducted in a realistic operational environment (i.e., deployment to an operational ATC base (to be determined) where typical TTB training missions will be flown and Air Force "hands-on" maintenance will be accomplished to the maximum extent feasible). The Initial Operational Test and Evaluation test team will consist of personnel from Air Force Test and Evaluation Center (AFTEC), ATC, Air Force Logistics Command (AFLC) and the Air Force Human Resource Laboratory. Test aircraft are expected to be preproduction versions of the TTP.

3. (U) System Characteristics: The significant performance parameters that will allow the Tanker, Transport, Bomber Training System to support training in the Specialized Undergraduate Pilot Training role are shown below.

CHARACTERISTIC	OBJECTIVE	DEMONSTRATED
Aircraft General	Multi-engine	To be determined
	Weight/Volume capability for for 3-man crew (2 student pilots, 1 instructor pilot), individuals gear, all necessary subsystems to meet mission requirements	To be determined
	Bird resistant windscreen at maximum low level speed	To be determined
Endurance	3 hour training mission (2 hours low level) plus divert 300 Nautical Miles land with fuel reserve	To be determined
Fatigue Life	18,000 hours	To be determined

Budget Activity: Tactical Programs #4
Program Element: 64233F Tanker Transport Bomber (TTB) Trainer Aircraft

CHARACTERISTICS	OBJECTIVE	DEMONSTRATED
Flight Characteristics	Yoke configuration and throttles similiar to large aircraft Stressed for low altitude/high speed flight Cruise Speed*	To be determined
Powerplant:	State of the art, fuel efficient, 8000 feet critical field length Take off from 4000 feet Pressure Altitude (PA) Cruise Speed* Speed at 500 feet above ground level (AGL)*	To be determined
Avionics	The aircraft is expected to have installed, as a minimum, the following avionics: Tatical Air Navigation (TACAN) with air-to-air capability Variable Omni Range (VOR) Instrument Landing System (ILS)/marker beacon Interphone panels at crew stations Very High Frequency (VHF) radio Inertial Navigation System (INS) (desired) Identification Friend or Foe (IFF) Weather radar with beacon capability Ultra High Frequency (UHF) radio with Automatic Direction Finding (ADF) capability Radar altimeter Radar beacon	To be determined

(U) The aircraft is to be used as a trainer for pilots selected to fly tanker, transport, and bomber aircraft. The aircraft will be operated at approximately ** knots at 500 feet AGL with pop-up for air drop training. The aircraft is expected to be operated at 5000 feet or below for 62% of the mission flight time (excludes divert time).

Budget Activity: Tactical Program #4
Program Element: 64233F Tanker Transport Bomber (TTB) Trainer Aircraft

the time at low altitude, approximately 20% of the time will be at 250 knots or faster. The aircraft is expected to average three landings per flight hour. The aircraft will be subjected to frequent bird strikes at speeds of up to ** knots, to gust loading at low altitude high speed and to "g" loading for both terrain avoidance and pop-up maneuver.

(U) *The Air Force has not established the cruise speed requirement. Use long range cruise and high speed cruise if .7 Mach or greater, and use speed attained with maximum continuous power if below .7 Mach.

(U) **The Air Force has not established the speed requirement. Assume the requirement is either 300 knots or maximum speed attainable at maximum continuous power if aircraft will not achieve 300 knots.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64312F
DOD Mission Area: Land-Based Strike, #111

Title: M-X
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1,491,626	1,963,157	2,759,332	2,651,476	TBD	TBD

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The requirement for M-X is a function of the need to respond to current and projected Soviet advanced ICBM developments. This will require a high degree of survivability. Further, the current ICBM systems are somewhat deficient in the measures of flexibility which will be required in the 1980s to maintain a high level of deterrence across the entire spectrum of potential response. The pace and scope of Soviet ICBM developments will result in a destabilizing imbalance between U.S. and Soviet strategic capability in the mid-1980s. M-X deployment is needed to alleviate this predicted asymmetry. The objective of this program is to develop an advanced, Multiple Independently Targetable Reentry Vehicle Intercontinental Ballistic Missile (ICBM), M-X. The basing subsystems include silos located at Minuteman sites, launch control and electronic power equipment, and mechanical hardware to support transportation and handling of the booster stages and the reentry system. Research and development will focus mainly on the Deep Basing concept, the Continuous Patrol Aircraft concept and Defended Deceptive Basing concepts to determine the most effective basing approach to increase survivability and regain offensive leverage for the U.S. land based ICBMs.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Fabrication and testing will be continued on all the major missile and basing subsystems. This will include the three booster motors (Stages I, II, and III), the post-boost vehicle, guidance and control, reentry system, missile transportation and handling equipment, and flight safety system. The basing vehicle subsystem will continue testing. Flight and targeting software design will be continued. Extensive flight and ground test planning and special test-unique hardware design will be fabricated. The missile and launch canister will complete integration testing and initial flight hardware will be tested. The research and development concept validation effort will continue for the long-term basing options of Deep Basing, Continuous Patrol Aircraft and Defended Deceptive Basing.

Program Element: #64312F
DOD Mission Area: Land-Based Strike, #111

Title: M-X
Budget Activity: Strategic Programs, #3

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: ($ in thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	1,491,600	2,408,700	2,278,800		3,601,170	10,599,800
Aircraft Procurement	Not Applicable					
Missile Procurement	Not Applicable					

(U) OTHER APPROPRIATION FUNDS: ($ in thousands)

Program Element 11215F (M-X Squadrons)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Military Construction	17,100	11,000	207,000	355,100	TBD	TBD
Aircraft Procurement					TBD	TBD
Missile Procurement			1,497,100	3,199,428	TBD	TBD

Program Element: #64312F
DOD Mission Area: Land-Based Strike, #111

Title: M-X
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The M-X missile system entered full scale development in September, 1979. In October 1981, the President redirected the program by cancelling the Multiple Protective Shelter basing mode and directing development of the silo basing concept for initial M-X deployment. In addition, research and development on survivable basing candidates was directed. The objective of this program is to develop an advanced, Multiple Independently Targetable Reentry Vehicle Intercontinental Ballistic Missile (ICBM), M-X, for initial deployment in existing Minuteman silos at the earliest possible time, with a follow-on deployment in a survivable basing mode for the long term. The major areas of effort are development of missile and basing subsystems, system integration and extensive system/subsystem testing to support the production/deployment decision. The missile subsystems are and will continue to be operational designs of the preprototype hardware developed in the Advanced ICBM Technology Program (Program Element 63305F). The missile subsystems will include an advanced guidance set derived from the Advanced Inertial Reference Sphere prototype. The three booster stages will contain an advanced solid propellant and lightweight motor cases and advanced nozzles which will produce about twice the propulsion efficiency of current ICBM systems. The M-X Post Boost Vehicle, although significantly larger than that of Minuteman, will use a similar, well proven configuration. The M-X reentry vehicle will be the Advanced Ballistic Reentry Vehicle (ABRV).

(U) RELATED ACTIVITIES: This program is directly related to the results of efforts in the Advanced ICBM Technology Program (PE 63305F), M-X Squadrons (PE 11215F), and Advanced Strategic Missile Systems (PE 63311F). This program and the related programs are all managed within the Ballistic Missile Office, and thus close coordination is assured. PE 11215F contains the funding for both M-X military construction and missile procurement.

(U) WORK PERFORMED BY: The program is managed by the Ballistic Missile Office, Norton Air Force Base, CA. Testing facilities at Arnold Engineering Development Center, Tullahoma, TN, will be used for motor testing. Contractors include: Thiokol, Brigham City, UT; Aerojet General, Sacramento, CA; Hercules, Magna, UT; Rocketdyne, Canoga Park, CA; Autonetics, Anaheim, CA; Northrop, Hawthorne, CA, and Norwood, MA; Honeywell, St Petersburg, FL; Charles Stark Draper Lab, Cambridge, MA; Logicon, Torrance, CA; Westinghouse, Sunnyvale, CA; AVCO, Lowell, MA; Martin Marietta, Denver, CO; TRW, Ballistic Missile Division, Norton AFB, CA; Boeing, Seattle, WA; GTE Sylvania, Needham, MA; and General Electric, Philadelphia, PA.

Program Element: #64312F
DOD Mission Area: Land-Based Strike, #111

Title: M-X
Budget Activity: Strategic Programs, #3

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Full-scale development of the M-X missile was initiated in September 1979. Funds requested in the FY 1979 Supplemental were used to accelerate purchase of tooling and missile subsystems for the M-X flight test program. In addition, system definition of the former multiple protective shelter basing mode was accelerated, to include acceleration of the construction of an engineering test bed.
(U) Fabrication and ground testing was initiated on all the major missile and selected basing systems previously developed under Program Element 63305F (Advanced ICBM Technology). This included the three booster motors (Stages I, II, and III), the post-boost vehicle, and guidance and control missile subsystems. The basing-unique vehicle subsystems began initial testing to validate the multiple protective shelter basing concept in such a manner that there was no commitment to one basing mode as directed by Congress. The hardware for the security and command and control began initial fabrication. Flight and targeting software design was continued. Extensive flight and ground test planning and special test-unique hardware design was also continued. Major subscale and full scale high explosive test design and fabrication for the basing facilities was initiated. Testing at the Engineering Test Bed was continued to evaluate various elements (power, security, preservation of location uncertainty, transportation/handling, command and control) associated with basing concepts. Finally, the missile and multiple protective shelter basing design was reviewed as an integrated system to establish the functional configuration baseline, review allocated requirements, approve operational and maintenance concepts, and ultimately approve the overall system design requirements.

(U) Most of the FY 1981 RDT&E request continued to be for missile development to include: propulsion stages; reentry system; guidance and control hardware and software; missile handling and transportation equipment; instrumentation and flight safety system; training equipment; data collection and evaluation; and general engineering support. The basing development included design, fabrication and test of: transporter-launcher vehicles; command, control and communications systems; ground power; physical security hardware and software; countermeasure techniques and equipment; environmental systems; targeting software, shelter closure development; facilities development; and environmental assessment. In addition, nuclear hardness and survivability testing was conducted, as well as basing tests and flight test preparation. Full scale development efforts continued on missile and basing subsystems, to include continued and refined design, fabrication and testing of the M-X missile.

Program Element: #64312F | Title: M-X
DOD Mission Area: Land-Based Strike, #111 | Budget Activity: Strategic Programs, #3

2. (U) FY 1982 Program: Weapon system full scale development will continue and a system design review will be held. The training equipment and course work will be developed for use by Strategic Air Command and Air Training Command personnel to train the operational and maintenance users. Design and fabrication of the missile and its launch canister will proceed through integration testing. First flight hardware will be delivered and there will be flight proof testing of the instrumentation flight safety system. The Vandenberg AFB flight test pads will go through assembly and check out. The launcher will undergo preliminary design. Complete system integration testing will begin at Vandenberg AFB. Thrust vector control and stage destruct testing will be accomplished at Arnold Engineering Development Center. The cost difference in 1982 was caused by the basing mode refinements directed by SecDef in the Fall of 1981. Concept validation efforts will be initiated on Deep Basing, Continuous Patrol Aircraft and Defended Deceptive Basing concepts.

3. (U) FY 1983 Planned Program: Weapon system full scale development will continue. There will be a critical design review on each of the missile's four stages leading to a first flight in early 1983. Flight hardware for the guidance and control system will be delivered. The inertial measurement unit will complete its critical design phase and the entire reentry system will go through integration and testing. There are five test flights scheduled from Vandenberg AFB and Defense System Acquisition Review Council III is scheduled for mid-CY 1983. The Vandenberg AFB support equipment delivery will be completed. Research and development will continue on the long-term basing concepts leading to a decision by July 1983. The differences between last years estimated FY 83 costs and this years were caused by the basing mode refinements directed by SecDef in the Fall of 1981.

4. (U) FY 1984 Planned Program: Weapon system full scale development will continue for silo deployment of M-X. There will be 4 test launches from Vandenberg AFB. Production will continue on the missile and support hardware. The selected long-term basing concept will continue in the validation phase or begin full scale development

5. (U) Program to Completion: M-X system development will continue with the emphasis shifting to flight testing and baselining the final M-X system design. The silo basing system Initial Operational Capability is late 1986 and the Research, Development, Test and Evaluation projection shows that FY 1987 will be the last year requiring Research and Development funds unless otherwise required by the long-term basing mode selected.

Program Element: #64312F
DOD Mission Area: Land-Based Strike, #111

Title: M-X
Budget Activity: Strategic Programs, #3

6. (U) Milestones:

		Date
a.	Defense System Acquisition Review Council I	9 March 1976
b.	Validation Phase Initiated	1 October 1976
c.	Defense System Acquisition Review Council IIa	5 December 1978
d.	Defense System Acquisition Review Council IIb	31 March 1979
e.	Defense System Acquisition Review Council IIc	14 July 1979
f.	Defense System Acquisition Review Council IId	21 July 1979
g.	Full Scale Development Initiated	September 1979
h.	System Design Review	23 September 1980
i.	Draft Environmental Impact Statement	18 December 1980
j.	First Flight Test	Early CY 1983
k.	Defense System Acquisition Review Council III	Mid-CY 1983
l.	Initial Operational Capability (10 missiles)	Late CY 1986

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Deceptive Summary: Not Applicable.

Budget Activity: Strategic Programs, #3

Program Element: #64312 M-X

1. (U) Test and Evaluation Data: The requirement for an advanced Intercontinental Ballistic Missile system, now designated M-X, was defined in Strategic Air Command Required Operational Capability 16-71. In 1973 the Air Force Chief of Staff directed an advanced missile technology effort. Since 1973, several basing modes have been studied, including vertical silos, horizontal shelters, trenches, submerged pool, and air mobile. The advanced technology effort proceeded through the conceptual and validation phases and in December 1978 completed a successful Defense Systems Acquisition Review Council Milestone II. In 1979 President Carter directed Full Scale Engineering Development (FSED) of a multiple protective shelter (MPS) basing mode. In October 1981, President Reagan terminated the MPS basing mode and directed that M-X be deployed in superhard silos. Mission requirements have remained essentially constant.

(U) Development Test and Evaluation began during the advanced development program and continued through the validation phase to investigate survivability, performance, and costs of critical elements of the missile and horizontal shelter and buried trench basing modes. The data from these efforts supported the Defense System Acquisition Review Council II reviews. M-X Development Test and Evaluation is being continued to assist the engineering design and development process, to verify specification requirements, and to address and resolve development test and evaluation areas of risk. The goal of future Development Test and Evaluation will be to verify, by test and evaluation, that the M-X missile and deployment facilities and equipment have been designed to satisfy operational requirements; and that each of the Development Test and Evaluation areas of risk has been resolved to a degree sufficient to permit a production decision. The test data provided thus far have provided high confidence that the required weapon system performance can be met within the identified state-of-the-art technologies at a reasonable cost. Additionally, testing has provided hardware design data which will assure more comprehensive specifications and a more realistic estimate of life cycle system costs. The test program initially evaluated areas of risk in guidance, accuracy, propulsion performance, radiation characteristic motor and nozzle performance, reentry system testing, launcher and shelter performance, command, control, and communications testing, ground power studies, physical security system testing, and nuclear hardness and survivability testing. Contractor test facilities, the Arnold Engineering and Development Center at Tullahoma, Tennessee and Rocket Propulsion Lab at Edwards Air Force Base, California have been used for most of the testing to date.

(U) Development Test and Evaluation during Full Scale Development is currently emphasing testing of components and subsystems to the design and development requirements. The third generation gyro, specific force integrating receiver, and advanced inertial reference sphere of the guidance and control systems have undergone extensive testing and production feasibility demonstrations. Production capability of these units was demonstrated by producing thirty specific force integrating receivers, twenty-four third generation gyros, and three advanced inertial reference spheres. Laboratory testing of the guidance and control components have accumulated 40,000 hours on four inertial measurement units of which 15,000 hours are on one inertial measurement unit. Two hundred forty thousand hours have been accumulated on the third generation gyro and specific force integrating receiver, and an additional 600,000 hours of life have been accumulated on the third generation gyro bearing. There have been three successful sled tests and a successful centrifuge test of the IMU at Holloman AFB. Half-scale and

Budget Activity: Strategic Programs, #3

Program Element: #64312 M-X

full-scale upper stage motors were tested, including high expansion-ratio, extendable nozzle exit cones; high strength, lightweight Kevlar motor cases; high performance Class I Division I propellants; a warm gas control actuator; and composite shim flexseal movable nozzle joints and carbon/carbon nozzle materials. Two full-scale lower stage nozzles were tested following materials evaluations and bench tests. These tests demonstrated that carbon/carbon nozzle material and the Techroll movable nozzle joint are capable of high angle, high rate, omniaxial deflection. Tests were conducted on a low length-to-diameter ratio motor typical of M-X third stage requirements to demonstrate the thrust termination capability. Static firing tests of two short-duration motors demonstrated the feasibility of deploying a full-scale folding petal extendable exit nozzle cone over the plume of a M-X motor, and the ability to design an extendible exit nozzle cone to eliminate the potential damage from particle impingement in high expansion ratio exit cones. Test results indicate that M-X performance can be achieved at low risk within demonstrated state-of-theart even though in-flight environments have not yet been measured. Carbon/carbon integral throat/entrance components have been manufactured for Stages I, II, and III. Carbon/carbon fixed nozzle liners (used only on Stage III) have been manufactured. Total full-scale successful sea level firings to date include three Stage I motors and two Stage II motors. The Stage III tests consist of three firings at sea level and two firings at altitude with no motor failures. Simulated missiles were ejected from a canister during six tests using a gas generator eject system. The launch dynamics and gas dynamics have been characterized sufficiently for continuing with this design concept. The vertical shelter engineering test bed program at Mercury, Nevada, provided data on shelter door and road construction and mechanical and transporter systems performance. Nuclear radiation simulation tests have been conducted on advanced technology semiconductors. Electron beam and underground nuclear tests were conducted on propellant samples. Laboratory and underground tests were conducted on extendible exit nozzle cone materials. Pebble impact and dust erosion tests were conducted on candidate external protection materials and candidate reentry system shroud materials. Material response to nuclear simulated environments are well enough understood to enter full-scale development. High energy-density power cell components have been tested to establish extended survival power. Results of M-X supersonic wind tunnel tests at Arnold Engineering Development Center showed that the center of pressure was slightly forward of the predictions, the raceway induced rolling moment was greater than predicted, and the jet-on base drag was greater than predicted. The operation of the roll control system showed no significant effect on the overall missile aerodynamic characteristics, but did indicate localized heating effects. Results of hypersonic wind tunnel testing at AEDC confirmed thin skin heating and pressure using 5% scale models of the M-X missile. Supersonic tests of I/II Staging indicated that a center of pressure disturbance during staging is within control system capability. One-tenth scale missile lightning attachment tests were successfully conducted. Successful lightning tests of a full size Post Boost Vehicle indicated that there is less coupling to electronics than originally anticipated.

(U) The M-X Test and Evaluation program is a combined Development Test and Evaluation/Operational Test and Evaluation test program. A combined Test and Evaluation program was developed to conserve on in both ground and flight testing. The combined test program prior to production is structured to address three major areas: demonstrate system and subsystem specification compliance, validate performance goals, and resolve areas of risk defined in the Test and Evaluation Master Plan. The System Test and Evaluation will be conducted at Vandenberg

THIS PAGE IS UNCLASSIFIED

Budget Activity: Strategic Programs, #3

Program Element: #64312 M-X

Air Force Base for the twenty missile flight program. Twenty test flights from the Western Test range at Vandenberg Air Force Base, California have been scheduled beginning in January 1983. The Test and Evaluation goals to be achieved are: M-X Stage II and III motor extendible nozzle exit cone capability to survive and perform during actual M-X missile powered flight; evaluate the capability of the Advanced Inertial Reference Sphere Guidance and Control units to achieve accuracy, reliability, and survivability goals in flight; determine M-X weapon systems hardness and survivability; evaluate the capability of the command, control, and communication system in various environments; confirm the capability of each configuration item to meet the specified design required to evaluate total M-X weapon system performance in the pre-, trans-, and post-attack mode; evaluate missile flight performance and reliability to include launch/facility, stages, guidance and control accuracy, reentry system footprint, and time of flight performance capabilities.

(U) The objective of the Development Test and Evaluation program is to demonstrate the capability of the instrumentation and flight safety system and the readiness of the overall M-X weapon system to enter Operational Test and Evaluation.

2. (U) Operational Test and Evaluation: Demonstation and Validation Phase. Several tests conducted by the Ballistic Missile Office during this phase have been judged to be operationally representative. Elements of these tests will be included in the Air Force Test and Evaluation Center evaluation of system survivability, operational effectiveness, and operational suitability.

(U) In addition, the Strategic Air Command is currently conducting Operational Test and Evaluation of the MK12A reentry vehicle on the Western Test Range using operational Minuteman missiles. The MK12A has been selected as the M-X deployment baseline reentry vehicle. Applicable data from this testing will be included in the Air Force Test and Evaluation Center evaluation of operational effectiveness.

3. (U) Full Scale Engineering Development: Test and Evaluation conducted during this phase will be combined Development Test and Evaluation/Initial Operational Test and Evaluation with separate additional Initial Operational Test and Evaluation events. Operational Test and Evaluation objectives have been integrated into both the Development Test and Evaluation ground and flight test programs. A total of twenty flight tests are planned to support missile system development and performance evaluations. These flight tests will begin during Development Test and Evaluation/Initial Operational Test and Evaluation and continue through Defense System Acquisition Review Council III and Follow-on Test and Evaluation. The flight test articles will be configured with test reentry vehicles and an in-flight safety system. The flight test series will begin in 1983. For approximately the next three years, Air Force Test and Evaluation Center Test involvement will focus on subsystem testing at Air Force and contractor test facilities. At least six months before the first flight test Air Force Test and Evaluation Center personnel will move to Vandenberg Air Force Base, California. Emphasis will then be placed on system testing. The operational suitability evaluation will include availability, reliabilty, maintainability, logistics supportability, operations and support costs, human factors, and training. This period of testing will be at least long enough to accomplish all operational tasks defined by the system's user, Strategic Air Command. Air

Budget Activity: Strategic Programs, #3

Program Element: #64312 M-X

Force Test and Evaluation Center will maintain overall management responsibility for M-X Initial Operational Test and Evaluation through Defense System Acquisition Review Council III. Air Force Test and Evaluation Center will also manage Follow-on-Test and Evaluation. Strategic Air Command will operate and maintain the system. Operational Test and Evaluation testing will be conducted at Vandenberg Air Force Base and other locations.

3. (U) Systems Characteristics

(U) Characteristics:	Objective:	Demonstrated:
(U) Length:	70 feet	To Be Determined
(U) Diameter:	92 inches	"
(U) Weight:	190,000 pounds	"
(U) Throwweight:	7937 pounds	"
(U) Payload:	10-12 reentry vehicles	"
) Accuracy:		"
) Range:		"
(U) Hardness of silos:	Under evaluation	"
) Launch and Flight Reliability:		"
) Pre-attack Availability:		"
) Reaction Time:		"

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64361F
DOD Mission Area: Airborne Strike, #113

Title: Air Launched Cruise Missile
Budget Activity: Strategic Programs #3

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT 1/	108,925	103,741	186,833	63,030	73,982	1,445,100

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Launched Cruise Missile is a small, long range, accurate, nuclear armed air-to-ground cruise missile programmed for use on the bomber force. The ALCM greatly enhances the air breathing leg of the Triad by: stressing and diluting Soviet defenses, thus improving the overall penetration prospects of the mixed air breathing force; compelling the Soviets to devote substantial resources to their national air defenses to counter this threat; increasing the number of weapons in our strategic forces in the near term and convincing the Soviets that their massive air defense efforts will not substantially blunt United States air breathing strike capabilities.

(U) BASIS FOR FY 1983 RDT&E REQUEST: $160M of the FY 83 request will be used to continue Full Scale Development of an improved ALCM. A portion of these funds will be used to continue depot level support equipment development. Other RDT&E efforts include the initiation of ALCM/B-52H integration testing. A large ALCM Mission Planning System effort will continue to improve the SIOP mission planning technique.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: ($ in Thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	107,300	70,600	11,300			1,098,700
Missile Procurement	579,600	605,400	511,700		2,294,300	4,662,700
OTHER APPROPRIATION FUNDS:						
Missile Procurement 2/	569,900	597,100	676,700	858,700	4,880,900	8,153,400
(Quantity)	(480)	(440)	(440)	(440)	(2275)	(4348)
Military Construction	66,300	102,300	0	32,000	141,900	356,700
Department of Energy Costs (W-80 Warhead)						

1/ FY 82-FY 84 estimates reflect costs for the improved ALCM as follows:
FY 82 = [illegible], FY 83 = 160.5, FY 84 = 43.3

2/ FY 83-FY 89 estimates reflect costs for the improved ALCM as follows:
FY 83 = 30.7, FY 84 = 224.0, add to complete = 1389.8

Program Element: #64361F
DOD Mission Area: Airborne Strike, #113

Title: Air Launched Cruise Missile
Budget Activity: Strategic Programs #3

DETAILED BACKGROUND AND DESCRIPTION: An Air Launched Cruise Missile (ALCM) system competition was conducted between the Boeing AGM-86B and the General Dynamics AGM-109 to provide a more cost effective missile system. The Boeing missile was selected in March 1980 due to its superior terrain following performance, navigation accuracy and maintainability characteristics. The Secretary of Defense approved full production of the ALCM at the 30 April 1980 Defense System Acquisition Review Council III meeting. Following that decision, the Boeing Company was awarded a fiscal year 1980 contract for 225 missiles with an option for 480 more in fiscal year 1981. The ALCM provides the bomber force with a 2500 kilometers (system operational range) air-to-ground missile which can be launched from both inside and outside enemy defenses. Current plans call for the procurement of 4348 ALCMs to equip each of the 90 Primary Aircraft Authorization B-52Gs, B-52Hs and B-1Bs with ALCMs. The deployment concept is to retain the current B-52G internal load of bombs and Short Range Attack Missile (SRAMs) while loading 12 ALCMs externally on two jettisonable pylons per aircraft. The weapon mix supports SAC's "shoot and penetrate" concept, and it prevents the Soviets from optimizing their defense against either the bomber or the cruise missile. Beginning in FY 1986, cruise missiles will be loaded externally on the B-52H aircraft complementing the existing SRAMs and bombs. Future plans include internal loading of ALCMs on the B-52H for a total of 20 missiles each. The B-1B bomber will also be cruise missile capable. [

]

(U) RELATED ACTIVITIES: The AGM-86B ALCM, land attack Sea Launched Cruise Missile (SLCM), and the Ground Launched Cruise Missile (GLCM) programs are structured to have maximum commonality in engine and navigation/guidance subsystems. The ALCM and SLCM share the common W-80 nuclear warhead under development by the Department of Energy. The SLCM and GLCM, the engine, navigation/guidance and mission planning projects are jointly managed through the JCMPO. However after the April 1980 production decision, management of the ALCM was transferred to the Air Force Strategic Systems Program Office (SSPO). The B-52 Squadrons, Program Element (PE) 11113F, is also related to the ALCM. The B-52 Cruise Missile Carriage, Offensive Avionics System, and other projects require close coordination with the ALCM program to ensure full compatibility. A memorandum of understanding exists between Air Force Systems Command and the JCMPO which delineates interface tasks. Development for an improved F107 ALCM engine (14A6) is being conducted under the Advanced Cruise Missile Technology PE 63319F. The Protective Systems development PE 64738F, laid the ground work for the ALCM HAVE RUST Program (electronic countermeasure protection). Development of an improved ALCM will be conducted under the current ALCM PE 64361F.

(U) WORK PERFORMED BY: The SSPO works under the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH in cooperation with the JCMPO (Naval Material Command), Washington, DC. The ALCM program also interfaces with; Department of Energy, Washington, DC (W-80 warhead); and Defense Mapping Agency, Washington, DC and St. Louis, MO, Strategic Air Command and Joint Strategic Target Planning Staff, Offutt AFB, NE (terrain contour matching map and mission planning). Department of Defense in-house facilities include: Arnold Engineering Development Center, TN; Naval Ship Research and Development Center, Bethesda, MD; Naval Air Propulsion Center, Trenton, NJ; Radar Target Scatter Facility and White Sands Missile Range, Holloman AFB, NM; Air Force Weapons Laboratory and Air Force Test and Evaluation Center, Kirtland AFB, NM; 4950th Test Wing and the Flight Dynamics Laboratory, Wright-Patterson AFB, OH; 6514th Test Squadron, Hill AFB, UT; Air Force Flight Test Center, Edwards AFB, CA and the Pacific Missile Test Center, Point Mugu, CA. The major contractors are: air vehicle - Boeing Aerospace, Seattle, WA; carrier

Program Element: #64361F
DOD Mission Area: Airborne Strike, #113

Title: Air Launched Cruise Missile
Budget Activity: Strategic Programs #3

aircraft equipment/cruise missile integration Boeing Military Aircraft Company, Wichita, KS; engine - Williams International Corporation, Walled Lake, MI and Teledyne CAE, Toledo, OH; navigation guidance - McDonnell Douglas Astronautics St. Louis, MO, Litton Industries, Woodland Hills, CA, Litton Canada Limited, Toronto, ONT, Minneapolis Honeywell, Minneapolis, MN; recovery system - Pioneer Parachute Company, Manchester, CT and Irvine Company, Los Angeles, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The Boeing AGM-86A utilized the technology of the cancelled Subsonic Cruise Armed Decoy air vehicle and engine to produce prototype models for testing. The Milestone II review in January 1977 approved the Full Scale Engineering Development for the current cruise missile programs. A Strategic Systems Program Office was formed at Wright-Patterson Air Force Base to integrate the Air Launched Cruise Missile (ALCM) into the B-52. The program included ALCM design and fabrication, B-52 integration, and rotary launcher and pylon development. In June 1978, Under Secretary of Defense for Research and Engineering deleted the Limited Operational Capability (June 1980) and redefined the Initial Operational Capability as one squadron of B-52G equipped with 12 ALCM each in December 1982. Boeing Military Aircraft initiated modification of three test B-52 aircraft in support of the competitive flyoff. Williams International F-107 engine qualification tests were initiated. Teledyne CAE was selected as licensed second source for the F-107 engine. Both ALCM contractors initiated the pilot production of 12 missiles each in September 1978. The major FY 1979 effort was the initiation of a two year competitive flyoff from February 1978 through March 1980. Each contractor participated in ten flights each, twelve were successful, six partially successful and two unsuccessful. The big event in FY 1980 was source selection and the ALCM production decision. The AGM-86B began a 20 flight Follow-on Operational Test and Evaluation program in June 1980 to estimate the operational effectiveness and suitability of the ALCM. Other development activities included formal qualification of the navigation/guidance system, completion of the engine qualification test, development of a new radar altimeter, maintainability demonstrations, flutter and missile jettison tests, pylon and rotary launcher tests and support equipment development. The Mission Planning Data Preparation system was delivered to the Strategic Air Command. The development effort also supported the ALCM/Offensive Avionics System (OAS) interfaces. Survivability testing with the air-to-air missile AIM-7M/7F and IHAWK surface-to-air missile was completed. The FY 1981 major event was meeting the First Alert Capability in September 1981 at Griffiss AFB, NY. One modified B-52G OAS and 13 ALCMs were delivered to meet the critical milestone of the first B-52G OAS aircraft equipped with 12 external missiles.

2. FY 1982 Program: Prime FY 1982 activity is meeting the December 1982 Initial Operational Capability at Griffiss Air Force Base, NY (The First Squadron of B-52Gs modified with OAS equipped with 12 external ALCMs). The ALCM Follow-on Operational Test and Evaluation program completes the last launches from the modified OAS B-52G aircraft. Second sources will be qualified for the F-107 engine. Development of depot level support equipment will continue. Engineering changes resulting from the Follow-on Operational Test and Evaluation program will be documented and incorporated into the production design. Retrofit kits will be developed to update missiles in the operational inventory to the approved configuration. The ALCM site activation task force will be active at Wurtsmith Air Force Base, MI, the second ALCM base. Site activation will also initiate interim contractor support to assist in maintaining initial operational readiness of the ALCM. A new FY 82 effort is underway for a Full Scale Development

Program Element: #64361F
DOD Mission Area: Airborne Strike, #113

Title: Air Launched Cruise Missile
Budget Activity: Strategic Programs #3

(FSD) demonstration of an improved Air Launched Cruise Missile (ALCM). The improved ALCM will be configured such that the]

] The improved ALCM is planned as a follow-on for the current ALCM-B with an Initial Operational Capability in FY 86.

3. (U) FY 1983 Planned Program: The major portion of the FY 83 effort will be the continuation of the FSD and testing of the improved ALCM. A large portion of the FY 1983 effort will be the initiation of ALCM/B-52G Offensive Avionics System (OAS) integration testing. Development of depot level support equipment will be completed and continue to refine the ALCM Mission Planning System. HAVE RUST (electronic countermeasures protection) for the ALCM will begin retrofit into the missile. The major portion of the cost increses ($174.9M in FY 83) is related to FSD and testing of the improved ALCM. The remainder is related to inflation, deferral of the support equipment development, costs associated with development of previously undefined depot level support equipment and corrections to the ALCM mission planning system. The FY 1984 cost increase ($63.3M) is related to completing the improved ALCM FSD and testing prior to a production decision. Other factors causing the increase are continuing development of depot level support equipment and the start of ALCM/B-52H integration testing.

4. (U) FY 1984 Planned Program: Planned activity will be centered around completion of the ALCM-C FSD and ALCM/B-52H integration testing. Any additional effort will depend on the success of the improved ALCM testing and ALCM/B-52H OAS integration.

5. (U) Program to Completion: The development activity planned beyond FY 1984 will be the start of the ALCM/B-1B integration effort. Additional development requirements will depend on the outcome of the ALCM/B-52H/B-1B integration testing.

6. (U) Milestones:	Dates
A. Defense System Acquisition Review Council I (Program Initiated)(AGM-86A)	February 1974
B. Defense System Acquisition Review Council II (AGM-86A)	December 1974
C. Defense System Acquisition IA (AGM-86A)	March 1975
D. Jettison Tests Completed (AGM-86A)	June 1975
E. Engine Preliminary Flight Rating Test Complete	October 1975
F. Initial Department of Energy Phase III (Warhead)	February 1976
G. First Powered Flight (AGM-86A)	March 1976
H. First Guided Flight (AGM-86A)	September 1976
I. Defense System Acquisition Review Council II (AGM-86A/B)	January 1977
J. AGM-86B/AGM-109 Competition Directed	July 1977
K. System Design Reviews	May 1978
L. First Full Scale Engineering Flight	July 1979
M. Source Selection	March 80

Program Element: #64361F

DOD Mission Area: Airborne Strike, #113

Title: Air Launched Cruise Missile

Budget Activity: Strategic Programs #3

N.	Defense System Acquisition Review Council III (Production Decision)	April 1980
O.	Follow-on Operational Test and Evaluation	June 1980 - June 1982
P.	First Alert Capability (One B-52G)	September 1981
Q	Improved ALCM Full Scale Development Decision	June 1982
R.	Initial Operational Capability (First B-52G Squadron)	December 1982
S	Improved ALCM Initial Operational Capability	Fiscal Year 1986
T.	Full Operational Capability	Fiscal Year 1990

7. (U) Resources: N/A

Budget Activity: Strategic Program #3
Program Element: #64361F, Air Launched Cruise Missile

Test and Evaluation Data

1. (U) Development Test and Evaluation: In 1975 and 1976, six advanced development tests were conducted on the medium range Boeing AGM-86A Air Launched Cruise Missile (ALCM). Jettison tests were successful, demonstrating that the AGM-86A could be safely launched at low and high airspeeds, and four of the six flight tests were successful. The fifth flight went out of control because the stable platform of the inertial navigational element tumbled and the sixth flight failed to obtain an engine start.

(U) The General Dynamics AGM-109 ALCM inherited the Development Test and Evaluation (DT&E) base of the BGM-109 Sea Launched Cruise Missile (SLCM). The SLCM has had a total of 76 flight tests as of 19 September 1981. The Joint Cruise Missiles Project Office's records indicate that 59 were successful while 17 were failures. Previously identified problems have been resolved and reported by the SLCM program.

(U) The Full Scale Engineering Development (FSED) program for the long range ALCM is structured into two phases. The first phase was the competitive flyoff between the AGM-86B and the AGM-109 with the AGM-86B chosen to proceed into production. The second phase consists of 20 follow-on flights to support B-52G/ALCM integation. The FSED test program began in April 1979 with B-52 flutter and jettison tests of each missile configuration. Two modified B-52Gs (one for each contractor) were delivered to Edwards Air Force Base, CA in May 1979 to begin the missile competitive flight test program. A third B-52 was used at Edwards Air Force Base for performance, flutter and jettison tests. The competitive flight test program ran from July 1979 through 8 February 1980 and consisted of B-52 performance evaluations with ALCM loaded; captive carry tests as required; live launches (ten flights per contractor); reliability and maintainability demonstrations; mid-air recovery; and survivability and vulnerability testing. During the flyoff, ten AGM-86Bs and seven AGM-109s (three were refurbished and reflown) were tested. The ten flights per competitor were further divided into three DT&E flights conducted by the contractors and seven Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) flights conducted by a joint Air Force DT&E/IOT&E test team. The IOT&E was managed by the Air Force Test and Evaluation Center. Of the 20 flights, 12 were successful, 2 unsuccessful and 6 partially successful. There were no significant problems with either of the missiles or the B-52 flutter and jettison tests.

(U) The Boeing AGM-86B missile was selected on 25 March 1980. The AGM-86B is now particpating in an additional 20 flight Follow-on Operational Test and Evaluation program that began in June 1980 with completion scheduled for late fiscal year 1982. The follow-on testing will use 11 missiles from the fiscal year 1978/1979 buy and 9 refurbished missiles. There have been 17 flights to date with 13 successes, 1 partial success and 3 failures. The partial success

Budget Activity: Strategic Program #3
Program Element: #64361, Air Launched Cruise Missile

was due to telemetry loss and not missile related. The first failure was caused by excessive carbon build-up in the engine resulting in first stage turbine burn-through. The second unsuccessful mission occurred when the launch sequence failed to deploy missile aero surfaces caused by an ejector rack solenoid failure. The third failure was due to an uncommanded engine shutdown caused by a faulty fuel control unit. All necessary hardware modification to correct these problems have been identified and implemented. Eleven of the 17 missions completed the Air Launched Cruise Missile/Cruise Missile Integrated (ALCM/CMI) B-52G aircraft interface. The next phase consists of test missions using the B-52G Offensive Avionics System (OAS) aircraft. There have been six successful ALCM Cruise/B-52G OAS integration missions to date. The next test mission is scheduled for July 1982, awaiting B-52G OAS Block I software change.

(U) The missiles tested during the flyoff were representative of those that will be procured. Changes identified during the flyoff are being tested by Boeing during the 20 flight follow-on phase. Included will be a new radar altimeter and the production configured engine. Support equipment, missile handling equipment and full capability electronic systems test sets will be tested during the follow-on test period.

(U) Testing of the missile was conducted out of Air Force Flight Test Center using primarily the Utah Test and Training Range and Pacific Missile Test Center. A combined test team consisting of Air Force Test and Evaluation Center personnel conducted the the test under the management of the Joint Cruise Missiles Project Office (JCMPO).

(U) The ALCM competition involved Boeing Aerospace, Seattle, WA, and General Dynamics Convair, San Diego, CA for the missile Williams International, Walled Lake, MI is the prime contractor for the engine. Teledyne CAE, Toledo, OH, will be the second source for the engine. Teledyne will start qualification testing of its copy of the engine in late 1981. McDonnell Douglas, St Louis, MO provided navigation/guidance hardware to both missile contractors, but participate in the competition with Boeing by providing navigational software to General Dynamics. Boeing Military Aircraft Company Wichita, KS is the cruise missile integration contractor responsible for B-52G modification and integration. ALCM development and initial production were managed by the JCMPO with the Navy as lead service. Rear Admiral Walter M. Locke was Program Director. The ALCM responsible test organization is the Air Force Flight Test Center, Edwards Air Force Base, CA. The Air Force Test and Evaluation Center is the independent operational test agency for Air Launched Cruise Missile. The Aeronautical Systems Division at Wright-Patterson Air Force Base, OH assumed ALCM program management responsibility in April 1980 with Major General Melvin F. Chubb as Program Director. Management transfer occurred after the 17 April 1980 production decision which approved full rate ALCM production. Engine and navigation/guidance systems management still remains with the JCMPO.

(U) Wind tunnel testing was accomplished at Arnold Engineering Development Center (AEDC) and the Naval Ship Research Development Center. Engine flight qualification and calibration occurred in fiscal years 1979/1980 at the AEDC and the Naval Air Propulsion Center. Rotary launchers were proof qualification tested in fiscal year 1979. Pylon proof testing began in February 1979. Pylon Jettison began in August 1980.

(U) Environmental testing in fiscal year 1979 consisted of static icing tests of the competing missiles. Fiscal year 1980 activities included simulated free flight icing tests of the missile in the AEDC wind tunnel and icing flight

Budget Activity: Strategic Program #3
Program Element: #64361F, Air Launched Cruise Missile

of the missile/pylon/B-52G combination using the KC-135 water spray tanker. The fiscal year 1981 effort consisted primarily of test planning and facility set up for further missile icing tests at Arnold Engineering Development Center and free flight icing test.

(U) The majority of the reliability and maintainability testing is being conducted during the follow-on test program now that sufficient production configured support equipment is available. During the flyoff the contractors were expected to demonstrate a test reliability of .575 to .744 for a hypothetical mission of 12 hours captive carry and 5 hours of free flight. A value of .68 was achieved. Ground test demonstrations conducted during the flyoff were evaluated as part of the competition. These included pylon/launcher loading, vehicle exchanges, payload exchange and limited capability electronic systems test set testing. These tests were conducted by Air Force Flight Test Center and Air Force Test And Evaluation Center (AFTEC) personnel at Edwards Air Force Base, CA.

2. (U) Operational Test and Evaluation: AFTEC was responsible for Initial Operational Test and Evaluation (IOT&E) and the early phase of Follow-on Operational Test and Evaluation (FOT&E) of the Air Launched Cruise Missile (ALCM). The ALCM test team is located at Edwards AFB, CA, and comprises approximately 80 personnel from AFTEC, Strategic Air Command, Air Force Logistics Command, and Air Training Command.

(U) A combined Development Test and Evaluation (DT&E)/FOT&E was conducted following the combined DT&E/IOT&E competitive flyoff between Boeing Aerospace Company (BAC) and General Dynamics Convair. Selection of the BAC AGM-86B was announced on 25 March 1980 after the DT&E/IOT&E fly-off. The Defense Systems Acquisition Review Council (DSARC) III, which met on 17 April 1980, provided direction for production of 225 missiles in fiscal year 1980, FOT&E, continuation of reliability and maintainability efforts, and management attention on improving BAC quality assurance discipline for this program. Plans for FOT&E included 34 additional launches before the Initial Operational Capability (IOC). The phase just completed included 11 launches from the same B-52G BAC used during the competition. All other launches will be from B-52Gs equipped with the Offensive Avionics System (OAS). Two of those launches have been completed as part of the OAS IOT&E conducted at the Boeing Facility at Wichita, Kansas.

(U) The significant milestone remaining in the ALCM program is the IOC in December 1982 at Griffiss Air Force Base, NY.

(U) All but two of the ALCM Operational Test & Evaluation (OT&E) flight tests to date originated from Edwards AFB, and most of the support equipment evaluation has been accomplished there. OT&E flight tests will continue to be conducted over and between several western test ranges, i.e., Utah Test and Training Range, Tonopah, Pacific Missile Test Range, and the Edwards Range. In addition, captive-carry flights will continue over the western part of the United States including Alaska.

(U) The additional testing, directed by the DSARC III, is designed to provide specific performance parameters to the user and to test required changes before putting the missile on sustained alert. The objectives cover the following

Budget Activity: Strategic Program #3
Program Element: #64361F, Air Launched Cruise Missile

areas: operational performance parameters, mission reliability, compatibility and interoperability, survivability, mission planning, availability, logistics reliability, maintainability, logistics supportability, operations and supportability cost training, human factors, and software suitability.

(U) Testing of the Air Launched Cruise Missile (ALCM) has been affected by a number of factors both internal and external to the program. Fiscal and time constraints limited the number of actual missile launches to ten per contractor during the competition and delayed availability of some pieces of support equipment at the test site until after the production decision. Four of the ten Boeing Aerospace Company competition AGM-86Bs crashed, two due to malfunctions of test peculiar equipment. In the more recent test series, 4 of 11 launches resulted in missile crashes, and 1 other in a no-test due to lost telemetry. The last launch in them Follow-on Operational Test and Evaluation (FOT&E) series was in April 1981 with two additional successful launches in August and September as part of the Offensive Avionics System (OAS) program. Updating of the B-52G with the OAS has also caused some change in Initial Operational Test and Evaluation programs for both systems. Several ALCM test objectives have been delayed until after the September 1981 First Alert Capability and an OAS-equipped B-52G is available. Examples of these objectives are: total system mission reliability, interoperability, compatibility, and some maintainability and logistics supportability.

(U) The ALCM Operational Test and Evaluation Final Report, dated September 1981, is based on testing through April 1981. Operational effectiveness test results to date are inconclusive with the exception of mission reliability for for which the data clearly indicated that substantial improvements are required. Operational effectiveness areas that are satisfactory include range, selection of of alternate mission profiles, arming and fusing, missile status monitoring, and B-52G flight handling characteristics. Operational performance of the AGM-86B in areas such as accuracy, terrain following, and the low altitude portion of the launch envelope are as yet undetermined. The suitability factors of availability, logistics supportability (excluding technical data), training and human factors were all previously rated as satisfactory. Recent test results, however, have lead to reduced availability predictions. Mission planning system capability and overall suitability of software are undetermined and major efforts will be required to complete these evaluations before Initial Operational Capability.

(U) Data on ALCM survivability is being gathered during five FOT&E mission segments, three of which have been completed. Data from these tests will be merged with survivability data obtained during the ALCM competive flyoff and from generic testing conducted in 1978 by the Joint Cruise Missiles Project Office.

(U) Continued Development Test and Evaluation/Operational Test and Evaluation of the ALCM system will be conducted at Edwards AFB, CA, from October-December 1981. This testing will combine the OAS with ALCM and become the Integrated Weapon System program. A major modification to the OAS computer program will be tested during the fiscal year 1982-83 timeframe. Strategic Air Command will manage the ALCM FOT&E following completion of the Air Force Test and Evaluation Center-managed phase of the test.

Budget Activity: Strategic Progam #3
Program Element: #64361F, Air Launched Cruise Missile

3. System Characteristics: Performance data are Decision Coordinating Paper thresholds/goals.

Physical Characteristic	Boeing AGM-86B
Length (feet)	20.75
Diameter (inches)	27.3
Weight (pounds)	3144
Wing Span (feet)	12.0
Wing Area (square feet)	11.0
Warhead Yield (kilotons)	
B-52 Internal Carriage (each)	8
B-52 External Carriage (each)	12

Performance Data	Threshold	Goal	Demonstrated
Maximum Low Altitude Speed (Mach number)			
Minimum Launch Altitude (feet)			
Minimum Enroute Altitude (feet)			
Propulsion Range (kilometers)			
System Operational Range (kilometers)			
Accuracy (Circular Error Probable)(feet)			

Low altitude at

At Mach last fix within nautical miles of target, terminal cell size

Extrapolated flight test data.

Median accuracy value due to lack of large enough statistical sample to establish Circular Error Probable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64406F
DoD Mission Area: Space Defense, #123

Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	133,873*	200,900	211,764	179,038	Continuing	Not applicable
2134	Miniature Systems	105,773	162,600	193,264	168,038	Continuing	Not applicable
2135	Advanced Systems	2,100	20,500	700	500	Continuing	Not applicable
2241	Instrumented Target Vehicle	26,000	17,800	17,800	10,500	Continuing	Not applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is developing and testing antisatellite (ASAT) systems in response to guidance contained in National Security Council/Presidential Directive -37 (National Space Policy). First flight test: Initial Operational Capability: . These systems are designed to remove the sanctuary status the Soviets currently enjoy in space by providing a capability to deny them the use of those space assets which enhance the effectiveness of their land, sea and aerospace forces.

BASIS FOR FY 1983 RDT&E REQUEST: This request funds the continuing development of the baseline Prototype Miniature Air-Launched System (PMALS) antisatellite, development of an Instrumented Target Vehicle (ITV) to serve as an orbital target for ASAT testing and limited investigations into the possible application of high energy lasers as ASAT weapons. Cost figures are based on October 1981 contractor cost proposals and System Program Office cost estimates.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	109,873	180,900	190,490	-	Continuing	Not Applicable

* $24 million increase in FY 81 relative to FY 1982 Summary reflects Congressionally approved reprogramming action.

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Procurement (PE 12450F)						
- Missile Procurement	0	0	0	32,800	Continuing	Not Applicable
Procurement (PE 12311F)						
- Mission Operations Center Hardware	0	4,247	0	0	0	4,200
Procurement (PE 12424F)						
- SPACETRACK Improvements	7,178	24,705	7,696	5,698	Continuing	Not Applicable

Program Element: #64406F
DoD Mission Area: Space Defense, #123

Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND: The ability of the Soviet Union to use military power on a worldwide basis is increasingly dependent on effective and reliable operation of various satellite systems. These systems enhance the performance of Soviet surface, sea and aerospace forces and [ ] Soviet reliance on military space support is growing at a rapid pace. The present-day Soviet military satellite population varies between [ ] active satellites on orbit. First and foremost, therefore, the U.S. has a legitimate need for an antisatellite capability to negate Soviet satellite systems. Currently, the United States has no nonnuclear capability to deny the Soviets the use of space for strategic and tactical forces support. Air Force antisatellite systems are being developed to deny the Soviets the use of space as a force multiplier and to remove the current sanctuary status the Soviets enjoy in the space environment.

The Air Force antisatellite (ASAT) program is also a response to the demonstrated Soviet ASAT capability. In the absence of a comparable United States system or comprehensive and verifiable negotiated limits on ASAT systems, the Soviet ASAT program raises the prospect of a unilateral Soviet military advantage which could also have adverse political implications. Such an advantage, [ ] could be detrimental to the United States. It would provide options to the Soviets during crisis and conflict that the United States could not match.

The primary effort funded by this program is the development and test of a Miniature System ASAT. Miniature System ASATs can be ground or air-launched. The baseline system is the Prototype Miniature Air-Launched System (PMALS) consisting of a modified Short-Range Attack Missile first stage, a modified ALTAIR III second stage and a Miniature Vehicle terminal warhead stage. Kill mechanism is [ ] The preliminary design of a lower risk, conventional antisatellite system using [ ] was completed in FY 1980. This design effort was pursued to assure the availability of a physical-attack antisatellite system in the [ ] if PMALS experiences severe technical difficulty. While the selected conventional antisatellite design will meet this requirement, it will be costly to deploy and will be limited only to low altitude [ ] intercepts.

PMALS is a lightweight and highly responsive system. However, it depends on achieving a [ ] circular error of probability which involves a moderate-risk development effort. The high payoff in cost effectiveness and operational flexibility has led the Air Force to aggressively pursue this antisatellite option. The Prototype Miniature Air-Launched System (PMALS) proceeded into hardware design and development in the fourth quarter FY 1977. Hardware assembly and test of subsystems commenced in FY 1978. If directed by the Secretary of Defense, this will lead to demonstation flights beginning in [ ] against targets being developed under Project 2241, Instrumented Target Vehicle.

(U) An instrumented Target Vehicle (ITV) is also being developed to provide a dedicated orbital test target for evaluation of ASAT system performance.

Program Element: # 64406F
DoD Mission Area: Space Defense, # 123

Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, #3

(U) During the course of this program, the Air Force will continue to participate in the DoD ground and space-based laser studies so when this technology matures, lasers can be evaluated for use as antisatellite weapons. Major elements of this project will be transferred to a new program element (PE. 63603F) Space Laser Program, starting in FY 1983.

(U) RELATED ACTIVITIES: This program is part of an integrated Space Defense Systems Program effort involving four functional areas: Antisatellite, Space Surveillance, Satellite Systems Survivability, and Command and Control. Program Element 63438F, Satellite Systems Survivability, is developing techniques to enhance the survivability of United States space systems. Program Element 63428F, Space Surveillance Technology, is developing improved surveillance capabilities to support ASAT targeting. Program Element 12311F, North American Air Defense Command Combat Operations Center, and Program Element 12424F, SPACETRACK, provide the needed tracking capability and command and control so the ASAT system can be targeted.

(U) WORK PERFORMED BY: Air Force Systems Command Space Division in Los Angeles, CA, manages this program. Aerospace Corporation, El Segundo, CA, provides technical support. PMALS contractors are: Vought Corporation, Grand Prairie, TX, and Boeing Aerospace Corporation, Seattle, WA. AVCO, Wilmington, MA, is developing the Instrumented Target Vehicle. The Arnold Engineering Development Center and Air Force Systems Command Space and Missile Test Organization are both supporting the PMALS development and test efforts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Two Miniature System ASAT concepts were pursued through preliminary design. The Vought/Boeing team was selected in the fourth quarter FY 1977 for development and ground tests. In 1978 the program was restructured to provide a prototype miniature antisatellite system to be launched from an airplane with an option for the development of ground launched system, if requirements dictate. The design of the ground-test configuration has been approved by the Air Force and assemblies of the miniature vehicle have undergone ground testing. An Air Force review of the PMALS preliminary design has been completed. Wind tunnel tests have been performed to define missile aerodynamic configuration. The preliminary design of the mission control segment to support ASAT testing has been completed. In June 1980, contracts were awarded to the Vought and Boeing Corporations for completion of final design and a [ ] flight test program. The conventional antisatellite preliminary design efforts have been completed and all contractual efforts were completed in February 1980. Fabrication of PMALS the test hardware for the flighttest program has started.

Detailed design of the Instrumented Target Vehicle to support ASAT flight testing was initiated following award of the development contract to AVCO Corporation in May 1979. An Air Force review of the design was accomplished in FY 1980. Subsystem qualification testing has begun. Fabrication of the [ ] ITVs for the PMALS test program has begun.

Program Element: # 64406F | Title: Space Defense Systems (Antisatellite)
DoD Mission Area: Space Defense, # 123 | Budget Activity: Strategic Programs, # 3

(U) Laser systems have been and will continue to be reviewed for possible advanced antisatellite (ASAT) applications. A Congressionally-directed mission analysis for a multi-mission space-based laser has been completed.

2. FY 1982 Planned Program: Detailed design of PMALS will continue. Ground tests of the MV will continue. System integration and test efforts will continue [ ] Activities at the Air Force Flight Test Center at Edwards AFB, CA will accelerate toward the [ ] first flight of the Miniature System ASAT. Testing of the interfaces between the ITV and its Scout booster will begin. [ ] Investigations will continue on possible new advanced ASAT techniques such as lasers and particle beams. The $20.0 million increase relative to the FY 1982 Descriptive Summary reflects a Congressional add to the FY 1982 Budget Request to support the Air Force portion of a new Space Laser Program.

3. FY 1983 Planned Program: [ ] Investigations will continue into possible advanced ASAT techniques. The additional funding relative to the FY 1982 Descriptive Summary will be used to reduce development risk and [ ]

4. FY 1984 Planned Program: [ ] System improvements will be studied for future implementation.

5. Program to Completion: This is a continuing program. PMALS [ ] data analyses will continue into [ ] This program will continue to support, as required, the deployment of an operational ASAT capability.

Program Element: # 64406F
DoD Mission Area: Space Defense, # 123

Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, # 3

6. (U) Milestones:

a. Start Fabrication of Flight-Test Missiles [ ]
b. (Miniature Vehicle Ground Tests Complete
c. (First Modified F-15 Available for Test [ ]
d. (First Missile Captive Flight Test
e. (First Instrumented Target Vehicle On-Orbit
f. (Missile Flight-Worthiness Test Complete
g. (MV Qualification Test Complete
h. (First Flight Test
i. (Initial Operational Capability

* Data presented in Fiscal Year 1982 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

a. (U) Start of fabrication delayed one month because of one-month slip in associated Critical Design Review (CDR). This CDR was slipped to align it with other on-going design reviews. No impact.

b. One system-level vibration test remains. All other tests completed on schedule. Minor structural redesign underway and will be tested in

e. (U) Error in last year's P.E.-level Descriptive Summary. Project-level FY 1982 Descriptive Summary had correct date.

g. Current schedule reflects first week in [ ] vice last week in [ ] in last year's Descriptive Summary

7. (U) Resources: Not applicable

8. (U) Comparison with FY 1982 Budget Data: Not Applicable

Project: # 2136 Title: Miniature Systems

Program Element: # 64406F Title: Space Defense Systems (Antisatellite)

DoD Mission Area: Space Defense, # 123 Budget Activity: Strategic Programs, # 3

DETAILED BACKGROUND AND DESCRIPTION: United States antisatellite (ASAT) development efforts were accelerated in January 1978 following promulgation of Secretary of Defense guidance to "vigorously pursue" an ASAT capability. This guidance followed growing recognition of (1) the growing asymmetry between the U.S. and the Union of Soviet Socialist Republics (USSR) in ASAT capabilities and (2) [ ] Thus, the development of an ASAT capability will enable the U.S. to respond to a Soviet ASAT attack by providing the means to destroy Soviet satellites which enhance their war fighting capabilities.

Air Force ASAT development efforts have concentrated on miniature, [ ] systems. This type of system is cost effective, operationally flexible and [ ] The baseline ASAT system, currently in prototype development consists of a modified Short-Range Attack Missile first stage, an ALTAIR III second stage and a Miniature Vehicle (MV) terminal warhead stage. This Prototype Miniature Air-Launched System (PMALS) ASAT weighs approximately [ ] pounds and is designed to attack targets at altitudes less than [ ] nautical miles. The MV warhead weighs approximately [ ] pounds, is approximately [ ] uses a [ ] sensor to detect and track a target satellite and, using small rockets, [ ]

Competitive design contracts for the PMALS were carried through preliminary design review in FY 1977. A Vought Corporation design for a [ ] was selected in the fourth quarter FY 1977 for full-scale development. The Vought design will be developed and ground-tested through [ ] Contracts to Vought and Boeing were let in FY 80 for the flight test of the PMALS. [ ] the first flight demonstration would occur in [ ] against an Instrumented Target Vehicle being developed under Project 2241.

(U) RELATED ACTIVITIES: Program Element (P.E) 63428F, Space Surveillance Technology, develops the satellite targeting sensors so the range and the prediction accuracy of SPACETRACK can be improved. This supports the PMALS program by reducing the maneuvering requirements during the attack engagement and enhancing the probability of kill. P.E. 12311F, North American Air Defense Command Combat Operations Center, is developing the Space Defense Operations Center to provide the command control of ASAT operations.

(U) WORK PERFORMED BY: Air Force Systems Command Space Division, Los Angeles, CA, manages this program. The primary contractors are Vought Corporation, Grand Prairie, TX, and Boeing Aerospace Corporation, Seattle, WA. Aerospace Corporation, El Segundo, CA, provides technical support.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Two competitive Miniature Vehicle (MV) design efforts were initiated in FY 1976. The efforts included the preliminary design of the MV and the spin-up and release mechanism, limited system

Project: # 2134
Program Element: # 64406F
DoD Mission Area: Space Defense, # 123

Title: Miniature Systems
Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, #

simulations and cost trade-offs against variations in mission requirements and investigations into MV booster interfaces and deployment concepts. In the fourth quarter of FY 1977, the Vought Corporation design was selected for Prototype Miniature Air-Launched System (PMALS) development leading to demonstration flights beginning in . Selection was primarily based on system performance, risk as defined by hardware state-of-the-art, applicability to existing booster systems, and cost. FY 1979 efforts included development at Arnold Engineering Development Center, redesign of the flight computer for more storage capacity and bench tests of attitude control subsystems. Carrier aircraft and PMALS engineering interfaces were further refined and targeting algorithm design was initiated. FY 1980 efforts included aircraft/missile wind tunnel testing at the Arnold Engineering Development Center (AEDC). These tests determined aircraft/missile aerodynamic characteristics. tests at AEDC have verified that the Contracts were let to Vought and Boeing for flight tests of PMALS. MV ground testing was completed in FY 1981. This included a number of drop tests to develop a detailed statistical model of the MV's ability to detect and track a simulated target. Integration testing was conducted with the MV and its spin-up mechanism. Fabrication of the flight-test hardware has started.

2. FY 1982 Planned Program: Detailed design of the air-launched missile, carrier aircraft equipment, F-15 aircraft modifications and support equipment will continue. Detailed design of the MV will be completed. A Critical Design Review (CDR) will be accomplished to authorize the fabrication of the flight-test hardware. Integration, validation and verification of the MV software will be completed.

3. FY 1983 Planned Program:

Additional funding will be used to reduce development risk. Additional diagnostic instrumentation will be added to the test missiles and additional ground tests at the Arnold Engineering Development Center (AEDC) will be conducted.

4. FY 1984 Planned Program: will continue. System improvement studies will be initiated.

5. Program to Completion: This is a continuing program. The PMALS flight test program is scheduled for completion in early

This Program Element will continue to support the PMALS through transition to an operational capability.

Project: # 2134
Program Element: # 64406F
DoD Mission Area: Space Defense, # 123

Title: Miniature Systems
Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, # 3

6. (U) Milestones:
a. Start Flight Test Missile Fabrication [ ]
b. (U) Start Flight Test Carrier Aircraft Equipment Fabrication *(Sep 1981) October 1981
c. (Miniature Vehicle Ground Test Complete [
d. (First Modified F-15 Test Aircraft Available
e. (First Missile Captive Flight Test
f. (Missile Flight-Worthiness Test Complete
g. (Miniature Vehicle Qualification Test Complete
h. (First Flight Test
i. (Last Test Flight]

* Data presented in Fiscal Year 1982 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES
a. (U) Start of fabrication delayed one month because of one-month slip in associated Critical Design Review (CDR). This CDR was slipped to align it with other on-going design reviews. No impact on overall schedule.
b. (U) Same as Item b. above.
c. One system-level vibration test remains. All other tests completed on schedule. Minor structural redesign underway and will be tested in [ ]
d. (U) FY 1982 Descriptive Summary reflected arrival at test base. Additional instrumentation and checkout require at test base.
g. Current schedule reflects first week in [ ] vice last week in [ ] in last year's Descriptive Summary.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E - Miniature Systems	105,773	162,600	193,264*	168,038	Continuing	Not Applicable
Procurement (PE 12450F)						
-Aircraft Modification	0	0	0	0	Continuing	Not Applicable
-Missile Procurement	0	0	0	32,800	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
RDT&E - Miniature Systems	82,473	162,600	173,690*	-	Continuing	Not Applicable
Procurement (PE 12450F)						
-Aircraft Modification	0	0	4,800**	-	Continuing	Not Applicable

* Increased funding will be used to reduce development risk [ ]
** Transferred within P.E. 12450F to RDT&E (3600) appropriation

Project: #2241
Program Element: #64406F
DoD Mission Area: Strategic Defense, #123

Title: Instrumented Target Vehicle
Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: Instrumented Target Vehicles (ITV) are required as orbital test targets to evaluate the effectiveness of the antisatellite system being developed by Project 2134, Miniature Systems. The ITV will contain sufficient on-board instrumentation for determining destruction and for assisting ground tracking stations in collecting antisatellite performance parameters; The objective of this program is to collect sufficient antisatellite performance information so that a go/no go decision can be made on deployment of an operational antisatellite system. For the Prototype Miniature AirLaunched-System with its Miniature Vehicle warhead, the target will be required to resolve Miniature Vehicle specifications call for a Two ITVs can be launched from a single SCOUT booster.

(U) RELATED ACTIVITIES: This project is required to support Prototype Miniature Air-Launched System (PMALS) flight demonstrations conducted under Project 2134.

(U) WORK PERFORMED BY: This project is managed by Air Force Systems Command's Space Division, Los Angeles, CA. The Aerospace Corporation, El Segundo, CA, provides technical support. AVCO Corporation, Wilmington, MA, was awarded the development contract for the Instrumented Target Vehicle in May 1979.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1.) FY 1981 and Prior Accomplishments: Preliminary designs for the ITV were examined under Project 2134, Miniature Systems. A survey was conducted of all Department of Defense instrumentation agencies to identify existing off-the-shelf hardware and techniques that could be applied to the development of a target vehicle. Analyses were performed to establish initial . The exclusive use of existing orbital objects or piggyback payloads as antisatellite targets was examined and found to be unsatisfactory. Only a dedicated and adequately instrumented target could verify antisatellite performance. A competitive design definition was initiated. AVCO Corporation won the competitive procurement for this effort. development tests were completed. P formance tests in vacuum and zero-gravity drop tests have been completed. A contract option for fabrication of ITVs and flight support was exercised in September 1980. Subsystem qualifcation testing has begun. Fabrication of ITVs for the PMALS flight test program has begun.

2. FY 1982 Planned Program: Fabrication of Instrumented Target Vehicles (ITV) for the Prototype Miniature Air-Launched System (PMALS) antisatellite flight test program will continue. System-level qualification testing will be completed. The final performance tests (dynamic structure, canister function, antenna patten and will be completed. Component and Integration testing between the ITV and its SCOUT booster will be conducted.

Project: #2241
Program Element: # 64406F
DoD Mission Area: Space Defense, # 123

Title: Instrumented Target Vehicle
Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, # 3

3. FY 1983 Planned Program: Fabrication of the ITVs for the PMALS flight test program will continue. A communication link between the launch site and the Air Force Satellite Control Facility will be established. Integration into the launch facilities will be accomplished. The first ITV satellites will be delivered.

4. FY 1984 Planned Program: The last ITVs will be delivered. The

5. Program to Completion: Assuming a successful development test and engineering effort for the PMALS, this program will complete in the time period. Target vehicles for advanced antisatellite technique such as lasers, may require additional Research, Development, Test and Evaluation funding in the out years. (FY 1984 and out)

6. (U) Milestones:

a. (U)	Instrumented Test Vehicle Contract Award	May 1979
b. (U)	Design Review to Authorize Fabrication	September 1980
c. (	Performance Tests Complete	
d. (	Qualification Tests Complete	
e. ( )	Launch First Vehicle (2 ITVs)	
f. ( )	Contract End	

* Data presented in FY 1982 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

c. (U) Slip caused by late delivery of electronic piece parts
d. (U) Same as Item c. above

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	26,000	17,800	17,800	10,500	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	25,300	17,800	16,100	-	Continuing	Not Applicable

Budget Activity: Strategic Programs, #3
Program Element: #64406F, Space Defense Systems

Test and Evaluation Data

1. (U) Development Test and Evaluation: Development testing on all elements of the Prototype Miniature Air-Launched System (PMALS) continue at an accelerated pace. Major system and sub-system tests on the flight sensor assembly, the ALTAIR second stage motor case and the focal plane cryogenic cooling system have been completed. A system level verification of critical flight events and an F-15/antisatellite missile fit check have also been conducted.

The flight sensor assembly (FSA) is the sensor of the Miniature Vehicle (MV). The sensor is an extremely small double folded Gregorian telescope. During the testing of the engineering model, three major problems were surfaced. A Performance Demonstration, completed in May 1981, verified the solutions of these problems. The three major performance problems were:

Hughes Aircraft Company, the contractor for the FSA, developed analysis and testing tasks to investigate and solve these problems. In the case of the first problem, testing of the sensor revealed that
The problem was resolved The second problem,

The problem was resolved by:

The sensor with the was then tested to verify performance. Single aperature line-of-sight measurements of were used to verify performance. During these
During the test,
- demonstrating improved quality. The improvements in measurements were verified by using the method. The last problem,

The FSA Performance Demonstration, which was a summary of the aforementioned tests, showed that the sensor would meet performance requirements. There is now a high degree of confidence that the FSA will meet requirements and the will adequately measure FSA performance. The will be validated with

(U) The second stage of the PMALS missile uses the Vought Corporation ALTAIR motor. The ALTAIR is a proven motor that has been used for many years as fourth stage of the Scout booster. The ALTAIR has been modified both structurally and thermally for the anticipated PMALS flight environments. A limited qualification program has been planned to verify the motor's performance. This program is comprised of an empty motor case test (1981), three development motor tests (1982) and two flight worthiness motor tests (1982). The motor case test was conducted in July 1981. The objective of the test was to determine the case structural load performance along with internal pressure limitations. By placing the

Budget Activity: Strategic Programs, #3
Program Element: #64406F, Space Defense Systems

case in a loads fixture and applying lateral and axial forces, the bending and twisting experienced during flight was simulated. The performance witnessed in this test showed significant margins. The structural integrity of the case is well above the levels required by the antisatellite (ASAT). Internal pressure limitations were tested by pressurizing the case with water at a specified rate until case failure. The case demonstrated a burst pressure well in excess of the proof levels required. However, when the case failed, it did not rupture in the anticipated region. After investigation of the case, the rivets used to hold the mounting flanges to the ends of the case were seen to have damaged the case at the fore and after domes. A redesign was initiated to update the riveting procedure to allow more clearance between the rivets and the case surface. Although positive margins were demonstrated in the test, the redesign was accomplished in order to allow for pre-interference with case expansion due to internal pressure and to lessen the risk of damaging the case during fabrication.

The [ ] system for the MV [ ] is housed in the ammunition bay of the F-15A and the upper stage of the ASAT missile. This system uses [ ] Similar [ ] systems have been used in a number of other satellite programs using [ ] sensors. The [ ] system for the ASAT, however, has been identified as a potential cost driver due to the configuration and environments. No other system has been placed in the severe environments produced by F-15 flight of up to [ ] hours. The [ ] system developments test were completed in July 1981. The test simulated the flight environments and mission timelines. The required [ ] was demonstrated. The results implied that the overall [ ] This problem was traced to differences between the flight-hardware and the test-hardware. All test anomalies were resolved. The test showed the system should perform its required mission.

Critical Flight Event Testing (CFET) was performed on the ground-test MV to verify its ability to correctly function under critical combinations of environments and functional requirements. These environments included the MV [ ] as a free body or in a constrained manner simulating three body motion; [ ] vacuum; "zero g"; and the dynamic interaction between the MV and dispenser. Functional evaluation of the MV avionics was accomplished on a system test bench that [ ] Targets with variations in intensity, size, modulation, and separation were provided. The MV [ ] was exercised. The functional evaluation of MV and dispenser working together was done in a vacuum chamber. [ ] A "Free-Fall" system supported the MV and dispenser and provided a platform for the pre-dispensing functions and a "zero g" dispensing environment. The MV performed [ ] The CFET demonstrated the [ ] capability, the MV's capability to [ ] a designated target, the dispenser capability to perform to design requirements, and the integrated MV/dispenser performance.

A full scale fit check of the ASAT hardware mock-ups and an F-15A was completed in [ ] No major problems were discovered. The check was done at Boeing Field in Seattle, WA. The pylon mock-up was mated to a test F-15A from Edwards Air Force Base. The missile mock-up was next mated to the pylon. Missile/pylon connections and

Budget Activity: Strategic Programs, #3
Program Element: #64406F, Space Defense Systems

structural clearances were verified. The pallet mock-up hardware was loaded into the F-15A and ammunition bay. Clearances in the bay were verified. ASAT pylon, pallet, and missile loading procedures were tested. A fit check with the flight-test hardware is scheduled for [ ]

2. Operational Test and Evaluation: The initial operational test and evaluation of the Prototype Miniature Air-Launched System of the Space Defense System Program will be conducted by the Air Force Test and Evaluation Center, with personnel and assistance from the Aerospace Defense Center, Tactical Air Command, Strategic Air Command, Air Force Logistics Command, Air Force Communications Command, and Air Training Command as part of a combined Development, Test and Evaluation/Initial Operational Test and Evaluation program. Initial Operational Test and Evaluation will provide test information to support scheduled decision milestones and to support a declaration of initial operational capability. More specifically, Initial Operational Test and Evaluation will evaluate the effectiveness and suitability of the antisatellite system and the capability of surveillance, command and control, and communications systems to provide adequate support. Test and evaluation is currently scheduled to commence in [ ] and is expected to be complete approximately [ ]

Initial Operational Test and Evaluation will accomplish the following major objectives. Evaluate:

(U) The capability of the surveillance sensors to collect and provide ephemeris data on designated targets with the required degree of accuracy and timeliness.

(U) The capability of command and control elements to perform all required functions, to include decision making, and dissemination of execute, recall, terminate and other commands.

(U) The capability of the communications system to pass required information between system elements in an accurate and timely manner.

(U) The capability to launch the Prototype Miniature Air-Launched System missile, with associated dispenser and miniature vehicle, from the F-15 aircraft within required accuracy and timeliness constraints.

The capability of the miniature vehicle to [ ]

(U) System suitability, to include initial data relevant to reliability, availability, maintainability, logistic supportability, and compatibility with other systems, computer hardware and software.

(U) The Initial Operational Test and Evaluation will be accomplished through evaluation and demonstration of the various system segments and tests of the entire system. Segment tests will evaluate the performance capabilities of individual system segments such as surveillance sensors, command and control elements, communications systems, etc. System testing will involve dry runs to exercise and evaluate all system segments to the point of weapon launch. Flight tests, under

Budget Activity: Strategic Programs, #3
Program Element: #64406F, Space Defense Systems

the direction of the Air Force Systems Command, will involve all segments and include launching the weapons against an Instrumented Target Vehicle, a specialized target vehicle developed by AVCO Corporation. Air Force Test and Evaluation Center will independently evaluate live-fire test data and will use simulation and analyses to supplement live-fire test results.

Prototype weapons and equipment, developed by Boeing and Vought Corporations, will be used for testing during Development Test and Evaluation/Initial Operational Test and Evaluation. Test residuals will support a Limited Capability between

(U) Primary test team elements will be located at Vandenberg Air Force Base, CA; Edwards Air Force Base, CA; and the North American Air Defense Command Cheyenne Mountain Complex, CO. Captive-carry and other segment tests will be conducted on the Air Force Flight Test Center range. Other captive-carry, dry run and live-fire tests will involve flying from Edwards Air Force Base to the Western Test Range near Vandenberg Air Force Base, CA, where flight tests will be monitored by Western Test Range sensors. The Air Force Satellite Control Facility will control and track the instrumented test vehicles. Evaluators located in the North American Air Defense Command Cheyenne Mountain Complex will evaluate mission operations center actions.

The number of test articles to be available for testing is as follows: (These test articles are not in addition to Development Test and Evaluation resources).

- Prototype Miniature Air-Launched System missile.
- (U) Two modified aircraft with associated pylons, carrier aircraft equipment, support equipment, etc.
- (U) A simulation model of weapon performance from launch of the missile from the aircraft to impact.
- Instrumented Target Vehicles to support all live fires.
- (U) A minimum of 93 captive-carry hours.

There will be a total of missiles procured for the test program and to support a Limited Capability.

(U) Reliability, availability and maintainability test and evaluation will be conducted using resources available, support and test support equipment, and captive-carry missions. Reliability, availability and maintainability goals have not yet been established. Initial evaluations will assume contractor maintenance and support for the life of the system; however, Air Force Test and Evaluation Center will perform "Blue Suit versus contractor" evaluations to recommend the proper mix of Blue Suit and contractor maintenance personnel.

(U) Follow-on Test and Evaluation will be conducted by Air Force Test and Evaluation Center (phase I) and the using command (phase II). Production weapons and using-command aircraft will be used to test areas not adequately tested during initial operational test and evaluation, changes, and deficiency correction.

Budget Activity: Strategic Programs, #3
Program Element: #64406F, Space Defense Systems

3. (U) System Characteristics:

(U) First Stage: Standard Short Range Attack Missile plus three fixed fins and two modified variable fins

		Objective	Demonstrated	Method
- Weight:	(Pounds)	1437	1437	Measurement
- Thrust:	(Pounds)	7511	7511	Ground Test
- Temperature:	(Degrees Fahrenheit)	-65 to +145	-65 to +145	Environmental Test
- Total Impluse:	(Pound-seconds)	252,800	252,800	Ground Test

(U) Second Stage: Standard ALTAIR III with minor structural modifications and reaction control system.

- Weight	(Pounds)	671	671	Measurement
- Thrust	(Pounds)	5,950	5,950	Ground Test
- Burn Time	(Seconds)	27.4	27.4	Ground Test
- Total Impluse	(Pound-seconds	170,000	170,000	Ground Test

Miniature Vehicle

- Sensor				
- Weight	(Pounds)			Measurement
- Dimensions	(Inches)			Measurement
- Destruct Mechanism				Flight Test

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64711F
DOD Mission Area: Airborne Strike, #113

Title: Systems Survivability (Nuclear Effects)
Budget Activity: Strategic Programs #3

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	12,149	12,055	13,948	17,361	Continuing	N/A
2485	S/V Assessment of C^3 Systems	1,600	2,100	2,100	2,600	Continuing	N/A
3763	S/V Assessment of Aerospace Systems	7,000	6,100	8,200	10,500	Continuing	N/A
4695	S/V Assessment of Satellites	3,549	3,855	3,648	4,261	Continuing	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The thrust of this program is to assess, through analysis and testing, the effects generated by a nuclear weapon on the survivability/vulnerability (S/V) of Air Force aerospace (aircraft, missiles), command and control communications (C^3) systems and satellites, and to develop the engineering technology for hardening these systems.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This program will develop and use analytical techniques and the electromagnetic pulse (EMP) and system generated EMP (SGEMP) test facilities needed to assess the nuclear S/V of aerospace systems associated structures (Project 3763), ground based C^3 systems and communications network overlays (Project 2485), and satellites and communication links (Project 4695). Cost based primarily on historic data and existing contracts.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	13,880	12,300	14,300		Continuing	N/A

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: 64711F
DoD Mission Area: Airborne Strike, #113

Title: Systems Survivability (Nuclear Effects)
Budget Activity: Strategic Program #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The objectives of this program are to assess the survivability/vulnerability (S/V) of Air Force aerospace and communications systems that may be required to operate in a nuclear environment, and to develop engineering technology for their hardening. The Air Force Nuclear Criteria Group establishes hardness criteria levels for developmental systems early in their design phase and for operational systems upon request. Requirements involving operational systems are provided by using commands. For some types of nuclear weapons effects, available assessment and hardening technology must be extended before application to complex modern systems. The assessments include: analyses to determine the paths and amounts of energy coupled into systems and to identify critical components and circuits; laboratory tests to measure the response of components, circuits, and subsystems to that energy; and simulation tests of full-scale systems to verify analyses and laboratory results, and to increase confidence in the techniques used for system hardening. The development of hardening guidelines uses the assessment results to specify methods to control energy entry into systems and to increase the resistance of susceptible components and subsystems.

The program is currently divided into three projects: Project 2485, S/V Assessment Command and Control Communications (C^3) Systems, consists of the development, acquisition, and use of assessment techniques and Electromagnetic Pulse (EMP) measured test data to determine the nuclear S/V of critical ground command and control communications including data links; Project 3763, Survivability/Vulnerability Assessment of Aerospace Systems, mainly consists of the assessment (analysis and testing) and hardening of aircraft and missiles such as the E-3, E-4, EC-135, F-16, B-52, B-1, FB-111, Air Launched Cruise Missile, Ground Launched Cruise Missile, MX, etc., when they are subjected to various nuclear environments; Project 4695, S/V Assessment of Satellites, consists of the development and use of analysis and testing techniques for the Systems Generated EMP and Transient Radiation Effects to assess space systems and their communications links with primary emphasis on warning, alerting and controlling the strategic forces. Hardening assistance and design guidelines are provided to Strategic Air Command and many Program Offices.

(U) RELATED ACTIVITIES: This Program is related to Air Force programs to develop and maintain a survivable strategic force with associated command and control communications systems. A joint working group between the Air Force, the Defense Communications Agency, and the Defense Nuclear Agency has been established to coordinate command and control communications assessment plans and to effect timely exchange of results. Program Element, 64747F/Project 1209, Nuclear Effects Simulation Test Facilities and Program Element, 62601/Project 8809, Nuclear S/V Technology, Program Element 63438F, Satellite Systems Survivability and PE 63244F, Aircraft Nonnuclear Survivability are related. (Test facilities for this program are acquired under Program Element 64747F, Project 1209, Nuclear Effects Simulation Test Facilities.)

(U) WORK PERFORMED BY: The program is managed by the Air Force Weapons Laboratory, Kirtland AFB, NM. Contractural work is performed by Nanofact Corporation, Chicago, Il; Textronics, Inc., Beaverton, OR: New Mexico School of Mines, Socorro, NM; T&M Electronics, Albuquerque, NM: University of Arizona, Tuscon, AR; EG&G Incorporated, Albuquerque, NM: Computer Sciences Corporation, Falls Church, VA; R&D Associates, Marina Del Rey, CA: TRW, Incorporated, El Segundo, CA; Intelecom Radiation Technology, San Diego, CA; Mission Research Corporation, Santa Barbara, CA; Physics, La Jolla, CA; and Mission Research Corporation, Albuquerque, NM.

Program Element: 64711F
DoD Mission Area: Airborne Strike, #113

Title: Systems Survivability (Nuclear Effects)
Budget Activity: Strategic Programs #3

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 81 and Prior Accomplishments: In Project 2485, an Air Force Strategic Command, Control and Communications (C^3) Data Base was established to cover all projects. A ground based High Altitude Radiation Detection System was also developed, tested, and installed at an operational location. An Electromagnetic Pulse (EMP) validation test of the Defense Support Program satellite simplified processing stations was completed. Final hardening design of Ground Launched Cruise Missile C^3 systems was studied. Investigation of the use of the fiber optics as a nuclear hardening technique was started. PAVE PAWS Electromagnetic Pulse Survivability/Vulnerability (S/V) Studies were completed. A hardened screen room for the Strategic Air Command has been designed, constructed, and tested. Electromagnetic pulse shielding was designed for the Operational Support Center for US Air Force Europe. Planning for an on-site test of the shield integrity was initiated. Validation of the Survivable Groundwave Communications Network concept was started.

In Project 3763, An EMP assessment was performed on the EC-135, E-3A, E4B, B-52, F-16, A-7, the Navy C-130 Take Charge And Move Out (TACAMO) Aircraft and the Air Launched Cruise Missile. An evaluation of EMP upset and permanent damage for E-4 subsystems was completed. Analytical tools to address external coupling, deliberate antennas and aircraft inadvertent penetrations were developed. A corona study on trailing wire antennas and an in-flight EMP test of the Navy TACAMO aircraft with trailing wire extended were completed. Nuclear blast, thermal and shock effects on aerospace systems were studied to develop necessary hardening techniques and guidelines for Program Offices. These techniques and others were integrated into the technology data base. An EMP assessment of the FB-111 aircraft was started. A cooperative multi-agency EMP technology development program was stated in conjunction with the Defense Nuclear Agency.

In Project 4695 a laboratory System Generated EMP experimental program received more emphasis. This program included development of low-level photon sorces and their use in analysis and testing of complex satellite models and subsystems. Satellites of the Fleet Satellite Communications System, Strategic Satellite System, Defense Communications Satellite System, Air Force Satellite Communications System, and Global Positioning System were assessed for nuclear S/V, and alternate means of hardening were provided to the Program Offices as design guidelines. The application/validations of current hardening techniques were addressed in conjunction with limited simulation techniques for verification and validation. Communication links were analyzed to determine the effect of propagation disturbance due to nuclear environments. A threat level X-Ray source for satellites and the first phase of testing on Fleet Satellite Communications Satellite qualification model hardware were completed.

Program Element: 64711F
DoD Mission Area: Airborne Strike, #113

Title: Systems Survivability (Nuclear Effects)
Budget Activity: Strategic Programs #3

2. (U) FY 1982 Program: In Project 2435, the definition of survivable C^3 systems will be completed and work on the assessment/validation of the hardness of these systems will be initiated. Hardening of satellite ground terminals, development of fiber optics as a hardening technique and Strategic Air Command (SAC) communications system hardening will all continue. A test of the Electromagnetic Pulse (EMP) shielding for the Operational Support Center will be conducted. Validation of the Survivable Groundwave Communications Network concept will be conducted.

(U) In Project 3763, the A-7E and F-14 aircraft will undergo EMP testing in the Air Force Weapons Laboratory EMP simulators. The EMP assessment of the FB-111 will be completed. The life cycle survivability program for aircraft and missiles involving the Program Offices and the Air Force Logistics Command will continue. Definition of systems upset methodology will be initiated.

(U) In Project 4695, the Fleet Satellite Communications System Generated EMP (SGEMP) photon tests will continue. Other continuing efforts include SGEMP simulation technique development, hardening design guideline development, and satellite communication system network analysis. The Air Force will work with DNA to develop a cooperative program in SGEMP hardening.

3. (U) FY 83 Planned Program: In Project 2485 work on development and validation of survivable overlay C^3 systems will continue. EMP hardening of facilities and development of fiber optics as an EMP Hardening Technique will also continue.

(U) In Project 3763, the total life cycle EMP hardness and hardness assurance program for aircraft and missile systems will continue. Alternative Survivability/Vulnerability (S/V) assessment methodologies will be developed and compared to the current methodology to see if their inherent limitations can be reduced/eliminated. The hardness maintenance/surveillance test methodology required to assure continued system effectiveness will continue to be developed and/or refined. In-house support of EMP testing of aircraft/missile system, and fiber optics system will continue. In the area of system associated structures, testing will be initiated as part of an iterative process of analysis test, methodology refinement and retest. This program will be used to define and verify the final methodology package. Work will begin to acquire a test bed aircraft to develop and verify EMP hardening techniques for aircraft. Additional funds in the FY 83 budget are for the support of the Multi-agency Cooperative EMP Technology Development Program.

(U) In Project 4695, SGEMP testing will continue. Specific areas will include development and testing of a complex satellite model which will serve as a test-bed for measuring the effectiveness of hardening approaches. Space system S/V integration will continue. Particular areas of emphasis will be analytical support and hardening trade studies. Satellite link performance and mitigation analysis will continue. The upgrading and application of the SCENARIO Code and Propagation Network Assessment Code to Satellite Communication System will be areas of primary emphasis. The Air Force will participate in a cooperative program with DNA to develop SGEMP hardening methods and assessment procedures.

4. (U) FY 1984 Planned Program: In Project 2485 work on the validation of survivable overlay C^3 systems will continue. EMP hardening of facilities and development of fiber optics as an EMP Hardening Technique will also continue. In Project 3763, the total life cycle EMP hardness and hardness assurance program for aircraft and missile systems will continue. The systems upset methodology scheduled for initiation in FY 1982 will continue. Alternative S/V assessment methodologies will be developed and compared to the current methodology to see if their inherent limitations

Program Element: 64711F
DoD Mission Area: Airborne Strike, #113

Title: Systems Survivabilitv (Nuclear Effects)
Budget Activity: Strategic Programs #3

can be reduced/eliminiated. The hardness maintenance/surveillance test methodology required to assure continued system effectiveness will continue to be developed and/or refined. In-house support of EMP testing of aircraft/missile systems (E-4B, EC-135), and fiber optics system will continue. Testing of the Hardness Assessment Mainteance Surveillance (HAMS) system will continue. In Project 4693, System Generated EMP testing will continue. The PIMBS-11 Laboratory X-Ray source will be used to test large area targets and the results compared to other test techniques to support system testing and hardness verification. Space system Survivability/Vunerability integration will continue; particular areas of emphasis will be analytical support and hardening trade studies. At this time, sufficient experimental and analytical data should exist to sponsor satellites with "point design" hardness to meet specific mission survivability requirements. Satellite link performance and mitigation analysis will continue. The SCENARIO Code and Propagation Network Assessment Code will be upgraded and applied to Satellite Communication System.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 82 Budget Data: Not applicable.

Project: #3763
Program Element: #64711F
DOD Mission Area: Airborne Strike, #113

Title: S/V Assessment of Aerospace Systems
Title: Systems Survivability (Nuclear Effects)
Budget Activity: Strategic Programs #3

(U) DETAILED BACKGROUND AND DESCRIPTION: Project 3763 develops the technology for analyzing and testing the survivability and vulnerability (S/V) response of current and future aerospace systems to nuclear effects. The nuclear effects of interest are: Blast, Electromagnetic Pulse (EMP), Shock, System Generated Electromagnetic Pulse (SGEMP), Thermal, Transient Radiation Effects and X-Rays. The eventual results of these efforts will be hardening techniques for aerospace systems so that they can effectively accomplish their missions in a war-created nuclear environment. The approach used to accomplish the S/V assessment of aerospace systems to nuclear effects is based on several parallel efforts. An effort concerning generic technology, heavily weighted towards assessment capability, is continuing. Included in this generic effort for the future are studies leading to recommendations on how to implement hardness life cycle survivability, military standards and specifications, and production standards and techniques. Parallel with this effort, evaluation and, when appropriate, development of basic analytical and testing techniques to accomplish S/V assessment will be continued. The third parallel effort will include as much support to the Program Office and other organizations in assessing the S/V of their particular aerospace system as the full resources of Project 3763 can accommodate.

(U) RELATED ACTIVITIES: Electromagnetic radiation test facilities required for this project are developed in Program Element (PE) 64747F Project 1209. Related technology for this project is developed under PE 62601 Project 8809, Nuclear S/V Technology.

(U) WORK PERFORMED BY: Air Force Systems Command manages this project through the Air Force Weapons Laboratory, Kirtland Air Force Base, NM. Contractors for various analyses and tests performed under this project include: BDM Corp., Albuquerque, NM: Boeing Company, Wichita, KS; Kaman Avidyne, Burlington, MA; EG&G Albuquerque, NM; Mission Research Corp., Santa Barbara, CA; Physics International, San Leandro, CA; R&D Associates, Marina Del Ray, CA; Science Applications Inc., Albuquerque, NM; TRW, Redondo Beach, CA; General Dynamics, Fort Worth, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In Project 3763, an EMP assessment was performed on the EC-135, E-3A, E4B, B-52, F-16, A-7E, the Navy C-130 Take Charge and Move Out (TACAMO) Aircraft and the Air Launched Cruise Missile. An evaluation of EMP upset and permanent damage for E-4 subsystems was completed. Analytical tools to address external coupling, deliberate antennas and aircraft inadvertent penetrations were developed. A corona study on trailing wire antennas and an in-flight EMP test of the Navy TACAMO aircraft with trailing wire extended were completed. Nuclear blast, thermal and shock effects on aerospace systems were studied to develop necessary hardening techniques and guidelines for Program Offices. These techniques and others were integrated into the technology data base. The EMP assessment of the advanced fighter aircraft using the F-16 as the test bed was completed. An unhardened B-52 underwent EMP testing at the TRESTLE threat level in-flight simulator at Kirtland AFB, New Mexico.

Project: #3763
Program Element: #64711F
DOD Mission Area: Airborne Strike, #113

Title: S/V Assessment of Aerospace Systems
Title: Systems Survivability (Nuclear Effects)
Budget Activity: Strategic Programs #3

2. (U) FY 1982 Program: The FB-111 and F-14 aircraft will undergo EMP testing in the Air Force Weapons Laboratory EMP simulators. The life cycle survivability program for aircraft and missiles involving the Program Offices and the Air Force Logistics Command will continue. Air Force participation in the Cooperative Multi-agency EMP Technology Development Program will continue.

3. (U) FY 1983 Planned Program: The total life cycle EMP hardness and hardness assurance program for aircraft and missile systems will continue. Definition of systems upset methodology will be initiated. Alternative S/V assessment methodologies will be developed and compared to the current methodology to see if their inherent limitations can be reduced/eliminated. The hardness maintenance/surveillance test methodology required to assure continued system effectiveness will continue to be developed and/or refined. In-house support of EMP testing of aircraft/missile systems, and fiber optics system will continue. In the area of system associated structures, testing will be initiated through an iterative process of analysis test, methodology refinement and retest. This program will be used to define and verify the final methodology package. The EMP Assessment of the FB-111 will be completed. Development and verification of EMP hardening techniques using a test bed aircraft will be initiated.

4. (U) FY 1984 Planned Program: The total life cycle EMP hardness and hardness assurance program for aircraft and missile system will continue. The hardness maintenance/surveillance test methodology required to assure continued system effectiveness will continue to be developed and/or refined. In-house support of EMP testing of aircraft/missile system, and fiber optics systems will continue. Testing of the Hardness Assurance and Maintenace System (HAMS) system will be conducted. In the area of system associated structures, testing using an interactive process of analysis, test, methodology refinement and retest will continue.

5. (U) Program to Completion: Not Applicable.

6. (U) Milestones: Not Applicable.

7. (U) Resources:	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
RDT&E	7,000	6,100	8,200	10,500	Continuing	N/A

8. (U) Comparison with FY 1982 Budget Data:

RDT&E	8,780	6,100	6,800		Continuing	N/A

FY 1983 funding increased to accomodate AF participation in the cooperative Multi-Service EMP Technology Development Program.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	121,659	95,639	121.767	82,105	Continuing	Not Applicable
2405	Strategic Avionics Crewstation Design Evaluation Facility	1,830	1.700		600	Continuing	Not Applicable
2406	B-52 Offensive Avionics System	48,043	21,539	4,500			211,982
2548	Nuclear Hardness Study/Electro Magnetic Pulse	22,600		13,567	33,405	11,100	101,672
2570	Electronic System Test Set	11,100	5,800				53,900
2571	B-52 Aircraft Modernization Program	11,200	11,300	20,200	30,200	Continuing	Not Applicable
2601	B-52 Strategic Rader	5,386	21,000	29,600	11,000	5,600	74,086
2652	Offensive Avionics System/Cruise Missile Integration Weapon System Trainer Modification	7,200	2,200				15,300
2653	B-52H Cruise Missile Integration		12,000	33,300	4,800		50,100
2692	B-52 Autopilot	12,300	14,000	15,700			42,000
2787	Conventional Standoff Capability	200	700				900
2824	Mission Data Preparation System	1,800	400	4,900	2,100	800	10,000
5615	Counter SUAWACS		5,000				5,000

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of the B-52 Squadrons development program is to maintain the operational effectiveness of the B-52 force. All models of the B-52 require some modernization to maintain their deterrent capability. Investments are necessary to increase force effectiveness, to provide option flexibility, and to reduce support costs. The aircraft themselves remain structurally sound; however, most B-52 aircraft subsystems are becoming difficult to support due to their age. Regardless of the outyear B-52 missions, the aircraft require updating to provide a supportable operational platform.

(U) BASIS FOR FY 1983 RDT&E REQUEST: During fiscal year 1983, this program element has seven critical ongoing, on-contract projects in progress. Two are completed in fiscal year 1983. The Of'ensive Avicnics System project completes this year with flight testing and missile launches. The other project to complete this year is the reliability,

Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

maintainability update to the B-52 autopilot system. The aircraft modernization program and related projects to update B-52 radar systems and autopilot are on contract and proceeding toward modification initiation and flight test. The individual project cost estimates are based on contractual and schedule requirements.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

		FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		120,465	141,100	111,100		Continuing	Not Applicable
Procurement	3010 *	437,300	331,500	461,000		743,000	2,623,300
	3400	34,100	44,100	66,500		251,700	399,500

(U) OTHER APPROPRIATION FUNDS:

		FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement	3010 *	381,700	388,600	528,800	910,700	2,054,800	4,812,700
	3400	33,400	36,900	61,400	83,400	381,300	599,600
Cruise Missile Carriage, B-52G/H:							
Procurement (3010)*		85,800	95,800	155,800	492,900	679,200	1,642,700
(Quantity)		(40)	(40)	(22)	(23)	(51)	(201)
Operation and Maintenance/Installation (3400/540)		1,000	2,900	4,800	6,700	14,600	30,000
(Input)		(3)	(28)	(40)	(40)	(95)	(201)
(Output)		(1)	(15)	(39)	(40)	(107)	(201)
Offensive Avionics System, B-52G/H:							
Procurement (3010)*		285,900	256,600	312,200	212,100		1,465,200
(Quantity)		(64)	(61)	(64)	(43)		(268)
Operation and Maintenance/Installation (3400/540)		31,000	28,600	49,100	55,900	51,800	219,500
(Input)		(5)	(40)	(62)	(63)	(98)	(268)
(Output)		(2)	(16)	(65)	(61)	(123)	(268)

*Includes Initial Spares

Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Observable Differences/Functionally Related Observable Differences, B-52G:						
Procurement (3010)*	10,000	7,500				46,300
(Quantity)	(40)	(41)				(105)
Operation and Maintenance/Installation (3400/540)	1,400	5,400	7,300	7,500	12,500	34,100
(Input)	(3)	(28)	(40)	(34)		(105)
(Output)	(1)	(13)	(40)	(40)	(11)	(105)
B-52G/H Electromagnetic Pulse:						
Procurement (3010)*				69,900	962,900	1,032,800
(Quantity)				(6)	(90)	(96)
Operation and Maintenance/Installation (3400/540)				5,100	197,900	203,000
(Input)				(1)	(95)	(96)
(Output)					(96)	(96)
Aircraft Modernization Program Fuel Quantity Indicating System Update Environmental Control System Update:						
Procurement (3010)*		28,700	39,900	44,800	67,300	180,700
(Quantity)		(42)	(60)	(64)	(102)	(268)
Operation and Maintenance/Installation (3400/540)			200	5,300	36,200	41,700
(Input)				(34)	(234)	(268)
(Output)				(29)	(239)	(268)

*Includes Initial Spares

Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
B-52G/H Strategic Radar Update:						
Procurement (3010)*			20,900	78,700	345,400	445,000
(Quantity)			(**)	(30)	(238)	(268)
Operation and Maintenance/Installation						
(3400/540)				2,900	58,800	61,800
(Input)						(268)
(Output)						(268)

*Includes Initial Spares
**Fiscal year 1982 funding will be used to procure 177 radar antenna modification kits on an accelerated basis to preclude nonsupport problems.

Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: Cruise missiles will become an important element of the air-breathing leg of the strategic TRIAD and an adequate carrier for these missiles must be provided. The nation is now committed to employ the B-52 as the first cruise missile carrier aircraft and the Air Force, at this time, believes that with reasonable improvements in maintainability, reliability, nuclear hardness, and selected avionics upgrades, the B-52G/H should serve as an effective and economical cruise missile carrier into the 1990s. The purpose of this program element is to develop the B-52 cruise missile carrier modifications and to evaluate and develop the weapon system upgrades necessary for maintaining the viability of the B-52 weapon system throughout the coming decade. The first priority is to upgrade the B-52G/H bombing navigation system and to integrate this upgraded system with the electronics and carriage gear required to carry and launch cruise missiles. The B-52 Offensive Avionics System program, formerly called the B-52 Avionics Update - Phase One, provides for the full scale engineering development of the necessary improvements to the bombing navigation system and will lower present avionics system support costs through replacement of selected components with components of improved reliability and maintainability. Other major program efforts will provide for improved flight safety, assess the current nuclear hardness of the aircraft and identify changes to improve hardness, develop an improved radar update, and update the Mission Data Preparation System to support the Offensive Avionics System. Air Launched Cruise Missile and Short Range Attack Missile. [

] Thus, the Avionics Update - Phase Two Project which was to have provided this capability has been restructured and renamed the Aircraft Modernization Program. This restructured program will improve B-52 reliability and maintainability and support use of the aircraft as a cruise missile carrier into the 1990s.

(U) Each of the projects under this program is described below. A more complete description of each of the major projects is provided on separate descriptive summaries which are attached.

(U) The B-52 Offensive Avionics System Project provides an offensive avionics update package for the B-52G/H. This update responds to a 1975 Strategic Air Command requirement to increase aircraft effectiveness and reduce support costs. The present bombing navigation system is 1950 analog technology and is clearly becoming less reliable, less effective, and more costly to maintain. This project also responds to the immediate needs to integrate with the cruise missile program, develop support equipment, and accelerate delivery of the first operational aircraft.

The B-52 Nuclear Hardness Study/Electromagnetic Pulse project will improve the survivability and vulnerability of the B-52 aircraft to nuclear effects. The first phase of the study laid out program needs. The second phase, which consisted mostly of testing on the trestle and dipole facilities identified a[

] The continuing testing and analyses will develop and verify the nuclear hardened baseline design for the entire B-52G/H weapon system for nuclear blast/thermal/electromagnetic pulse weapon effects, evaluate alternative approaches for hardening, and further examine the needs for additional protection. In addition, the project will test the offensive avionics system and cruise missile carriage modified aircraft with and without the electromagnetic pulse protection kit, support a technology base effort, and establish protocol/criteria for evaluation

Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

purposes. These expansions and increased research, development, test and evaluation investment were recommended by the Defense Science Board in studies during 1979 through 1981. The project will develop electromagnetic pulse fixes for modification of critical aircraft systems that support launch and release of weapons.

The B-52 Aircraft Modernization Program is a completely restructured and revised program formerly called Offensive Avionics System - Phase Two. It now focuses on two primary objectives. The first supports the transition of the B-52G/H force [ ] This transition will require updates to maintain aircraft operationally effective. The second purpose is to ensure the force remains supportable through its predicted extended life into the next century. Analyses have been completed in fiscal year 1980 to identify potential problem areas in essential systems. The shift of outyear mission requirements provided by Headquarters Strategic Air Command and future aircraft problem predictions provided by Headquarters Air Force Logistics Commmand have been incorporated into the definition and scope of this program. The project coordinates planning, definition, integration, and eventual flight testing of the overall aircraft modernization.

(The B-52 Strategic Radar project is a reconstructed effort from what was formerly known as the Electronically Agile Radar project. [ ] the requirement for a forward looking radar as sophisticated as the Electronically Agile Radar was eliminated. Therefore, to meet the FY 85 nonsupportability date, this project will provide a critically needed radar update which is significantly less complex than the original program but which is suitable for solving the serious maintainability, reliability and supportability problems with the current aging system and enables the B-52 to perform the mix of penetration and stand-off missions envisioned for the 1980s.

(U) The B-52H Cruise Missile Integration project begins in fiscal year 1982. This is a follow-on effort from the B-52G and provides external and internal cruise missile carriage for the B-52H. Efforts prior to fiscal year 1982 were aimed at providing only the B-52G with external cruise missile carriage followed by internal cruise missile carriage in the late 1980s. With the development of the B-52H cruise missile capability, the B-52G internal carriage requirement has been deleted and 105 of the 172 B-52G models will be externally modified.

(U) Autopilot project started in fiscal year 1981 and is a four year effort. Activities include design, fabrication, and integration of a new flight control system. This update is required to replace current systems having supportability and safety of flight problems. B-52G/H modification is scheduled to begin in fiscal year 1985.

(U) RELATED ACTIVITIES: The B-52 Squadrons program has received benefits from the Low Life Cycle Cost Avionics (PE 63705F), the Electronically Agile Radar (PE 63241F), the Standard Precision Navigator (PE 64201F), and other similar ongoing Research and Development efforts in Air Force Systems Command, as well as contractor internal research and development efforts. The program will support the B-52 avionics update requirements as stated in Strategic Air Command Required Operational Capabilities 6-75 and 12-76. The cruise missile development program will be integrated with the offensive avionics update projects in this program element.

Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

(U) In fiscal year 1982, the Congress directed $5 million in research and development funds for development of a nonlethal Counter Soviet Airborne Warning and Control System (SUAWACS) program. The program is being directed under PE 64738F. Its purpose is to provide a countermeasures system for B-52 Cruise Missile Carrier aircraft to deny second generation Soviet AWACS the ability to detect US aircraft and direct hostile fighter aircraft to an intercept.

(U) WORK PERFORMED BY: The original avionics study which identified avionic subsystems requiring upgrading under this program was accomplished by Boeing Military Airplane Company. The development program has been awarded to them on a sole source basis. The major subsystems/subcontractors were selected by Boeing Military Airplane Company with Air Force approval. The list of contractors is as follows:

Prime Contractor:	Product:
Boeing Military Airplane Company, Wichita, Kansas	Offensive Avionics System
Major Subcontractors for Offensive Avionics System	
Lear Siegler, Grand Rapids, Michigan	Attitude and Heading Reference System
Sperry Flight Systems, Phoenix, Arizona	Controls/Displays
International Business Machine, Owego, New York	Processor
Norden, Norwalk, Connecticut	Radar Modification
Honeywell, Minneapolis, Minnesota	Radar Altimeter
Honeywell, St. Petersburg, Florida	Inertial Navigation Set
Softech, Waltham, Massachusetts	Jovial 3B Compiler
Sundstrand, Redmond, Washington	Data Transfer Unit, Data Transport Devices
Teledyne - Ryan, San Diego, California	Doppler Velocity Sensor
Associate Contractors on Offensive Avionics System	
Boeing Aerospace Co, Seattle, Washington	Air-to-Ground Missile-86 Cruise Missile

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The major focus of the fiscal year 1976 program was to study numerous alternative update systems, packages, and approaches for updating the B-52 offensive avionics system. The study was completed, the update system was defined, and both Headquarters Air Force and the Office of the Secretary of Defense gave their approval. The doppler program started a Research, Development, Test and Evaluation effort to develop a nuclear hardened doppler velocity sensor for strategic bomber application. The Strategic Avionics Crewstation Design and Evaluation Facility was converted and secured for program support. The B-52 Antiship Capability Study was completed and the Guided Bomb Unit-15 integration was tasked to the Guided Bomb Unit-15 program element.

Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

(U) The 1977 program finalized the development contract for the B-52 Offensive Avionics System development effort. This represented the first major offensive avionics update approved for the B-52 and therefore it required a careful definition in concert with expected future missions. The doppler project completed source selection and two contractors were selected for the flight test/flyoff phase along with survivability analysis tests to be conducted by the Air Force Weapons Laboratory. The Strategic Avionics Crewstation Design and Evaluation Facility completed crewmember tests and evaluations to establish a baseline of present capabilities against which to design/evaluate future changes.

(U) In 1978, the Common Strategic Doppler contractors submitted doppler radar sets for a flight test evaluation and competition. The winner was Teledyne Ryan. The Strategic Avionics Crewstation Design and Evaluation Facility established the baseline of present avionics for comparisons and assisted in the planning of effective controls and displays. The B-52 Offensive Avionics System project, formerly known as the B-52 Avionics Update - Phase One, was accelerated one year with funds from the fiscal year 1978 Supplemental Budget. The program completed a Systems Requirement Review, contractor awards were made, and software development was initiated. The total Offensive Avionics System research, development, test and evaluation contract was signed. The studies for B-52 life extension and nuclear hardness were initiated. The Electronic System Test Set development was continued. No efforts were accomplished in fiscal year 1978 on a B-52 Avionics Update - Phase Two program which was planned as a follow-on to the Offensive Avionics System Phase One program.

(U) In 1979, the Common Strategic Doppler project was completed and efforts were initiated to integrate the modification on the C/KC-135 force and to integrate the hardened sensor into B-52G/H Offensive Avionics System. The Strategic Avionics Crewstation Design Evaluation Facility completed human engineering testing with B-52 crewmembers on the B-52 Offensive Avionics System project package prior to flight testing. Under the Offensive Avionics System project, subsystem deliveries were received for integration into the Offensive Avionics System package, fabrication of the system integration laboratory and test facility was begun, and testing efforts were initiated. Long lead procurement funding was released for cruise missile external pylons. The Avionics Update Phase Two project, now restructured and renamed the B-52 Aircraft Modernization Program, began in fiscal year 1979 with trade studies, system definition, and initial system design. Efforts identified in the Life Extension Study which required development or prototyping were included. The Nuclear Hardness Study was completed. These results will be used to develop and verify a hardness baseline for nuclear blast/vulnerability assessments for the B-52G/h system. The Electronic System Test Set project continued development. The observable differences/functionally related observable differences development project was initiated and completed.

In 1980 the Offensive Avionics System program production decision and contract actions were completed in the fourth quarter of fiscal year 1979. The Offensive Avionics System efforts in research, development, test and evaluation include completing software development and system integration laboratory and test facility integration. The flight test aircraft (B-52G) modification began flight testing in September 1980. The combined developmental test and evaluation and initial operational test and evaluation is scheduled from September 1980 through fiscal year 1982. The Nuclear Hardness Study/Electromagnetic Pulse project began testing of a B-52G on Trestle. The tests show that

Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

some aircraft Electromagnetic Pulse mods are required. The Electronic System Test Set project continued development of the support equipment. Fiscal year 1980 was the second year of efforts on the B-52 Aircraft Modernization Program. The outyear B-52 modernization efforts were completely revised in 1980. Under this effort changes have been identified to provide for sustained use of the B-52 as an all standoff cruise missile carriage force into the 1990s. [

Crew task loading studies were initiated to determine outyear mission needs due to reduced penetration requirements and the need to reduce support costs. Tasks identified in the fiscal year 1978 Life Extension Study were also included under this project. [

] the need for a forward looking radar with the full capability of the electronically agile radar were diminished. Therefore, the project was restructured to provide a radar update more suitable to solving growing radar system supportability problems and to meeting outyear B-52 missions requirements. Development of engineering data to incorporate the offensive avionics system/cruise missile integration package into the B-52 Weapon System Trainer was initiated.

In 1981, the combined developmental test and evaluation and initial operational test and evaluation of the Offensive Avionics System began and is scheduled to be completed September 1982. Modification of both B-52G and H aircraft with the Offensive Avionics System mod package begins this year. Nuclear weapon certification testing begins and will continue into the next year. Combined testing with launches of the Air Launched Cruise Missile and the Short Range Attack Missile take place late in this year. The Strategic Avionics Crewstation Design Evaluation Facility will concentrate on the human engineering aspects of the design and layout of Aircraft Modernization Program efforts, to include pilot compartment evaluations. [

Planning for scheduled outyear testing will be accomplished. The Electronic System Test Set project continued in this year with concentration on development of software and test package sets for the Air Launched Cruise Missile and the Short Range Attack Missile support. The Mission Data Preparation System project was established. Previously part of the Offensive Avionics System, the Mission Data Preparation System development provides updated software routines to optimize integration of cruise missile and Offensive Avionics System mission preparation. In the Aircraft Modernization Program, the initial full scale engineering and development contract is to be signed. Integration and software design is to begin in the laboratory in anticipation of hardware delivery. Final refinements to architecture and interfaces with the B-52 Offensive Avionics System project are scheduled. The strategic radar project will initiate full scale engineering development for eventual input to the Aircraft Modernization Program. In addition, the Offensive Avionics System/Cruise Missile Integration Weapon System Trainer modification package development will continue this year.

2. (U) FY 1982 Program: During this year, the Offensive Avionics System project will be completed and the test aircraft will be transferred to the B-52 Aircraft Modernization Program. The electromagnetic pulse project will continue to refine the information needed to support a hardening decision. Efforts will concentrate on evaluating alternative approaches for strategic aircraft hardening and further examining the threats and thus the needs for additional protection. A B-52G modified with the Offensive Avionics System and Cruise Missile Carriage will be tested and

Project Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

data will be analyzed for existing levels of protection. The Electronic System Test Set project will be completed this year except for necessary items uncovered during initial operational test and evaluation and early follow-on test and evaluation. This year Initial Full Scale Engineering Development for the strategic radar project will complete and Full Scale Development will commence and be carried through Preliminary Design Review. The modification to the weapon system trainer for Offensive Avionics System and Air Launched Cruise Missile will be completed this year. Initiation of modification efforts for Aircraft Modernization Program subsets which have completed development are scheduled to begin this year. These include the Fuel Quantity Indicating System and the Environmental Control System updates. The Mission Data Preparation System project is continuing development. The Strategic Avionics Crewstation Design Evaluation Facility project will continue during this year. One new start will be initiated - B-52H Cruise Missile Integration. This project provides for cruise missile carriage on the B-52H.

3. (U) FY 83 Planned Program: During this year the B-52 Aircraft Modernization Program and related Strategic Radar and Autopilot projects continue. Initiation of the modification to update the current forward looking radar system begins this year. The project to develop the cruise missile integration interfaces to permit cruise missile carriage for the B-52H is continuing. The development program to provide electromagnetic pulse protection and associated aircraft survivability and vulnerability problems for the B-52G/H is continuing. Technology findings and hardness verifications will be made available to adjust the modification program and to provide follow-on strategic bomber efforts with an extremely valuable data base. The Mission Data Preparation System development is continuing with completion in fiscal year 1984. All significant program cost changes are addressed in the individual project Descriptive Summaries which are attached.

4. (U) FY 84 Planned Program: The B-52 Aircraft Modernization Program and related Strategic Radar projects are continuing. The Autopilot development project will complete and aircraft modification will begin for the Strategic Radar update. The B-52H cruise missile integration project will complete and modification will begin this year. Also completing development is the Mission Data Preparation System project. A hardening approach will be selected to provide electromagnetic pulse protection for the B-52 followed by aircraft modification and testing.

5. (U) Program to Completion: The modification program for the electromagnetic pulse fixes and associated aircraft survivability and vulnerability problems ends. The B-52 Aircraft Modernization Program continues with modifications to the autopilot and electro-optical viewing systems. Cruise missile carriage modification for the B-52H will be completed. If further cruise missile or weapon system introductions are made, then their integration will be required. The Aircraft Modernization Program will require an update to the Weapon System Trainer system. Additional B-52 projects may be required for specialized role and mission conversions.

Project Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

6. (U) Milestones: Date

A. B-52 Offensive Avionics Systems (Formerly Avionics Update - Phase One):

(1)	Initial Contract Signed (Studies)	January 1976
(2)	Phase 0 Definition Contract Signed	October 1977
(3)	Phase 1 Contract	August 1978
(4)	Release Long Lead Production Funds for Cruise Missile Pylon	September 1978
(5)	Production Decision/Approval	July 1979
(6)	Initiation of Developmental Test and Evaluation/Initial Operational Test and Evaluation	September 1980
(7)	Completion of Developmental Test and Evaluation/Initial Operational Test and Evaluation	September 1982
(8)	First Aircraft - In (Boeing)	December 1980
(9)	First Aircraft - Out (Boeing)	June 1981
(10)	First Aircraft Delivery to Strategic Air Command	August 1981
(11)	First Aircraft - Alert Air Launched Cruise Missile with Offensive Avionics System	September 1981
(12)	Initial Operational Capability - B-52G Squadron (16 PAA) with Air Launched Cruise Missile and Offensive Avionics System	December 1982

B. B-52 Aircraft Modernization Program (Formerly Avionics Update - Phase Two):

(1)	Definition/Trade Studies	Fiscal Year 1979/1980
(2)	Initial Full Scale Engineering and Development Contract	Fiscal Year 1981
(3)	Prototyping Initiation	Fiscal Year 1983
(4)	First Aircraft - In/Out	Fiscal Year 1985

C. Electronic System Test Set:

(1)	Critical Design Review	October 1977
(2)	First Fabricated Set	October 1977
(3)	System Software Critical Design Review	May 1978
(4)	Planned Production Start	January 1980
(5)	Initial Operational Capability	December 1982

Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

D. Nuclear Hardness Study/Electromagnetic Pulse:

(1) Start Studies	Fiscal Year 1978
(2) Dipole Testing	Fiscal Year 1979
(3) Trestle Testing - Basic Aircraft	Fiscal Year 1980/1981
(4) Trestle Testing - Offensive Avionics System/Cruise Missile Carriage Aircraft	Fiscal Year 1982
(5) Alternative Approaches Analysis	Fiscal Year 1981-1983
(6) Trestle Testing - Offensive Avionics System/Cruise Missile Carriage/Protection Kit Aircraft	Fiscal Year 1984-1985

E. B-52 Strategic Radar:

(1) Strategic Air Command Required Operational Capability 6-75 Approved	December 1976 (Electronically Agile Radar)
(2) Initiation of Engineering	October 1979 (Electronically Agile Radar)
(3) Completion of Advanced Development (PE 63241/PE 11113F)	January 1980 (Electronically Agile Radar)
(4) Start Flight Testing	Fiscal Year 1984
(5) Complete Flight Testing	Fiscal Year 1984

F. B-52H Cruise Missile Integration:

(1) Full Scale Engineering and Development Contract	Fiscal Year 1982
(2) Start Flight Testing	Fiscal Year 1982-1983
(3) Complete Flight Testing	Fiscal Year 1983
(4) Production Decision	Fiscal Year 1983
(5) First Aircraft in for Modification	Fiscal Year 1984

G. Autopilot:

(1) Initial Full Scale Engineering and Development Contract	Fiscal Year 1981
(2) Start B-52G/H Modification	Fiscal Year 1985

Project: #2406
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Offensive Avionics System
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The present B-52G/H bombing navigation system and other systems were designed with technologies available in the early 1950s and are[ ]and increasing maintenance costs (e.g., the present Mean Time Between Failure of the bombing navigation system in the B-52G/H fleet is[ ] and the[Projected improvements in the enemy defensive threat demand navigation accuracy and[

Of equal importance, a study of avionics systems, completed in October 1976, found that selected offensive avionics system support costs could be reduced if high cost, low reliability components and subsystems identified in the study were exchanged with suggested replacement items. Finally there is the need to modify the B-52G and B-52H aircraft to be compatible with the carriage and launch of cruise missiles.

(U) The B-52 Offensive Avionics System project, formerly known as the B-52 Avionics Update - Phase One, responds to the immediate need to improve the performance of the B-52G/H bombing navigation system, to reduce avionics system support costs, and to integrate cruise missile carriage on the B-52G. The urgency of the need for improved performance and cruise missile carriage, tempered by the desire to effect significant Operational and Support cost savings shapes the priorities of this project.

(U) The Offensive Avionics System project includes an improved heading system, integrated controls and displays; a reliability modification to the present forward looking radar; a high accuracy inertial navigation system; the addition of digital processing and a new data bus; and a new doppler and radar altimeter. As well as accommodating cruise missile carriage, the new avionics developed under the Offensive Avionics System project will provide stored data and integrated sensor updates to the missiles (Air Launched Cruise Missile and Short Range Attack Missile) prior to launch from the aircraft. Precision initialization is required prior to launch of Air Launched Cruise Missile to insure a high probability of acquiring the first terrain correlation matching guidance update point. Other benefits to the cruise missile are a two-fold increase in system reliability and nuclear hardness to electromagnetic pulse/transient radiation effects on electronics.

(U) The first B-52G upgraded with the integrated Offensive Avionics System package achieved alert capability with external Air Launched Cruise Missiles in September 1981. The program Initial Operational Capability date, which consists of the first full squadron (16 PAA B-52G) updated with Offensive Avionics System and capable of carrying and launching cruise missiles, is December 1982.

Project: #2406
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Offensive Avionics System
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

(U) RELATED ACTIVITIES: The B-52 Squadrons program benefits from the Low Life Cycle Avionics (PE 63705F), the Electronically Agile Radar (PE 63241F), the Standard Precision Navigator (PE 64201F), and other similar Research and Development efforts in Air Force Systems Command, and contractor internal research and development efforts. The program will support the B-52 avionics update requirements as stated in Strategic Air Command Required Operational Capabilities 6-75 and 12-76. The cruise missile development program will be integrated with the B-52 Offensive Avionics System project.

(U) WORK PERFORMED BY: The avionics study which identified avionic subsystems for incorporation into this program was accomplished by Boeing Military Airplane Company. The development program has been assigned to Boeing Military Airplane Company on a sole source basis. The major subsystems/subcontractors were selected by Boeing Military Airplane Company with Air Force approval. The list of contractors is as follows:

Prime Contractor	Product
Boeing Military Airplane Company, Wichita, Kansas	Offensive Avionics System
Major Subcontractors for Offensive Avionics System	
Lear Siegler, Grand Rapids, Michigan	Attitude and Heading Reference System
Sperry Flight Systems, Phoenix, Arizona	Controls/Displays
International Business Machine, Owego, New York	Processor
Norden, Norwalk, Connecticut	Radar Modification
Honeywell, Minneapolis, Minnesota	Radar Altimeter
Honeywell, Saint Petersburg, Florida	Inertial Navigation Set
Softech, Waltham, Massachusetts	Jovial 3B Complier
Sundstrand, Redmond, Washington	Data Transfer Unit
Teledyne - Ryan, San Diego, California	Doppler Velocity Sensor
Associate Contractors on Offensive Avionics Systems (Through Joint Cruise Missile Project Office)	
General Dynamics, San Diego, California	Air-to-Ground Missile-109 Cruise Missile
McDonnell Douglas, Saint Louis, Missouri	Air-to-Ground Missile-109 Cruise Missile Software
Boeing Aerospace Company, Seattle, Washington	Air-to-Ground Missile-86 Cruise Missile

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. (U) FY 1981 and Prior Accomplishments: The major effort of the fiscal year 1976 program was to study numerous alternative update systems, packages, and approaches for upgrading the B-52 offensive avionics. The study was completed, the update system was defined, and both Headquarters Air Force and the Office of the Secretary of Defense gave their approval to proceed.

Project: #2406
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Offensive Avionics System
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

(U) The 1977 program finalized the Research, Development, Test and Evaluation contract for the B-52 Offensive Avionics System project development. This represented the first major offensive avionics update approved for the B-52 and required a careful definition in concert with expected future missions.

(U) In 1978, the B-52 Offensive Avionics System project, known then as the B-52 Avionics Update - Phase One, was accelerated one year with funds from the fiscal year 1978 Supplemental Budget. The program completed a System Requirements Review, contractor awards were made, and software development was initiated. Total Phase One Research, Development Test and Evaluation contract was signed in August 1978.

(U) In 1979, the hardened sensor developed under the Common Strategic Doppler project was completed (this sensor will be integrated into B-52G/H under the Offensive Avionics System project). Deliveries were received for integration into the Offensive Avionics System package, fabrication of the system integration laboratory and test facility was begun, and testing efforts were initiated. Long lead procurement funding will be released during fiscal year 1979 for cruise missile external pylons to meet the programmed September 1981 initial alert requirement.

(U) In fiscal year 1980, the Offensive Avionics System program production decision and appropriate related contract actions occurred in the fourth quarter of fiscal year 1979. The efforts in Research, Development, Test and Evaluation included completing software development and system integration laboratory and test facility integration. The flight test aircraft (B-52G) modifications completed this year with flight testing starting in September 1980. The combined developmental test and evaluation and initial operational test and evaluation is scheduled from September 1980 through fiscal year 1982.

(U) In 1981 flight testing was the main task for this year. Both testing of the Offensive Avionics System and then integration with the Air Launched Cruise Missile and Short Range Attack Missile took place. The combined development test and evaluation and initial operational test and evaluation of the Offensive Avionics System will continue to September 1982. Modification of both B-52G and H aircraft to incorporate the Offensive Avionics System will begin this year.

2. (U) FY 1982 Program: Flight testing is scheduled for completion during this year. Flight testing for the first quarter (October through December) has already been scheduled. The Offensive Avionics System update testing will complete in FY 1982 with nuclear weapons certification and the test aircraft will transition to the B-52 Aircraft Modernization Program.

3. (U) FY 1983 Planned Program: Not Applicable.

4. (U) Program to Completion: Not Applicable.

Project: #2406
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Offensive Avionics System
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

5. (U) Milestones: Date

		Date
A.	Initial Contract Signed (Studies)	January 1976
B.	Phase 0 Definition Contract Signed	October 1977
C.	Phase I Contract	August 1978
D.	Release Long Lead Production Funds for Cruise Missile Pylon	September 1978
E.	Initiation of Development, Test and Evaluation/ Initial Operational Test and Evaluation	June 1980
F.	Completion of Development, Test and Evaluation/ Initial Operational Test and Evaluation	September 1982
G.	Production Decision/Approval	July 1979
H.	First Aircraft - In (Boeing)	December 1980
I.	First Aircraft - Out (Boeing)	June 1981
J.	First Aircraft Delivery to Strategic Air Command	August 1981
K.	First Aircraft - Alert Air Launched Cruise Missile with Offensive Avionics System	September 1981
L.	Initial Operational Capability - B-52G Squadron (16 PAA) with Air Launched Cruise Missile and Offensive Avionics System	December 1982

7. (U) Resources ($ in thousands):

		FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		48,045	21,559	4,500			211,982
Procurement	3010 *	359,800	359,900	468,000	705,000	666,600	3,129,000
	3400	55,400	39,000	61,200	70,100	64,300	293,100

8. (U) Comparison with FY 1982 Descriptive Summary:

		FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		45,000	21,900				204,000
Procurement	3010	417,500	[illegible]	388,700		597,200	2,292,400
O&M	3400	54,100	44,100	60,900		190,500	352,700

*Procurement funds are a total of Offensive Avionics Systems, Cruise Missile Carriage including the Common Strategic Rotary Launcher, and Observable Difference/Functionally Related Observable Difference.

Project: #2406
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Offensive Avionics System
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

(U) The increase in fiscal year 1983 development funds is required to complete report writing and demodify the flight test aircraft. The increase in procurement funding is due to inflation/cost increases within the program and the addition of the Common Strategic Rotary Launcher for internal cruise missile carriages on the B-52H model.

Project: #2548
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: Nuclear Hardness Study/Electromagnetic Pulse
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The purpose of the B-52 Nuclear Hardness Study/Electromagnetic Pulse project is to improve the survivability and vulnerability of the B-52G/H to nuclear effects. The first phase of the study identified program needs. The second phase, consisted of testing a B-52G aircraft on the EMP facilities at Kirtland AFB, NM.

A modification plan to fix these identified deficiencies was proposed. Further evaluation of the test program and the hardening approach as well as recommendations by the Defense Science Board, which addressed the program from 1979 through 1981, indicated that additional testing and hardening kit development was necessary. A program was begun in fiscal year 1981 to test an OAS/CMC equipped B-52G and concurrently develop two hardening approaches, one a tailored design to fix only those LRU's determined to be vulnerable, the other a comprehensive shielding design.

(U) RELATED ACTIVITIES: PE 64711F Systems Survivability (Nuclear Effects) supports Electromagnetic Pulse testing of the B-52. PE 64711F develops test methodology, procedures, and prescribes facilities needed for Air Force testing. PE 64747 Electromagnetic Radiation develops the nuclear simulator for testing (Project 1209).

(U) WORK PERFORMED BY: The test facilities at the Air Force Weapons Laboratory, Kirtland Air Force Base, NM, will be used for the majority of the actual aircraft, subsytem, and/or piece part testing. Computer facilities at Air Force Weapons Laboratory and selected civilian contractors will also be used.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Headquarters Air Force directed the Air Force Weapons Laboratory to lay out a total evaluation program for the B-52G/H. Phase One was completed by Air Force Weapons Laboratory in 1976. The program was suspended shortly thereafter to allow facility testing to be concentrated on B-1 requirements. Following the cancellation of B-1 production, the B-52 program was re-established in the fiscal year 1978 Supplemental Budget. Efforts through fiscal year 1978 defined the test program, prepared for basic aircraft systems testing, and initial computer analysis was performed. In fiscal year 1979, basic aircraft systems testing began at Air Force Weapons Laboratory on the Dipole facilities. In 1980, testing begun in the preceding year was completed. In addition, the aircraft was tested on the Trestle facility in fiscal year 1980. The Trestle testing originally proposed in this program was expanded considerably this year to clear up the Electromagnetic Pulse uncertainties of the B-52. Data from the Electromagnetic Pulse portion of the tests was analyzed to initiate development of Electromagnetic Pulse fixes to Planning for an EMP test of an Offensive Avionics System/Cruise Missile Carriage equipped B-52G was begun in fiscal year 1981.

2. (U) FY 1982 Planned Program: The project will continue to refine the information needed to support an EMP hardening decision. This includes continued analyses of the results of the fiscal year 1980 system level test, additional subsystem tests and a system level test of an Offensive Avionics System/Cruise Missile Carriage (OAS/CMC) equipped aircraft. Two hardening approaches will be developed through Preliminary Design Review (PDR).

Project: #2548
Program Element: #11113F
DoD Mission Area: 113, Airborne Strike

Title: Nuclear Hardness Study/Electromagnetic Pulse
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

3. (U) FY 1983 Planned Program: The results of the fiscal year 1982 test and development programs will be analyzed leading to a hardening approach decision. The choice of the hardening approach to be used for the B-52 will be made in fiscal year 1983 based on the results of the fiscal year 1982 program. The selected approach will be developed through Critical Design Review (CDR).

4. (U) FY 1984 Planned Program: A prototype hardening kit will be developed and installed on an aircraft and tested. Final technology findings and hardness verifications will be made available to adjust the ongoing modification program and to provide follow-on strategic bomber efforts an extremely valuable data base.

5. (U) Program to Completion: Not Applicable

6. (U) Milestones:

	Date
A. Start Studies	Fiscal Year 1978
B. Dipole Testing	Fiscal Year 1979
C. Trestle Testing - Basic Aircraft	Fiscal Year 1980/1981
D. Trestle Testing - Offensive Avionics System/ Cruise Missile Carriage Aircraft	Fiscal Year 1982
E. Alternative Approach Analyses	Fiscal Year 1982
F. Hardening Approach Decision	Fiscal Year 1983
G. Prototype Kit Installed	Fiscal Year 1984

7. (U) Resources ($ in thousands):

		FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		22,600		13,567	33,405	11,100	101,672
Procurement	3010				69,900	962,900	1,032,800
O&M	3400				5,000	198,000	203,000

Project: #2548
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: Nuclear Hardness Study/Electromagnetic Pulse
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

8. (U) Comparison with FY 1982 Descriptive Summary:

		FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		22,565	26,600	13,600			83,865
Procurement	3010	20,000		66,300		119,700	288,600
O&M	3400		10,000	15,500		83,600	109,100

(U) Procurement funding is delayed one year to take advantage of the results of the fiscal year 1982 system level test of an Offensive Avionics System/Cruise Missile Carriage modified aircraft. The increases in the total estimated costs are due to the inclusion of the comprehensive shielding design hardening approach.

Project: #2570
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: Electronic System Test Set
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The goal of developing automatic test equipment common to the Short Range Attack Missile and Air Launched Cruise Missile was highlighted in January 1976 when Strategic Air Command identified its requirements for such equipment. In the Short Range Attack Missile B trade study, different options were evaluated to find the most cost-effective common test equipment for the Air-to-Ground Missile 69A, Air-to-Ground Missile 69B, Air-to-Ground Missile 86A, B-52 missile related carrier aircraft equipment, and B-1 applications. A preferred concept resulting from the study was a computerized automatic test equipment common to the two missiles and missile related aircraft systems. The Electronic System Test Set, formerly the Integrated Computerized Test Set, was selected to complement the concept. The advantages of common automatic test equipment, in addition to effecting major changes in projected life cycle costs are: growth potential, system software change flexibility through on-line edit capability and improved operational capability associated with testing all aircraft and missile systems with a single piece of equipment.

(U) The Short Range Attack Missile Program Management Directive, September, 1976, directed the Short Range Attack Missile System Project Office, to develop the automatic test equipment common to the Air-to-Ground Missile-69A, Air-to-Ground Missile 69B, Air-to-Ground Missile 86A, B-1 gravity weapons, and B-52/B-1 munitions related carrier aircraft equipment. The required operational capability for the Air Launched Cruise Missile also stated a need for common automatic test equipment.

(U) When the B-1 and Short Range Attack Missile B missile production were cancelled in July 1977, all Short Range Attack Missile B work except the Electronic System Test Set was stopped. Electronic System Test Set work continued and was expanded to include the Air-to-Ground Missile 109 which had been introduced into the air launched cruise missile competition. Thus Electronic System Test Set satisfies the automatic test equipment requirement for the Air-to-Ground Missile 69A, Air-to-Ground Missile 86B, Air-to-Ground Missile 109 and combination of the Short Range Attack Missile and Air Launched Cruise Missiles, loaded and empty launcher and pylons, and B-52 carrier aircraft equipment at the B-52 integrated maintenance facility.

(U) A review completed in November 1977 reconfirmed the requirement and effectiveness of continuing the development of a common set of automatic test equipment.

(U) RELATED ACTIVITIES: The B-52 Offensive Avionics System modernization program with new digital systems and cruise missile integration and the B-52/SRAM weapon system will benefit from this development effort. The B-52/Short Range Attack Missile/Cruise Missile/Avionics interface units developed under the program can be checked for maintenance corrective action using the Electronic System Test Set.

(U) Support for the B-52 weapon system and associated missiles will be performed by the Boeing Company under contract to the Aeronautical Systems Division of the Air Force Systems Command.

Project: #2570
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: Electronic System Test Set
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. (U) FY 1981 and Prior Accomplishments: Development of Electronic System Test Set began under the Short Range Attack Missile program element reacting to requirements for integrated automatic test equipment. The program was interrupted by B-1 and Short Range Attack Missile B production cancellation decisions and a concomitant loss of funding. In 1978, the Electronic System Test Set development continued with remaining Short Range Attack Missile B funds. A total of $1,999 thousand was reprogrammed into this project in fiscal year 1978. Hardware and system software development along with the fabrication of the first seven Electronic System Test Set ESTS developmental sets will take place.

(U) In 1979, the weapon system peculiar test package sets, which are an integral part of the Electronic System Test Set, began development by the competing missile subcontractors. This effort consisted primarily of software and adapters. In addition the first production configured Electronic System Test Set entered fabrication. These five sets will be used for qualification testing, software validation/verification and compatibility. Total system capability for the B-52G/H, Short Range Attack Missile, offensive avionics system, and cruise missiles checkout continued to be funded by this project.

(U) In 1980, development of hardware and Short Range Attack Missile/cruise missile/carrier aircraft checkout and support equipment continues. Any modifications required by the uniqueness of the cruise missile selected for production were being incorporated into a final Electronic System Test Set configuration. Funding shortfalls in fiscal year 1979, not made up in the fiscal year 1979 Supplemental Budget, had to be moved into fiscal year 1980. This resulted in a program slip of approximately six months for the full capability. Development efforts were prioritized to concentrate on the Air Launched Cruise Missile, the missile interface unit, and the Short Range Attack Missile in that order.

(U) In 1981 development required for production deliveries in fiscal year 1981 will be completed to meet the scheduled initial alert capability date of September 1981 and an initial operational capability of December 1982. The fiscal year 1981 program was expanded to include items not completed in fiscal year 1980. The efforts will include development of the remaining Air Launched Cruise Missile test package sets, Short Range Attack Missile test package sets, and missile interface unit requirements.

2. (U) FY 1982 Planned Program: This is the last year of the Electronic System Test Set project. Development is scheduled to be completed. Discrepancies discovered during air launched cruise missile and offensive avionics systems integrated testing will be corrected during this year. Modifications and/or additions to this test set may be required if future generations of cruise missiles are introduced into the Air Force inventory.

Project: #2570
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: Electronic System Test Set
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

3. (U) FY 1983 Planned Program: Not Applicable

4. (U) Program to Completion: Not Applicable

5. (U) Milestones:

	Date
A. Critical Design Review	October 1977
B. First Set Fabricated	October 1977
C. System Software Critical Design Review	May 1978
D. Planned Production Start	January 1980
E. First Alert Capability	September 1981
F. Initial Operational Capability	December 1982

6. (U) Resources: ($ in thousands)1/

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs1/
Development	11,100	5,800				53,900

1/ Does not include Short Range Attack Missile or Air Launched Cruise Missile contributory efforts.

7. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Development	19,100	8,700				64,800

(U) Total estimated costs decrease is a result of reassessment of depot level support equipment costs.

Project: #2571
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Aircraft Modernization Program
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The present B-52G/H aircraft systems were designed with technologies available in the early 1950s and are consequently experiencing [ ] increasing maintenance costs as they continue to age. The B-52 Aircraft Modernization Program focuses on two primary objectives. The first is the eventual transition of the B-52G/H force [ ] This transition will require updates to keep the aircraft operationally effective. The second purpose is to ensure the force remains supportable through its predicted life into the 1990s. The shift of outyear mission requirements provided by Headquarters Strategic Air Command and future aircraft problem predictions provided by Headquarters Air Force Logistics Command have been incorporated into the definition and scope of this program. The project will coordinate planning, definition, integration, and eventual flight testing of the overall aircraft modernization.

The B-52 Aircraft Modernization Program (formerly Avionics Update - Phase Two) [

In this context, the B-52 Aircraft Modernization Program represents a systems approach to follow-on B-52 modernization aimed at the eventual transition of the B-52 force [A complete aircraft and mission requirement evaluation was done in fiscal year 1980 and a full scale engineering and development contract is scheduled for fiscal year 1982. Thus far the following items are considered minimum requirements for this program: radar system update, integrated pilot/copilot heading displays, autopilot update, electro-optical viewing systems update, new fuel quantity indicating system, and an improved environmental control system. The radar system and autopilot updates are addressed in separate projects. This project will incorporate any related life extension/modernization projects identified in the Life Extension Study carried out in fiscal year 1978.

(U) Defensive avionics systems under development in other program elements will be phased with those actions to provide a total, integrated approach in B-52G/H modernization efforts.

(U) RELATED ACTIVITIES: The program will receive benefits from the completed Low Life Cycle Cost Avionics (PE 63705F), the terminated Electronically Agile Radar (PE 63241F) effort, the Standard Precision Navigator (PE 64201F), and other related Research and Development efforts under the supervision of Air Force Systems Command, and contractor internal research and development efforts. The program objective is to meet the total offensive avionics update requirement as stated in Strategic Air Command Required Operational Capability 6-75. All B-52 related missile development programs will be integrated with other offensive and defensive avionics update projects.

(U) WORK PERFORMED BY: The avionics study which initially identified avionics subsystems for incorporation into this program was accomplished by Boeing Military Airplane Company. The B-52 Offensive Avionics System development program has been assigned to the Boeing Military Airplane Company on a sole source basis. Initial design and definition tasks under the Aircraft Modernization Program has also been awarded to the Boeing Military Airplane Company.

Project: #2571 Title: B-52 Aircraft Modernization Program
Program Element: #11113F Title: B-52 Squadrons
DOD Mission Area: 113, Airborne Strike Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The Low Life Cycle Cost Avionics Study was completed in fiscal year 1976 and fiscal year 1977. Fiscal year 1978 work concentrated on the Offensive Avionics System program.

(U) In 1979, the package began with trade studies, system definition. and initial system design. Efforts identified in the Life Extension Study which require development or prototyping were initiated under the Aircraft Modernization Program tasking if they related to the major headings of offensive avionics, offensive and defensive avionics integration crew reduction, or reliability, maintainability, and supportability problems.

(U) In fiscal year 1980 Boeing Military Airplane Company was put on contract early in fiscal year 1980 to evaluate operational requirements, logistical support problems, alternative B-52 missions, and to recommend alternative modification options depending on selected B-52 outyear missions. Each option will also include recommended subcontractor requirements. The options will be presented to Air Force and Office of the Secretary of Defense agencies for multiple reviews.

(U) In 1981 selected aircraft modernization program options were put into competitive source selection with Boeing Military Aircraft Company and Air Force Systems Command making tentative subcontractor selections. An initial full scale engineering development contract was awarded in the fourth quarter of fiscal year 1981. Additionally, procurement requests were issued for Research, Development, Test and Evaluation items in preparation for system integration and software development. Basic software development and interface with the Offensive Avionics System software package began in the Systems Integration Laboratory and Test Facility.

2. (U) FY 1982 Planned Program: During the year, full scale engineering development will continue on the various subsystems. Preliminary Design Review on two of the subsystems will occur in the second quarter of the fiscal year. Items/subsets undergoing modification procurement in 1983 will receive extra attention to ensure completeness. Procurement begins this fiscal year on the fuel quantity indicating system and the environmental control system. Both system updates require immediate attention to maintain force readiness.

3. (U) FY 1983 Planned Program: Updated subsystems will be received for checkout and integration in the Systems Integration Laboratory and Test Facility. These subsystems and associated software will be packaged for development and flight test aircraft modification during the latter part of this year. Radar update procurement will also begin.

4. (U) FY 1984 Planned Program: The remaining subsets will be integrated into the flight test aircraft. The radar system update, the autopilot, their interfaces and interfaces with the other subsets will be totally integrated and flight testing accomplished during this year.

Project: #2571
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Aircraft Modernization Program
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

5. (U) Program to Completion: Current planning shows that by the end of fiscal year 1984 an integrated, updated modification package could be ready for a production decision. The remainder of the program will be conducting flight and ground testing on any other supportability or mission oriented requirements which may be added at a later date.

6. (U) Milestones:

	Date
A. Definition/Trade Studies	Fiscal Year 1979-1980
B. Initial Full Scale Engineering Development Contract	Fiscal Year 1981
C. Prototyping Initiation	Fiscal Year 1983
D. Production Decision - Total Package	Fiscal Year 1984
E. First Aircraft - In/Out	Fiscal Year 1985

7. (U) Resources ($ in thousands):

		FY 1981 Actual	FY 1982 Estimated	FY 1983 Estimated	FY 1984 Estimated	Additional to Completion	Total Estimated Costs
RDT&E		11,200	11,300	20,200	30,200	Cont	Not Applicable
Procurement	3010		28,700	39,900	44,800	TBD	TBD
O&M	3400			200	5,300	Cont	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E		6,200	25,500	27,500		Cont	Not Applicable
Procurement	3010		26,500	TBD			

(U) As a result of fiscal year 1982 Appropriation reductions, the Aircraft Modernization Program was rescoped to reflect the fiscal year 1983 funding level.

Project: #2601
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Strategic Radar
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The forward looking radar requirements for the B-52G/H force and strategic aircraft in general were stated in 1975 by Strategic Air Command. [ ] Under the penetration missions requirements, a radar system like the Electronically Agile Radar was required, developed, and tested. Installation, integration, and flight testing of an Electronically Agile Radar (EAR) on a B-52 was completed in FY 1980. However, the Electronically Agile Radar was judged as too sophisticated and expensive [ ]

But, a radar update is still required [ ] and to solve serious reliability/maintainability problems with the existing radar subsystems. This project now represents a restructuring of the entire B-52G/H radar update effort. It will now concentrate on meeting radar subsystem mission and supportability requirements of the Strategic Air Command and the Air Force Logistics Command. The radar update incorporated into the offensive avionics system program was only an interim update [ ] Now, the remaining serious radar system problems must be addressed and are the primary objectives of this project. The radar subsystem remains the most unreliable in the bombing navigation system. Air Force Logistics Command has singled out the radar system as unsupportable in the [ ] The primary problems being in the transmit/receive section and antenna. Because these parts of a radar system are very sensitive to capability and mission application, updates were withheld in the offensive avionics system project until these factors were determined. Sources for many replacement components are no longer available. Based on this supportability predictions, Strategic Air Command has requested the radar system be updated prior to the expected nonsupportability date. Initiation of the modification is now planned for 1983.

(U) RELATED ACTIVITIES: The technology for this radar update is based on several efforts: The Forward Looking Advanced Multimode Radar effort under Program Element 63203F; the Multi-Mode Radar performed by the Navy and the Reliable Advanced Solid State Radar of the Advanced Avionics Project (63203F); the advanced development Electronically Agile Radar effort (63241F); and the Low Life Cycle Cost Avionics (63705F) effort.

(U) WORK PERFORMED BY: The Aeronautical System Division, Wright-Patterson Air Force Base, an organization of Air Force Systems Command, will manage the project. The integration flight test will be accomplished at Wichita, KS, by the Boeing Military Airplane Company.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Low life cycle studies under Program Element 63705F confirmed the cost-effectiveness of an Electronically Agile Radar like radar to fulfill the requirements of Strategic Air Command penetrating bomber mission requirements. Flight tests were begun.

Project: #2601
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Strategic Radar
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

(U) In 1979, the Electronically Agile Radar/B-52 flight tests continued. Built-in Test/fault isolation tests were accomplished. The weapon system interface trade study was begun to establish cost, schedule and risk of full scale development for a modification program.

(U) In fiscal year 1980, flight tests were completed and test aircraft demodification was initiated. The remaining funds were used to carry out an analysis to define radar alternatives that better match the revised outyear mission objectives of the B-52G/H force.

(U) During fiscal year 1981, identification and laboratory testing of the selected radar modifications began. Software development and test for all radar modes was initiated. Initial Full Scale Engineering Development began.

2. (U) FY 1982 Planned Program: The Initial Full Scale Engineering Development phase will complete and Full Scale Development will commence and be carried through Preliminary Design Review. Mock-up in preparation for aircraft modification will also take place this year.

3. (U) FY 1983 Planned Program: The Full Scale Engineering Development phase will be completed through Critical Design Review and qualification testing will be initiated. Prototype installation and integration will be checked in the Systems Integration Laboratory and Test Facility. Procurement of kit proof assets as well as accelerated procurement of antenna components to protect the fiscal year 1985 support date is programmed this year.

4. (U) FY 1984 Planned Program: Component qualification testing will be completed. The updated radar package will be put into the flight test aircraft and integrated with other Aircraft Modernization Program subsets. Flight testing will initiate and complete this year.

5. (U) Program to Completion: Project 2601 will complete the engineering development, flight test, evaluation and qualification of an updated radar for the B-52 weapon system.

6. (U) Milestones:

	Milestones	Date
A.	SAC ROC 6-75 Approved	December 1976 (Electronically Agile Radar)
B.	Initiation of Engineering	October 1979 (Electronically Agile Radar)
C.	Completion of Advanced Development (63241/11113F)	January 1980 (Electronically Agile Radar)
D.	Critical Design Review	Fiscal Year 1983 (Radar Update)
E.	Start Antenna Modification	Fiscal Year 1983 (Radar Update)
F.	Start & Complete Flight Testing	Fiscal Year 1984 (Radar Update)
G.	Start Aircraft Modification	Fiscal Year 1984/1985 (Radar Update)

Project: #2601
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52 Strategic Radar
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

7. (U) Resources ($ in thousands):

		FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		5,386	21,000	29,600	11,000	5,600	74,086
Procurement	3010			20,900	78,700	345,400	445,000
	3400/540				2,900	58,800	61,800

8. (U) Comparison with FY 1982 Descriptive Summary

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	6,100	21,200	20,000		16,600	65,400

(U) The project funding has been increased to maintain the development program and the associated modification programs for the B-52G/H ahead of the logistical reliability/supportability problems and in concert with the latest strategic mission requirements for the B-52.

Project: #2633
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52H Cruise Missile Integration
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides as external and internal cruise missile integration and carriage capability for the B-52H. Program meets requirement to provide a fiscal year 1986 initial operational capability.

(U) RELATED ACTIVITIES: The current ongoing air launched cruise missile development, procurement and B-52G modification programs for cruise missile carriage, offensive avionics system, and observable differences/functionally related observable differences are related activities. The B-52H is currently being modified with the offensive avionics system. The Common Strategic Rotary Launcher (PE 63258F) is being developed for internal carraige of cruise missiles. Development will be completed to meet the initial operational capability date of the B-52H with external and internal cruise missile carriage.

(U) WORK PERFORMED BY: The Aeronautical System Division, Wright-Patterson Air Force Base, OH, and organization of Air Force Systems Command, will manage the project. The contractor is the Boeing Military Airplane Company.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable.

2. (U) FY 1982 Planned Program: During this year, modified B-52G data will be used to initiate a B-52H cruise missile integration program. Data on aircraft compatibility and carriage interfaces with the B-52H will be obtained. Initial flight test planning will be accomplished.

3. (U) FY 1983 Planned Program: In this year, test aircraft modification for external carriage will be completed and missile carriage and launch will be accomplished. Internal carriage development will continue. The necessary data to start the aircraft modification program for external carriage will be obtained.

4. (U) FY 1984 Planned Program: External carriage aircraft modification will begin and internal carriage development will progress toward completion.

5. (U) Program to Completion: The Common Strategi Rotary Launcher will be installed for internal carriage.

6. (U) Milestones:

Milestones	DATA
A. Development Program	Fiscal Year 1982 - 1983
B. Modification Production Decision	Fiscal Year 1984
C. Internal Cruise Missile Carriage Installation	Fiscal Year 1985
D. First Operational Capability	Fiscal Year 1986

Project: #2633
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: B-52H Cruise Missile Integration
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

7. (U) Resources ($ in thousands):

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RD&TE		12,000	33,300	4,800		50,100

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		15,000	31,900			46,900

(U) Cost increases are due to adaption of the Common Strategic Rotary Launcher for internal carriage.

Project: #2692	Title: B-52 Autopilot
Program Element: #11113F	Title: B-52 Squadrons
DOD Mission Area: 113, Airborne Strike	Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The basic B-52 autopilot technology dates back to World War II. In the early 1960's, its functions were expanded to include the Low Level and Aerial Refueling modes. The Mean Time Between Failure for the existing system is about 15 hours. The age of the autopilot has made it extremely difficult and costly to maintain. The autopilot has been plagued with unscheduled pitch up/down on Low Level and Aerial Refueling modes, roll wallow, erratic aerial refueling operation, and yaw oscillations. Of particular concern are the extremely narrow safety margins in the Low Level and Aerial Refueling modes. The project will provide autopilot updates which will improve reliability, maintainability, and safety to an acceptable level by providing new line replaceable units combining the functions of several existing units that are high failure items and containing a model pitch channel with appropriate comparators. A redundant pitch force transducer and a second altitude source will also be included.

(U) RELATED ACTIVITIES: Outputs from this project will be integrated with other subsets of the Aircraft Modernization Program (Project 257[illegible]).

(U) WORK PERFORMED BY: The Aeronautical Systems Division, Wright-Patterson Air Force Base, an organization of Air Force Systems Command, will manage the project. The integration of flight test will be accomplished at Wichita, KS, by the Boeing Military Airplane Company.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Began Initial Full Scale Engineering Development, Phase One, to design and integrate the updated autopilot system.

2. (U) FY 1982 Planned Program: Phase Two of the Initial Full Scale Engineering Development will be completed through Preliminary Design Review. Prototyping in preparation for aircraft modification will be accomplished.

3. (U) FY 1983 Planned Program: The Full Scale Engineering Development will be completed through Critical Design Review and qualification testing will be initiated. The updated system will be integrated with other modernization projects prior to flight test.

4. (U) FY 1984 Planned Program: The autopilot package will be flight tested this year following test aircraft modification. Project will complete this year.

5. (U) Program to Completion: Aircraft modification initiated.

6. (U) Milestones:

		Date
A.	Definition/Trade Studies/Contractor Selection	Fiscal Year 1981
B.	Flight Testing	Fiscal Year 1984
C.	B-52G/H Modification Start	Fiscal Year 1985

Project: #2692
Program Element: #11113F
DOD Mission Area: 113, Airborne Strike

Title: Autopilot
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

7. (U) Resources ($ in thousands):

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	12,300	14,000	15,700			42,000
Procurement 3010					198,600	198,600
3400					TBD	TBD

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	12,500	16,600	15,700			44,800
Procurement 3010			8,000		26,100	42,300
3400			100		2,600	2,700

(U) The previous project estimate was based on B-52D procurement beginning in fiscal year 1983. B-52D modification has been deleted and procurement for the B-52G/H will begin in fiscal year 1985.

Budget Activity: Strategic Programs #3
Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Offensive Avionics System test program is a combined Development Test and Evaluation/Initial Operational Test and Evaluation effort extending through fiscal 1982. The flight testing portion began in September 1980 with completion scheduled for September 1982. Between October 1981 and January 1982, combined OAS and Air Launched Cruise Missile (ALCM) testing will continue with four ALCM launches using Block Zero software. During the remainder of fiscal 1982, the test aircraft will be modified with a third avionics control unit and configured with Block One software culminating in three ALCM launches, one Short Range Attack Missile launch and live gravity weapon releases.

(U) The objective of the B-52 Offensive Avionics System program is to test and evaluate the operational effectiveness and operational suitability of the selected Offensive Avionics System package including the integration of the Air Launched Cruise Missile and Short Range Attack Missile. The test environment will represent the actual combat conditions as close as possible using a modified B-52G. Operational deficiencies will be identified and changes/tradeoffs will be recommended. Information will be provided for refining training concepts, refining tactics, techniques and doctrine, updating publications, and refining operating and support cost estimates.

(U) The test team crewmembers is drawn from the mainstream of the Strategic Air Command crew force in order to provide a more realistic appraisal of the new equipment.

(U) The program provides an update to the B-52G/H offensive avionics package. The effort will include design, fabrication, and integration of an offensive avionics system for a flight test evaluation program leading to a Class V modification to the B-52G/H fleet.

(U) The new avionics systems will include as a minimum, but not be limited to, the addition and/or modification of the following systems/capabilities:

a. (U) Attitude and heading reference system - Replace present heading and attitude systems with a more reliable, accurate system.

b. (U) Radar altimeter - Replace radar altimeter with a more reliable system capable of performing terrain correlation.

c. (U) Digital processor(s) - Replace present analog bombing navigation system computers providing bombing, navigation, and air launched missile computations.

Budget Activity: Strategic Programs #3
Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

d. (U) Military-Standard-1553A Data Bus - Insures resultant system architecture will meet Air Force digital time division multiplex standard.

e. (U) Controls and displays - Provide necessa.. controls and displays to ensure proper man/machine interface.

f. (U) Doppler Velocity Sensor - Replace present APN-89A Doppler radar with the common strategic doppler.

g. (U) Mapping radar modification - Modify the present radar system to improve performance, reliability, and - itairability.

h. (U) Inertial navigation capability - Provide an inertial navigation capability sufficient to meet the stated requirements in Strategic Air Command Required Operational Capability 6-75 for a high precision navigator. The capability must be Air Force-qualified and nuclear hardened to stated requirements. No Research Development Test and Evaluation (DT&E) funds are provided for either nuclear hardening or prototype systems other than United States Air Force government furnished equipment.

i. (U) Terrain correlation - An operational evaluation of terrain correlation as a navigational aid in the performance of the strategic mission.

j. (U) Air launched missile(s)/aircraft avionics tie-in - Integration of development software/hardware required to support air launched missile delivery.

(U) The development contractor is the Boeing Military Airplane Company in Wichita, Kansas. The DT&E service program manager is the Aeronautical Systems Division at Wright-Patterson Air Force Base, Ohio. The Operational Test and Evaluation (OT&E) agency is the Air Force Test and Evaluation Center at Kirtland Air Force Base New Mexico. The test location will be the Boeing Wichita plant 13 and the Air Force Flight Test Center, Edwards AFB, California.

(U) Particular emphasis will be placed on testing the operational effectiveness of the fault detection/isolation capabilities of the new equipment. Initial Operational Test and Evaluation (IOT&E) test team personnel will maintain the updated avionics system using the same available organizational/intermediate level techniques/equipment that are to be used when the system is deployed.

(U) Preliminary validated technical orders will be provided to DT&E/IOT&E test team personnel to perform maintenance associated with the new systems. These technical orders will be verified during DT&E/IOT&E to provide final tech data for system deployment.

Budget Activity: Strategic Programs #3
Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

(U) An evaluation of software for the B-52 OAS will be performed by the software assessment team at Boeing Military Airplane Company and Oklahoma City-Air Logistics Center (OC-ALC). In the test team, contractor development and test activities, as well as flight testing, will be monitored to assess software performance and suitability factors. The effectiveness of software development tools to support future software maintenance will also be assessed. At OC-ALC, computer programs and the associated documentation will be evaluated to judge their adequacy for software maintenance.

(U) In addition, a limited simulation capability for the OAS computer complex is planned to allow some performance evaluation of OAS Operational Computer Programs. This activity also begins a buildup of Air Force expertise at OC-ALC on which to base future organic support for B-52 OAS software.

(U) A high degree of similarity exists between the items tested during Development Test and Evaluation (DT&E), those tested during Initial Operational Test and Evaluation (IOT&E), and those in the production configuration. Except for minor installation and wiring differences, the subsystems should be completely interchangeable. Software will be continually updated with test findings.

(U) Below are sections for special items of concern which will be evaluated and will affect the Test and Evaluation portion of this program.

a. (U) Reliability:

(1) (U) Primary Mission Equipment shall have a minimum mean time between failure of 43 hours evaluated by burn in, qualification testing, ground tests, and flight tests.

(2) (U) Interface equipment shall have a minimum mean time between failure of 2500 hours.

(3) (U) Aircraft installed equipment shall have a minimum mean time between failure of 400 hours.

b. (U) Maintainability:

(1) (U) The total "on aircraft" maintenance time for new equipment shall not exceed 140 hours per 1000 system operating hours.

(2) (U) The mean time to restore failed equipment "on aircraft" shall not exceed 1 hour.

Budget Activity: Strategic Programs #3
Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

(3) (U) The mean time to restore failed equipment at the intermediate level shall not exceed 1.5 hours.

c. (U) Environmental Qualification Testing:

(1) (U) All new primary mission equipment will be tested for explosion proof, temperature shock, temperature-altitude, vibration, shock, acoustics, humidity, sand and dust, fungus, salt atmosphere, moisture, radiation, and overpressure using the appropriate Military-Standard.

(2) (U) Vibration testing includes 11 hours of random vibrations at two temperature levels, -55° and 71°C.

d. (U) Test Flights: The program has combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) flights. The DT&E testing has included 71 flights to date.

e. (U) Management: The test and evaluation program management for the OAS and air launched cruise missile integration is described below.

(1) (U) The development portion is a combined DT&E/IOT&E program and will continue through the full scale engineering and development contract. The test portion is from September 1980 through September 1982. The overall program manager is the Strategic Systems System Program Office (ASD/YY) who is also in charge of DT&E. Air Force Test Evaluation Center (AFTEC) is responsible for the IOT&E.

(2) (U) Beyond the DT&E/IOT&E program, a Follow-on Operational Test and Evaluation (FOT&E) is planned with two phases. The first phase, January 1982 to December 1983, will be the responsibility of AFTEC. After Initial Operational Capability (IOC), Headquarters Strategic Air Command (SAC) will begin the second phase.

2. (U) Operational Test and Evaluation Data:

a. (U) Testing began in September 1980 and continued through 25 September 1981.

b. (U) The test was combined DT&E/IOT&E and used one OAS - modified B-52G aircraft which staged from the Boeing Military Airplane Company/McConnell AFB, Kansas facilities. Test ranges used included White Sands Missile Range, Nellis Range, Utah Test and Training Range, and Tonopah Test Range. Boeing Military Airplane Company is the prime contractor. The Air Force Test and Evaluation Center (AFTEC) had overall responsibility for the IOT&E. SAC. Air Force Logistics Command (AFLC) and Air Training Command (ATC) provided personnel to the test team. The objectives of the IOT&E were to:

Budget Activity: Strategic Programs #3
Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

(1) (U) Evaluate the operational effectiveness of the OAS-modified B-52 to perform the Strategic Air Command (SAC) operational mission (i.e., quick reaction launch, air alignment of the inertial measurement unit, tanker rendezvous, overwater flight, landfall fix, weather avoidance, high and low altitude navigation, high and low altitude gravity weapon delivery, simulated and actual missile launch [Short Range Attack Missile/Air Launched Cruise Missile (SRAM/ALCM)], interoperability, and poststrike recovery).

(2) (U) Evaluate the operational suitability of the OAS (i.e., system reliability, maintainability, supportability and availability). Reliability and maintainability data was collected during in-flight and ground operations of the system and normal maintenance operations. Additional maintainability events were conducted to explore the whole range of normal operational maintenance events.

(3) (U) Identify system characteristics or deficiencies which significantly impact operating and support (O&S) costs. Identify operational deficiencies. Recommend and/or evaluate changes or tradeoffs in production configuration. Evaluate the effectiveness of the computational subsystem software, to include functional performance, degraded mode operations, and software man-machine interface.

c. (U) All minor support equipment was evaluated during the test. Minor changes were recommended and made to several items, and two items were completely redesigned. Several items of major support equipment received only cursory evaluations as they were not available until late in the program. Additional evaluations will be performed during Follow-on Operational Test and Evaluation (FOT&E). During Initial Operational Test and Evaluation (IOT&E), intermediate-level maintenance was performed largely by the contractor using special equipment. Consequently, estimates of operational reliability and maintainability for this level of maintenance will be degraded. Supportability of the test sets will be evaluated during FOT&E.

d. (U) The system and subsystems tested were preproduction configuration. "Patches" to system software were made during the test and included in the operational system. Operational Test and Evaluation (OT&E) operations and maintenance personnel were representative of user personnel.

e. (U) With the concurrency of the full scale development and production programs, some long-lead production decisions were made prior to the completion of flight testing. One hundred sets of aircraft equipment were on contract and the first three aircraft were modified before the test ended.

f. (U) Continued Development Test and Evaluation (DT&E)/OT&E of the OAS system will be conducted at Edwards AFB, California from October-December 1981. This test will combine with ALCM testing to become the Integrated Weapon System (IWS) program. A major modification to the OAS computer program will be tested during mid-FY 82 and the IWS FOT&E will be conducted during the FY 82-83 timeframe.

Budget Activity: Strategic Programs #3
Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

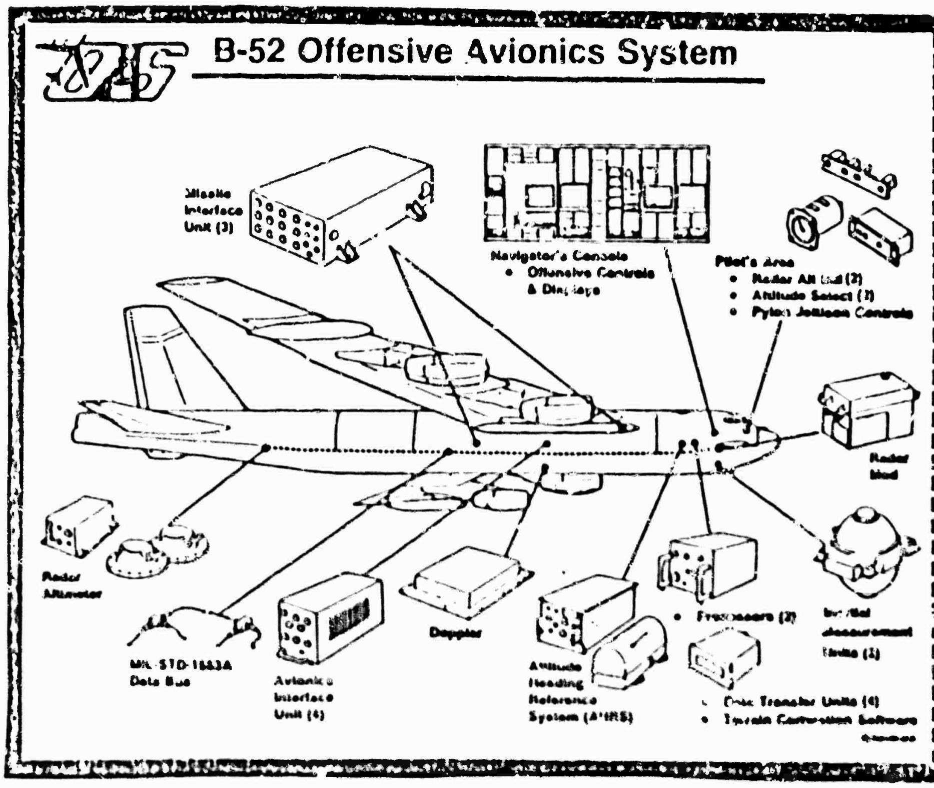
g. (U) Seventy-four sorties and 640 flying hours were expended in support of the test. Three dedicated Initial Operational Test and Evaluation (IOT&E) sorties designed around standard SAC operational missions were flown. In addition two Air Launched Cruise Missile (ALCM) and two Short Range Attack Missile (SRAM) live launches and four gravity weapon shapes were dropped to compare actual with simulated release activity.

h. (U) Over 150 service reports have been written on system deficiencies. Numerous fixes have been verified and tested; however, some fixes will have to be tested during the Follow-on Test and Evaluation (FOT&E). Major deficiencies exist in the radar system.

i. (U) No definitive statements can be made at this time on system reliability and maintainability. Much of the limited data is in analysis; however, specific comments will be in the final report to be published November-December 1981.

Budget Activity: Strategic Programs #3
Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

3. Systems Characteristics: The following are general characteristics of the new offensive avionics systems to be modified by the B-52G/H aircraft.



B-52 Offensive Avionics System
WEAPON SYSTEM ACCURACY

	BASELINE	PHASE 1
SRAM (FEET)		
PRIMARY MODE		
TERCOM		
SECONDARY MODE		
OVERALL (7 MIN) (90 SEC)		
GRAVITY WEAPON (FEET)		
PRIMARY MODE		
TERCOM		
SECONDARY MODE		
OVERALL		
NAVIGATION (NM)		
PRIMARY MODE		
SECONDARY MODE		

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11142F
DOD Mission Area: Airborne Strike, #113

Title KC-135 Squadrons
Budget Activity Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	20,145	30,000*	28,950	11,792	N/A	90,787
2214	Improved Aerial Refueling Systems	1,714	2,300	2,650	3,392	Continuing	9,956
2391	Avionics Modernization	2,231	2,800	-	-	Complete	5,031
2469	KC-135 Reengining	16,200	24,900	26,300	8,400	Complete	75,800

* Does not include $1,780K for Fuel Savings Advisory System

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The use of aerial refueling is fundamental to strategic, tactical and mobility operations in support of national strategy. The 25 year old KC-135A tanker -- the cornerstone of the United States Air Force aerial refueling force -- must be modernized if it is to continue to carry out this role. The objective of the KC-135 Squadrons Element is to assess and apply recent technology improvements to the KC-135A, where it is feasible to do so. The most essential project is 2469 - KC-135 Reengining. The present J57 engine is old, deficient in thrust, environmentally unacceptable, and fuel inefficient. Replacement with the selected CFM56 and the accompanying modernizations will eliminate these problems and add new capability and service life to the aircraft. Improved aerial refueling systems will permit safer and more efficient transfer of fuel to receivers and add interoperable refueling systems to be compatible with NATO/Navy receivers.

(U) BASIC FOR FY 1983 RDT&E REQUEST: The primary 1983 effort is the final developmental testing on the first CFM56 reengined aircraft -- the KC-135R. The aircraft will complete flight test and follow-on operational test at selected Strategic Air Command bases. Follow on KC-135R modification kits will be ordered for approximately 13 more aircraft at projected funding levels. KC-135R funding has received Air Force Systems Acquisition Review Council (AFSARC) and Independent Cost Analysis review. In addition, the Improved Aerial Refueling System (IARS) project will complete final R&D integration on the improved boom nozzle, hose reel system and boom control improvements.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Research, Development, Test and Evaluation	23,414	31,900	30,100		46,500	144,550
Procurement (Aircraft) (Quantities)	102,500	246,800	N/A		N/A	354,300
Operations and Maintenance (PE #72207F)		3,300				3,300

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
KC-135 Reengining						
Procurement (Aircraft)*	102,500	246,800(9)	584,600(TBD)	1,341,033(58)	Continuing	N/A**
Installation (PE #72207)		2,700	2,400	12,500	Continuing	N/A**

* Includes initial spares. FY 83 buy is 20-23 aircraft depending on support equipment requirements.
** Total program for acquisition in FYDP is $5,805,910 (300 aircraft) with $147,900 in associated installation; program planned to continue at 72 aircraft per year until fleet is reengined.

Program Element: #11142F
DOD Mission Area: Airborne Strike, #113

Title: KC-135 Squadrons
Budget Activity Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The ongoing wing reskin structural modification will extend the KC-135 service life to approximately the year 2040. However, present performance, avionics, and efficiency shortcomings exist which must be corrected. The KC-135 is equipped with underpowered, old technology turbojet engines rendering adverse environmental noise and smoke, high fuel consumption, deterioration due to age, and increasing maintenance costs. These characteristics restrict operations, limit operational use to less than optimal performance, place an increasing burden on Operation and Support funds, and reduce safety factors. This program element's objective is to enhance KC-135 operations by elimination of the above deficiencies. Specifically, improved refueling systems will afford faster fuel offload to receivers and safer operations at critical times, and avionics modernization will allow us to complete the mission more efficiently and safely. Reengining - a fundamental requirement - accomplishes significant improvements in capability, operational flexibility, energy consumption reduction, environmental protection, and will provide significant Operation and Support cost savings. (See the separate reengining description attached.) In summary, a modernized KC-135 is the goal.

(U) RELATED ACTIVITIES: Program element 72207 contains the installation labor funding required for the KC-135 reengine project.

(U) WORK PERFORMED BY: The KC-135 reengining program is managed by the Aeronautical Systems Division of the Air Force Systems Command, located at Wright-Patterson Air Force Base, OH. The prime contractor is the Boeing Military Airplane Company, Wichita, KS. The engine manufacturer is the CFM Company, a partnership between General Electric of the United States and Snecma of France.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Improved aerial refueling systems entered full scale engineering development and feasibility flight testing of the hose reel system while completing flight testing of more efficient offload pumps. Reengining (see attached summary for full description) completed the Critical Design Review and engineering for the first production aircraft. Procurement of the first aircraft hardware has been accomplished. The additional funds provided by Congress procured tooling and long lead materials for follow-on KC-135R production. Avionics modernization moved into full scale engineering development of an improved cockpit design and was integrated into the Fuel Savings Advisory System specification.

2. (U) FY 1982 Planned Program: In full scale engineering development the improved boom, improved nozzle, and hose reel system will complete feasibility flight testing. Support equipment will be developed. Reengining integration and fabrication of the first aircraft continues in preparation for ground flight and test. Follow-on procurement of approximately nine reengining kits and associated start-up costs for fleet modification begins. Avionics full scale engineering development should be complete and production will be initiated.

3. (U) FY 1983 Planned Program: Improved aerial refueling systems production and any appropriate residual research and development as appropriate on the boom nozzle and boom control improvements will be accomplished. Production funds required will be determined. The reengined configuration will be certified and flight tested and follow-on test and evaluation will be completed by September 1983. Funds are added for this effort. Residual research and development and

Program Element: #11142F

DOD Mission Area: Airborne Strike, #113

Title: KC-135 Squadrons

Budget Activity Strategic Programs, #3

remaining production integration engineering will be accomplished.

4. (U) FY 1984 Planned Program: Improved aerial refueling system research and development on the hose real should be complete. A modernized aerial refueling system for the KC-135 will be in the installation process, if funded. In avionics, modification of the aircraft cockpit with FSAS will be in progress. Reengining is a continuing modification. See project summary on KC-135 reengining for detailed funding requirements.

5. (U) Program to Completion: KC-135 reengining and improved aerial refueling systems procurement will continue to fleet retrofit. Reengining optimum rate is 72 aircraft per year which is concurrent with the ongoing wing reskin program.

6. (U) Milestones: Not applicable.

Project: #2469
Program Element: #11142F
DOD Mission Area: Airborne Strike, #113

Title: KC-135 Reengining
Title: KC-135 Squadrons
Budget Activity Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force operates 615 primary KC-135 aircraft, all of which are required to support the strategic bomber and reconnaissance forces committed to the general war plan. These same aircraft are also tasked in a host of contingency plans to provide for the deployment and employment of our tactical fighter force and to provide critically needed refueling to the airlift force as well. Numerous studies confirm that we need substantially more aerial refueling capability than is available in the present or programmed KC-135/KC-10 force. As an example, the fuel requirement for the shoot and penetrate era of the mid-1980s increases by 30 percent because of B-52 Air Launched Cruise Missile range penalties. Other non-strategic air refueling requirements have increased significantly since nearly every front line aircraft now in the Air Force has air refueling capability. Reengining provides increased operational flexibility by eliminating the current dependence on extremely long runways. More importantly, reengining with a modern, fuel efficient engine will save vast amounts of fuel and eliminate the environmental difficulties -- noise and particulate pollution -- of the current engine, while reducing Operations and Support costs. A summary of the reasons for reengining follows:
(1) Air Refueling Capability Increases: Offload increase (30-200 percent depending on scenario-an average of 50 percent).
(2) Operational Flexibility: Operation from shorter runways (North Atlantic Treaty Organization, United States dispersal, Air National Guard/Air Force Reserve). 130 more Continental United States/171 more North Atlantic Treaty Organization runways are usable for KC-135 operations.
(3) Savings of Scarce Resources: 110,000,000-125,000,000 gallons of fuel per year with a fleet retrofit.
(4) Environmental: Significantly reduces exhaust, air pollution, and noise emissions at domestic and overseas bases.
(5) Reduced Operations and Support Costs: Newer technology engines reduce overall costs (40-50 percent).

(U) RELATED ACTIVITIES: The CFM56 engine has completed development and certification on the Boeing 707 aircraft reengined prototype which accumulated some 200 flying hours of operation. It has been selected by several commercial airlines to reengine their DC-8 aircraft (Delta, Flying Tiger, United, Capitol). The engine was selected after a comprehensive two-year technical and cost evaluation by the Air Force. It will provide significantly increased fuel offload capability and reduction in fuel consumption, as well as superior emission and noise performance. It meets all United States Air Force emission goals and the 1985 Federal Aviation Regulations for commercial operators. This engine, derived from the B-1 aircraft engine, also contains long range reliability and maintainability design features. The French Government has joined the Air Force effort in 1981. They will reengine their 11 KC-135F aircraft in conjunction with the United States Air Force effort and will contribute funds to the total developmental effort.

(U) WORK PERFORMED BY: The developmental effort on the KC-135 reengine program is managed by the United States Air Force Aeronautical Systems Division and the Boeing Military Airplane Company. Modification of the initial vehicle involves much more extensive development and nonrecurring costs than just integrating engines on the airframe. There are 34 major systems and subsystems involved which have required considerable design and engineering changes. Nonrecurring production and test costs encompass most of the first article costs, thus distorting the actual flyaway cost which is approximately $11.5 million (Fiscal Year 1981 dollars). As an aircraft Class V modification, management of the program will revert to the Air Force Logistics Command after the developmental effort is complete.

Project: #2469
Program Element: #11142F
DOD Mission Area: Airborne Strike, #113

Title: KC-135 Reengining
Title: KC-135 Squadrons
Budget Activity Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. (U) FY 1981 and Prior Accomplishments: The KC-135 reengine program was approved for the first aircraft developmental effort. Congressional language directed an accelerated production program. The engine source selection was completed in January 1980. First aircraft tooling, mock-up and engineering were completed. The Critical Design Review occurred in April 1981, two months ahead of schedule. Production tooling and long lead materials for follow-on aircraft were ordered. The additional funds provided by the Congress for tooling and long lead materials accelerated follow-on production by six months to one-year.

2. (U) FY 1982 Planned Program: Installation tooling will be completed. Fabrication and modification of the first aircraft will be completed. Engine and strut tests and all ground tests will be completed. Production Readiness Review #2 will be completed. Flight test will begin. Aircraft kits for follow-on modifications of aircraft will be ordered to begin retrofit of the 615 primary aircraft KC-135 fleet. Follow-on procurement of nine modification kits is presently funded.

3. (U) FY 1983 Planned Program: The aircraft will undergo and complete and flight test by the third quarter. Initial and Operational Follow-on Test and Evaluation will be completed in the fourth quarter of Fiscal Year 1983. Approximately 20-23 more kits will be ordered.

4. (U) FY 1984 Planned Program: During Fiscal Year 1984, residual research and development and test is accomplished on the first aircraft and appropriate subsystems. Landing gear durability, fifth nacelle and strut, nuclear hardness test, engine health monitor development and Arnold Engineering Development Center test of the engine will be finished. The aircraft will be fully complete by the third quarter of 1984. Continued reengining of the KC-135 fleet will continue to build to an optimum procurement rate of 72 aircraft per year.

6. (U) Milestones:

	Milestone	Date
A.	Engine Source Selection Completed	22 Jan 1980
B.	Engine Production Readiness Review #1	23 Sep 1980
C.	Preliminary Design Review	21 Oct 1980
D.	Complete #1 Airplane Specification Release	29 Oct 1980
E.	Start Tooling	17 Nov 1980
F.	Mock-up complete	15 Dec 1980
G.	Critical Design Review	2 Apr 1981
H.	#1 Airplane engineering completed	7 May 1981
I.	Final engineering completed	22 Sep 1981
J.	Engine #1 on-dock	4 Jan 1982
K.	Start airplane modification	22 Feb 1982
L.	Start engine test at Peebles, OH	15 Mar 1982

Project: #2469
Program Element: #11142F
DOD Mission Area: Airborne Strike, #113

Title: KC-135 Reengining
Title: KC-135 Squadrons
Budget Activity Strategic Programs, #3

M.	Complete airplane modification	*(11 Jun 1982)	22 May 1982
N.	Start ground test		24 May 1982
O.	Engine Production Readiness Review #2		29 Jun 1982
P.	Airplane Production Readiness Review #2		12 Jul 1982
Q.	Complete ground test	*(14 Oct 1982)	12 Aug 1982
R.	Start flight test		13 Aug 1982
S.	Complete flight test	*(9 Jun 1983)	6 Apr 1983
T.	Start Operational Test and Evaluation		9 Jun 1983
U.	Complete Operational Test and Evaluation		9 Sep 1983

* Date presented in Fiscal Year 1981 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES

In response to Congressional direction program has accelerated.

7. (U) Resources

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Research, Development, Test and Evaluation	16,200	24,900	26,300	8,400	Complete	97,200
Procurement Aircraft (Quantities)	102,500	246,800(9)	584,600(TBD)	1,341,033(58)	Continuing	N/A **
Operation and Maintenance (PE 72207)	-	2,700	2,400	12,500	Continuing	N/A **

8. (U) Comparison with FY 1982

Research, Development, Test and Evaluation	16,200	24,900	15,400	N/A	19,900	86,400
Procurement (Aircraft)*	102,500	246,800	N/A	N/A	-	354,300
Operation and Maintenance (PE 72207)	-	-	3,300	-	-	3,300

RDT&E changes in 1983 and 1984 are as projected to complete first aircraft development. Procurement funds have been added in Fiscal Year 1983 to continue follow on procurement of reengining production kits. O&M changes reflect the addition of a second modification period to install the Quick Start System and Landing Gear in 1983.

* Includes initial spares. FY 83 buy is 20-23 aircraft depending on support equipment requirements.
** Total program for kit acquisition in FYDP is $5,805,910 (300 aircraft) with $147,900 in associated installation; program planned to continue at 72 aircraft per year until remaining fleet is reengined.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11213F
DOD Mission Area: Land-Based Strike, #111

Title: Minuteman Squadrons
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	53,121	19,626	12,857	5,173	Continuing	3,945,000
	Command, Control, Communications Integration	19,900	10,400	4,400			54,400
	Airborne Launch Control System Phase III	26,800					
	Minuteman III Guidance Upgrade		5,500				
	Program Support	6,421	3,726	8,457	5,173	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The program provides improvements and modifications to the Minuteman Intercontinental Ballistic Missile force to enhance its contribution to strategic deterrence. Improvements include integration of new command, control, and communications equipment into Minuteman launch control centers, upgrade of Minuteman III guidance, and acquisition of MK 12A reentry vehicles.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds to complete design and testing of the accommodation hardware needed to integrate and install the new command, control, and communications equipment. This will provide Minuteman with enhanced communications capabilities compatible with all Single Integrated Operational Plan forces. Also included in this request are funds to continue program level support for all Minuteman improvement efforts. These costs are based on current program office and contractor estimates. The Airborne Launch Control System Phase III program was cancelled as part of the overall defense budget reduction during formulation of the FY 1983 budget.

Program Element: #11213F
DOD Mission Area: Land-Based Strike, #111

Title: Minuteman Squadrons
Budget Activity: Strategic Programs, #3

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	53,300	33,600	42,100		16,800	4,000,000
Procurement (Missile)	132,800	93,900	39,700			8,814,200*
Procurement (Aircraft)		11,200	24,700			35,900

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Missile) Total	131,100	111,300		31,700		8,821,900*
MK 12A Reentry Vehicle	89,000	57,000				393,600*
Command, Control, Communications Integration	40,200	54,300		31,700		139,900
Airborne Launch Control System Phase III	1,900					
Operation and Maintenance Total				17,000		
Command, Control Communications Integration				17,000		17,000**

* Includes initial spares
** In Program Element #72207F.

Program Element: #11213F
DOD Mission Area: Land-Based Strike, #111

Title: Minuteman Squadrons
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Minuteman weapon system was initially conceived in the late 1950s. It was developed to provide a rapid reaction Intercontinental Ballistic Missile that would be storable for long periods of time in underground launch facilities to provide survivability. Minuteman has served as a prime nuclear deterrent force of the United States for almost 20 years. Minuteman II and III are three-stage solid propellant ballistic missiles which are guided to their targets by all-inertial guidance and control systems. The missiles are deployed in hardened and dispersed underground silos which are unattended, but constantly monitored by an electronic system which provides data to an underground launch control center manned by two officers. There is one launch control center for each ten missiles. The missiles can also be launched by the Airborne Launch Control System aircraft, at least one of which is airborne at all times. The Minuteman III uses the same rocket motors for the first and second stages as Minuteman II, but a higher performance third stage, and a post-boost vehicle (consisting of a post-boost propulsion system, the missile guidance set, and the MK 12 or MK 12A reentry system) has been added. With the improved third stage and the post-boost propulsion system, the Minuteman III missile can deliver multiple independently targetable reentry vehicles (MIRVs) and their penetration aids to multiple targets. The present force structure of 450 Minuteman II and 550 Minuteman III missiles was achieved in July 1975. The survivability of the Minuteman force was enhanced by the Upgrade Silo Program which provided improved blast and shock, radiation, and electromagnetic pulse protection to Minuteman silos. Hardness modification of all silos was completed in January 1980.

(U) The objective of the on-going program is to improve the Minuteman Weapon System to ensure it remains a strong and viable deterrent. The program includes development of improvements enhancing command and control and force effectiveness. The current program includes three basic tasks: MK 12A; Command, Control, and Communications Integration; and Minuteman III Guidance Upgrade. Programmatic support for these development tasks (e.g., Systems Engineering/Technical Direction support, collateral testing and analyses, travel, etc.) are provided at the program level. This summary addresses the overall program and includes total funding for the development tasks and program support. These tasks are described in three separate descriptive summaries. Development of the MK 12A was completed in 1979 and deployment is on-going in 1982.

(U) RELATED ACTIVITIES: Advanced Strategic Missile Systems, Program Element #63311F, is a Department of Defense program which develops subsystems and applied technology having potential application to operational and future ICBMs. The new strategic missile program, M-X, Program Element #64312, is developing system technology for the next generation missile. Duplication is avoided by assigning all of these programs and Minuteman development activities to a single organizational entity, the Ballistic Missile Office. Relative to the communications integration program, the three communications systems are each being developed and procured by their respective program elements and the equipment will be delivered to the Minuteman integration program as Government Furnished Equipment (as described in the project section) for integration into the Minuteman system.

Program Element: #11213F Title: Minuteman Squadrons
DOD Mission Area: Land-Based Strike, #111 Budget Activity: Strategic Programs, #3

(U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force Systems Command's Ballistic Missile Office, Norton Air Force Base, CA. The principal contractors and their responsibilities are: TRW Systems, San Bernardino, CA - system engineering and technical direction; the Boeing Company, Seattle, WA - assembly and checkout, missile interstages, and system testing; Rockwell International, Autonetics Division, Anaheim, CA - guidance and control; Thiokol Corporation, Wasatch Division, Brigham City, UT - Minuteman III Stage I and III motors; Aerojet Solid Propulsion Company, Sacramento, CA - Minuteman III Stage II motors; General Electric Company, Philadelphia, PA MK 12 and 12A Reentry Systems; GTE Sylvania, Incorporated, Needham Heights, MA - ground electronics; and Bell Aerospace Corporation, Buffalo, NY - Propulsion System Rocket Engine.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The Minuteman II developmental flight program was concluded in February 1968. Ninety percent of the 51 launches were successful. Five hundred (500) Minuteman IIs were deployed with Minuteman Is, making a total 1,000-missile force. The first developmental flight of Minuteman III was conducted in August 1968. Through July 1971, a total of 25 Minuteman III developmental flights were conducted, of which 19 were successful. Initial Operational Capability for Minuteman III was achieved in June 1970. Continued deployment of Minuteman III resulted in a force mix of 450 Minuteman II and 550 Minuteman III missiles by the end of July 1975. Nineteen Minuteman III Special Test Missiles and 19 Production Verification Missiles (which verify performance of new subsystems and qualify new production hardware) have since been successfully launched. The last Minuteman III developmental flight test was conducted in March 1980. Design and development of modifications to protect Minuteman III missiles from the effects of nuclear dust and debris were completed and incorporated into the operational force. Development of silo improvements for increased blast, shock, and electromagtic pulse hardness was completed. Design, development, and test of Minuteman III Command Data Buffer remote retargeting capability for Wings III, V, VI, and Squadron 20 were completed. A formal demonstration of Command Data Buffer system operation was successfully conducted in November 1972, and deployment was completed. Development of the Missile Performance Measurement System was completed in 1977. This is an airborne instrumentation system which provides improved performance data on the Missile Guidance System. The MK 12A and Guidance Improvement Programs were started in 1975. Deployment of the new software developed in the Guidance Improvement Program was completed in September 1978. The Force Modernization Program to improve silo hardness was completed at Wing IV (Whiteman AFB, MO) in January 1980, completing the entire program. Development of the MK 12A is complete and deployment began in December 1979. The Command, Control, and Communications Integration program was initiated in October 1978 and design and test activity has been completed for installation of the Air Force Satellite Communications system terminals and a jam resistant modification to the Survivable Low Frequency Communication System (616A). Design for the Strategic Air Command Digital Network integration was initiated in FY 1981. Airborne Launch Control Systems Phase III program was initiated in October 1978 and the Preliminary Design Review was conducted in September 1980. This program has subsequently been canceled.

Program Element: #11213F
DOD Mission Area: Land-Based Strike, #111

Title: Minuteman Squadrons
Budget Activity: Strategic Programs, #3

2. (U) FY 1982 Program: Deployment of the MK 12A will continue. The major part of the 616A and satellite terminal installation will be completed and design for the integration of the digital network accommodations will be completed. Design of software revisions will be initiated for upgrading Minuteman III guidance.

3. (U) FY 1983 Planned Program: Deployment of the MK 12A will be completed in early fiscal year 1983. Testing of the digital network integration will be completed. Production funding for the digital network integration has been slipped to FY 1984 for alignment with the revised delivery schedule for the communication system. Installation funding has been moved from the procurement appropriation to the operation and maintenance appropriation for proper financing. The Guidance Upgrade program was added by Congress in FY 1982. The continuation activity on this program will be determined as part of the initial FY 1982 activity.

4. (U) FY 1984 Planned Program. Installation of the digital network communication system will be started.

5. (U) Program to Completion: Installation and integration of the three communications systems will be completed in FY 1986.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Budget Data: Not applicable.

Project: # N/A
Program Element: #11213F
DOD Mission Area: Land-Based Strike, #111

Title: Command, Control, and Communications Integration
Title: Minuteman Squadrons
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: Three command, control and communications systems will be incorporated into the Minuteman launch control centers. These are the 616A Survivable Low Frequency Communication System, the Air Force Satellite Communication system and the Strategic Air Command Digital Network. The 616A will improve survivable low frequency communications for receipt of emergency action messages. The satellite system will provide a two-way ultra-high frequency communication capability for launch control centers to receive and transmit via satellite to higher authority. The digital network will provide replacement equipment for the existing 465L system which uses dedicated land lines for high speed two-way traffic. In addition, the digital network's User Terminal Element will serve as the functional integrating unit for processing all record traffic including receiving emergency action messages and providing a common output for the missile crew operator. The Communications Integration Program will integrate and install these systems into the launch control centers to ensure proper installation, to minimize the impact on cooling air/power requirements, to eliminate duplicate emergency action message processing, and to ensure system operability during time urgent situations. The program started in October 1978 with initial design work on the 616A and satellite systems. The Minimum Essential Emergency Communications Network Message Processing System was previously envisioned as a separate system which would reduce transmission time over low frequencies. It has now been determined that this function can best be incorporated into the other systems, so it is no longer part of this program. Since there are two configurations of ground electronics in Minuteman launch control centers, commonly referred to as the A-M and B systems, two distinct design efforts are required for installing the communications systems.

(U) RELATED ACTIVITIES: 616A is being procured under Program Element #33131F. Program Element #33601F provides for development and procurement of the satellite terminals, except for the Ultra High Frequency antenna. The digital network hardware is being developed and procured under Program Element #11316F. The communications hardware is being provided as Government Furnished Equipment to the Ballistic Missile Office for integration into the Minuteman launch control centers.

(U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force System Command's Ballistic Missile Office, Norton Air Force Base, CA. The principal contractors and their responsibilities are: TRW Systems, San Bernardino, CA - system engineering and technical direction; the Boeing Company, Seattle, WA - systems installation and integration for the A-M system; and GTE Sylvania, Incorporated, Needham Heights, MA systems installation and integration for the B system.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The Communications Integration Program was initiated in October 1978. Final design and testing of the 616A and satellite terminal accommodation hardware were completed with a Critical Design Review in July 1981. Design for integration of the digital network was initiated in FY 1981.

Project # N/A
Program Element: #11213F
DOD Mission Area: Land-Based Strike, #111

Title: Command, Control and Communications Integration
Title: Minuteman Squadrons
Budget Activity: Strategic Programs, #3

2. (U) FY 1982 Program: Design of the digital network integration will be completed. The major part of the 616A and satellite system installation will be completed.

3. (U) FY 1983 Planned Program: Critical Design Reviews for the digital network integration will be conducted in October 1982 and April 1983 and final qualification testing will be performed.

4. (U) FY 1984 Planned Program: Installation of the digital network will be started.

5. (U) Program to Completion: Installation and integration of the digital network will be completed in mid-FY 1986, ending the Command, Control Communications Integration program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	19,900	10,400	4,400			54,400
Procurement (Missile)	40,200	54,300		31,700		139,900
Operation and Maintenance				17,000		17,000

8. (U) Comparison with FY 1982 Budget Data:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	19,900	10,400	4,500			54,500
Procurement (Missile)	42,000	56,400	38,700			150,800

The FY 1983 procurement funding has been slipped to FY 1984 for alignment with the revised schedule of deliveries from the Strategic Air Command Digital Network program. The funds for installing the communications systems ($17 million) have been moved from the missile procurement appropriation to the operation and maintenance appropriation for proper financing.

Project # N/A
Program Element: #11213F
DOD Mission Area: Land-Based Strike, #111

Title: Guidance Upgrade
Title: Minuteman Squadrons
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Guidance Improvement Program was a software revision to the Minuteman III guidance system, deployed in October 1978. The new software corrected several known errors and updated the geodetic and geometric values but at the same time allowed some new error sources to surface. Thus the potentially large accuracy gains anticipated were not realized. Under this upgrade program a new measurement will be taken to refine the characterization of the guidance gyros and corrections will be made to the software. This program is being started with FY 1982 funding added by the Congress.

(U) RELATED ACTIVITIES: Not applicable.

(U) WORK PERFORMED BY: The responsible Air Force agencies are the Air Force System Command's Ballistic Missile Office, Norton AFB, CA and the Air Force Logistics Command's Ogden Air Logistics Center, Hill AFB, UT.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Investigations into the causes of Minuteman III guidance errors have been underway for two years. This has included extensive analysis of flight test data and empirical qualification on four recent flight tests. In January and March 1980, two Minuteman IIIs were flown, each carrying two Inertial Measurement Units. One unit guided the missile as on a typical flight while the second unit, linked to the Global Positioning System, served as an experimental control device. By comparing the telemetered data from the two units, precise measurements were made of discursions in the operational unit. In 1981, engineering predictions were made for the performance of two operational flight tests as if the proposed corrections had been incorporated. The theoretical predictions proved to be extremely close to the missiles' actual performances.

2. (U) FY 1982 Program: The new measurement of guidance gyros will begin and design of the required software revisions will be initiated.

3. (U) FY 1983 Planned Program: Gyro measurement will continue with the derived values adjusted in the guidance software.

4. (U) FY 1984 Planned Program: Measurement of all gyros will be completed, concluding this program.

5. (U) Program to Completion: Not applicable.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E		5,500				5,500
Procurement (Missile)			6,500	1,000		7,500

8. (U) Comparison with FY 1982 Budget Data: Not applicable. This is a new start in FY 1982.

Project # N/A
Program Element: #11213F
DOD Mission Area: Land-Based Strike, #111

Title: Program Support
Title: Minuteman Squadrons
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The element Program Support includes funding for Systems Engineering/Technical Assistance (SE/TA) and all operating costs (collateral testing, analyses, travel, etc.) in support of Minuteman programs at the Ballistic Missile Office.

(U) RELATED ACTIVITIES: Not applicable.

(U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force Systems Command's Ballistic Missile Office, Norton AFB, CA. The SE/TA contractor is TRW Systems, San Bernardino, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: This has been a continuing support element since the beginning of the Minuteman program in the late 1950s.

2. (U) FY 1982 Program: This is a continuing activity.

3. (U) FY 1983 Planned Program: This is a continuing activity.

4. (U) FY 1984 Planned Program: This is a continuing activity.

5. (U) Program to Completion: This is a continuing activity.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimate Cost
RDT&E	6,421	3,726	8,457	5,173	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Budget Data:

RDT&E	6,600	3,900	10,100		Continuing	Not Applicable

Budget adjustments have been made as the required level of support has varied.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11312F
DOD Mission Area: Strategic Command and Control, #331

Title: Post Attack Command and Control System (E-4)
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	9,797*	9,365	24,034	34,366	Continuing	N/A
2211	Block I	6,400	3,300	5,200	7,000		376,400
2212	Future Blocks		6,065	18,8[illegible]4	27,366	Continuing	N/A

* $3,397,000 was authorized and utilized under Program Element 32010F, WWMCCS ADP/E-4. This modification program has been included in Program Element 11312F beginning with FY 1983.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The overall objective of the E-4 Program is to develop and acquire the E-4B system to support the National Emergency Airborne Command Post mission. The E-4 provides significant improvement in capability, survivability, and reliability for the command and control of strategic forces in the pre, trans, and post attack phases of a general nuclear war.

(U) BASIS FOR FY 83 RDT&E REQUEST: Includes funds for Contractor Support services for the development E-4B. Continues engineering and development to support the integration of additional Super High Frequency Satellite Channels and begins engineering and development to support the incorporation of a Super High Frequency Single Channel Transponder Message transmit capability. Begins planning effort for a Trailing Wire Antenna Electromagnetic Pulse test in 1985. Cost estimates are based on historical data and projected man-year requirements to accomplish development as of 28 July 1982.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	7,000	9,600	3,700		Continuing	N/A
Procurement (Aircraft)	145,400	111,600	290,100		290,800	1,061,300

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Aircraft) (Project 2211)**	140,500	10[illegible]				470,700
(Quantity Retrofit)	(1)	(1)	(1)			(3)
Procurement (Aircraft) (Project 2212)**		200	7,800	10,800	Continuing	N/A
Military Construction						19,700
Operations and Maintenance (PE 72207)		45,900	93,200			139,100

**Includes Modification Initial Spares

Program Element: #11312F   Title: Post Attack Command and Control System (E-4)
DOD Mission Area: Strategic Command and Control, #331   Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: Strategic deterrent credibility depends in part on the existence of a reliable and survivable command and control system. The airborne command post system provides the most survivable element of our current strategic command and control capability due to the mobility of its airborne platforms. To be effective, the airborne platforms must not only survive but be able to perform their mission of message dissemination and force management in an environment including the presence of electromagnetic pulses and electronic jamming. The objective of the E-4 Program is to develop and acquire the E-4B system to provide the National Command Authorities with a highly survivable airborne command post to insure adequate command and control capabilities during all phases of a general war. The EC-135 airborne command posts formerly used by the National Command Authorites are considered inadequate due to their lack of nuclear effects hardening, insufficient floor space to house the requisite battlestaff and limited capacity to accept new or additional communication capabilities. In December 1971, the Worldwide Military Command and Control System Council, chaired by the Deputy Secretary of Defense approved the Advanced Airborne Command Post Program to replace selected EC-135 Airborne Command Posts with larger and more capable 747 aircraft. Initiation and guidance for Block I of the E-4 program was received in a Deputy Secretary of Defense memorandum dated 19 January 1973. The E-4B Advanced Airborne Command Post provides a large increase in floor space, seating, and payload capacity. Its communications capability represents a significant improvement in capability to include a high speed data terminal; a high-power, low frequency radio system incorporating anti-jam features; increased secure voice capability; and two satellite communications systems with anti-jam capabilities. The entire aircraft has been hardened to withstand the electromagnetic pulse and radiation effects of nuclear blasts. The overall effect is to greatly improve survivability and connectivity over existing EC-135 airborne command posts. The E-4 program is structured around a block concept. Block I included the procurement of three interim E-4A aircraft, the production of a development E-4B and the retrofit of the three E-4A aircraft to a standard E-4B configuration for a total fleet of four aircraft. Block II provides for the development and integration of new systems to insure E-4B compatibility with existing and evolving elements of the Worldwide Military Command and Control System. It is planned to move all E-4 funds from Program Element 11312F to Program Element 32015F beginning with the FY 1984 Budget Cycle since the decision not to procure production E-4B aircraft means that only the National Emergency Airborne Command Post will be supported by E-4B aircraft.

(U) RELATED ACTIVITIES: Strategic Air Command Communications, Program Element 11316F; Air Force Satellite Communication Program, Program Element 33601F; System Survivability, Program Element 64711F; Electromagnetic Radiation Test Facilities, Program Element 64747F; National Emergency Airborne Command Post, Program Element 32015F; Air Force Support to Minimum Essential Emergency Communications Network, Program Element 33131F; the Defense Support Program, Program Element 12431F, and Worldwide Military Command and Control System Automated Data Processing/E-4, Program Element 32010F.

(U) WORK PERFORMED BY: The Air Force Systems Command, Electronic Systems Division, L. G. Hanscom AFB, MA., has responsibilities for the program. The Boeing Company, Seattle, WA., was the prime contractor for the development of the E-4B. The contract for modification of the E-4As to the E-4B configuration was awarded to the Boeing Company, Seattle, WA with E-Systems, Greenville, TX being a major subcontractor.

Program Element: #11312F — Title: Post Attack Command and Control System (E-4)
DOD Mission Area: Strategic Command and Control, #331 — Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Studies in the early 1970s investigated numerous alternatives to assist in defining an Advanced Airborne Command Post program. A Block and phase concept was selected with Block I being the production of baseline Advanced Airborne Command Posts and Block II being the addition of growth items. The first phase consisted of the purchase of three Boeing 747 aircraft and their modification to an interim Airborne Command Post configuration by transfering the command, control and communications equipments from EC-135 aircraft. This effort was accomplished by E-Systems of Greenville, TX and was completed with the delivery of the third E-4A to support the National Emergency Airborne Command Post in September of 1975. The second phase of the program was the development of an advanced airborne command post to be designated the E-4B. This phase included the purchase of a fourth 747 aircraft to serve as the test-bed airframe. A contract for this development effort was awarded to The Boeing Company, Seattle, Washington in the third quarter of Fiscal Year 1974. A Critical Design Review for the E-4B was completed in the first quarter of Fiscal Year 1977. Aircraft modifications; development of advanced command, control and communications systems and the integration of these systems into the E-4B were completed in early 1978 and were followed by an extensive Development, Test and Evaluation period which was completed in December of 1978. This was followed by an Initial Operational Test and Evaluation which was completed in Febuary of 1979. The E-4B then underwent electromagnetic pulse testing at Kirtland AFB, NM, and was returned to the Boeing Company for aircraft refurbishment. Refurbishment of the E-4B was completed in October 1979. An additional period of Development Test and Evaluation and Initial Operational Test and Evaluation occurred between October and December 1979 to verify performance of new systems and to evaluate deficiency correction. The E-4B was delivered to the Air Force on 21 December 1979 and was transferred to the Strategic Air Command on 7 January 1980 for operational use. The Defense System Acquisition Review Council Milestone III Briefing was held on 1 May 1980 resulting in a Decision Memorandum dated 5 June 1980 allowing the program to proceed. A contract for retrofit of the first E-4A to the E-4B configuration was awarded on 26 June 1980 and the contract option for the second retrofit was exercised on 3 December 1980.

2. (U) FY 82 Program: Continues to provide contractor support services for the development E-4B and supports the program office as a part of Block I. Under Block II, engineering and development will begin on the addition of four additional channels for the Super High Frequency Satellite terminal. These additional channels will increase the total available to five and allow simultaneous transmission and reception of data and voice circuits between the E-4B and separate ground terminals. The contract option for the third and last retrofit was exercised on 7 October 1981.

3. (U) Planned FY 83 Program: Continues to provide contractor support services for the development E-4B. Initiates planning for an additional Electromagnetic Pulse test that is currently planned for 1985. The specific purpose of this activity is to test the Trailing Wire Antenna in its extended mode which has not been done before. Under Block II, work will continue on the addition of multiple Super High Frequency satellite channels and the engineering and development required to incorporate a Super High Frequency Single Channel Transponder message transmit capability will begin. Increased RDT&E funding results from the need for an additional year of support for the development E-4B and the need to conduct an additional Electromagnetic Pulse Test. Increased Block II RDT&E funds reflect a better understanding of the complexity of these integration tasks. The large reduction in procurement funds is the result of the decision to delete production E-4B aircraft.

Program Element: #11312F Title: Post Attack Command and Control System (E-4)
DOD Mission Area: Strategic Command and Control, #331 Budget Activity: Strategic Programs, #3

4. (U) FY 84 Planned Program: Continues preparation for the additional Electromagnetic Pulse test of the E-4B. Continues engineering and development tasks to support the integration of the multiple Super High Frequency Satellite Channels and the Super High Frequency Single Channel Transponder message transmit capability. RDT&E increases result from the addition of the Electromagnetic Pulse test and accurate estimates of the requirement for Block II integration. The large decrease in procurement funds is the result of the deletion of the sixth production E-4B.

5. (U) Program to Completion: Completion of the additional Electromagetic Pulse test and delivery of the final retrofit in January 1985 will complete the Block I Program. Efforts leading to the completion of the Super High Frequency Single Channel Transponder message transmit modification and the multiple Super High Frequency Satellite channels will continue. Expected completion for these modifications on the four aircraft fleet is mid 1987.

6. (U) Milestones:

	Milestone	Date
A.	Contract Award (aircraft #1 & 2 mods)	February 1973
B.	Equipment Transfer Contract Award	May 1973
C.	Contract Award (aircraft #3)	July 1973
D.	Contract Award (aircraft #4 test bed)	December 1973
E.	Interim National Emergency Airborne Command Post Final Operational Capability (3 aircraft)	September 1975
F.	Special Defense Systems Acquisition Review Council	October 1975
G.	Development Test and Evaluation Complete	December 1978
H.	Initial Operational Test and Evaluation Complete	February 1979
I.	Delivery of test-bed E-4B to Strategic Air Command (Initial Operational Capability)	January 1980
J.	Defense Systems Acquisition Review Council Milestone III decision	June 1980
K.	Contract Award for first retrofit with options for future years	June 1980
L.	Initiate Retrofit of Second E-4A to E-4B	October 1980
M.	Initiate Retrofit of Third E-4A to E-4B	October 1981
N.	Full Operational Capability (four E-4Bs)	January 1985
O.	Future Block Program	Continuing

Project Number: #2211 | Title: E-4 Block I
Program Element: #11312F | Title: Post Attack Command and Control System (E-4)
DOD Mission Area: Strategic Command and Control, #531 | Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of the E-4 Program is to develop and acquire the E-4B system to provide the National Command Authorities with a highly survivable airborne command post to insure adequate command and control capabilities during all phases of a general war. The EC-135 airborne command posts formerly used by the National Command Authorities are considered inadequate due to their lack of nuclear effects hardening, insufficient floor space to house the requisite battlestaff and limited capacity to accept new or additional communication capabilities In December 1971, the Worldwide Military Command and Control System Council, chaired by the Deputy Secretary of Defense approved the Advanced Airborne Command Post Program to replace selected EC-135 Airborne Command Posts with larger and more capable 747 aircraft. Initiation and guidance for Block I of the E-4 program was received in a Deputy Secretary of Defense memorandum dated 19 January 1973. The E-4B Advanced Airborne Command Post provides a large increase in floor space, seating, and payload capacity. Its communications capability represents a significant improvement in capability - to include a high speed data terminal; a high-power, low frequency radio system incorporating anti-jam features; increased secure voice capability; and two, satellite communications systems with anti-jam capabilities The entire aircraft has been hardened to withstand the electromagnetic pulse and radiation effects of nuclear blasts. The overall effect is to greatly improve survivability and connectivity over existing EC-135 airborne command posts. The E-4 program is structured around a block concept. Block I included the procurement of three interim E-4A aircraft, the production of a development E-4B and the retrofit of the three E-4A aircraft to a standard E-4B configuration for a total fleet of four aircraft.

(U) RELATED ACTIVITIES: Strategic Air Command Communications, Program Element 11316F; Air Force Satellite Communication Program, Program Element 33601F; System Survivability, Program Element 64711F; Electromagnetic Radiation Test Facilities, Program Element 64747F; National Emergency Airborne Command Post, Program Element 32015F; Air Force Support to Minimum Essential Emergency Communications Network, Program Element 33131F; the Defense Support Program, Program Element 12431F; and Worldwide Military Command and Control System Automated Data Processing/E-4, Program Element 32010F.

(U) WORK PERFORMED BY: The Air Force Systems Command, Electronic Systems Division, L. G. Hanscom AFB, MA., has responsibilities for the program. The Boeing Company, Seattle, WA., was the prime contractor for the development of the E-4B. The contract for modification of the E-4As to the E-4B configuration was awarded to the Boeing Company, Seattle, WA with E-Systems, Greenville, TX being a major subcontractor.

Project Number: #2211 | Title: E-4 Block I
Program Element: #11312F | Title: Post Attack Command and Control System (E-4)
DOD Mission Area: Strategic Command and Control, #331 | Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Studies in the early 1970s investigated numerous alternatives to assist in defining an Advanced Airborne Command Post program. A Block and phase concept was selected with Block I being the production of baseline Advanced Airborne Command Posts. The first phase consisted of the purchase of three Boeing 747 aircraft and their modification to an interim Airborne Command Post configuration by transfering the command, control and communications equipments from EC-135 aircraft. This effort was accomplished by E-Systems of Greenville, TX and was completed with the delivery of the third E-4A to support the National Emergency Airborne Command Post in September of 1975. The second phase of the program was the development of an advanced airborne command post to be designated the E-4B. This phase included the purchase of a fourth 747 aircraft to serve as the test-bed airframe. A contract for this development effort was awarded to The Boeing Company, Seattle, Washington in the third quarter of Fiscal Year 1974. A Critical Design Review for the E-4B was completed in the first quarter of Fiscal Year 1977. Aircraft modifications; development of advanced command, control and communications systems and the integration of these systems into the E-4B were completed in early 1978 and were followed by an extensive Development, Test and Evaluation period which was completed in December of 1978. This was followed by an Initial Operational Test and Evaluation which was completed in Febuary of 1979. The E-4B then underwent electromagnetic pulse testing at Kirtland AFB, NM, and was returned to the Boeing Company for aircraft refurbishment. Refurbishment of the E-4B was completed in October 1979. An additional period of Development Test and Evaluation and Initial Operational Test and Evaluation occurred between October and December 1979 to verify performance of new systems and to evaluate deficiency correction. The E-4B was delivered to the Air Force on 21 December 1979 and was transferred to the Strategic Air Command on 7 January 1980 for operational use. The Defense System Acquisition Review Council Milestone III Briefing was held on 1 May 1980 resulting in a Decision Memorandum dated 5 June 1980 allowing the program to proceed. A contract for retrofit of the first E-4A to the E-4B configuration was awarded on 26 June 1980 and the contract option for the second retrofit was exercised on 3 December 1980.

2. (U) FY 82 Program: Continues to provide Contractor Support services for the development E-4B and supports the program office. The contract option for the third and last retrofit was exercised on 7 October 1981.

3. (U) Planned FY 83 Program: Continues to provide contractor support services for the development E-4B. Initiates planning for an additional Electromagnetic Pulse test that is currently planned for 1985. The specific purpose of this activity is to test the Trailing Wire Antenna in its extended mode which has not been done before.

Project Number: #2211
Program Element: #11312F
DOD Mission Area: Strategic Command and Control, #331

Title: E-4 Block I
Title: Post Attack Command and Control System (E-4)
Budget Activity: Strategic Programs, #3

4. (U) FY 84 Planned Program: Continues preparation for the additional Eectromagnetic Pulse test of the E-4B. RDT&E increases result from the addition of the Electromagnetic Pulse test. The large decrease in procurement funds is the result of the deletion of the sixth production E-4B.

5. (U) Program to Completion: Completion of the additional Electromagetic Pulse test and delivery of the final retrofit in January 1985 will complete the Block I Program. This will result in a four aircraft E-4B fleet for the support of the National Emergency Airborne Command Post.

6. (U) Milestones:

	Milestone	Date
A.	Contract Award (aircraft #1 & 2 mods)	February 1973
B.	Equipment Transfer Contract Award	May 1973
C.	Contract Award (aircraft #3)	July 1973
D.	Contract Award (aircraft #4 test bed)	December 1973
E.	Interim National Emergency Airborne Command Post Final Operational Capability (3 aircraft)	September 1975
F.	Special Defense Systems Acquisition Review Council	October 1975
G.	Development Test and Evaluation Complete	December 1978
H.	Initial Operational Test and Evaluation Complete	February 1979
I.	Delivery of test-bed E-4B to Strategic Air Command (Initial Operational Capability)	January 1980
J.	Defense Systems Acquisition Review Council Milestone III decision	June 1980
K.	Contract Award for first retrofit with options for future years	June 1980
L.	Initiate Retrofit of Second E-4A to E-4B	October 1980
M.	Initiate Retrofit of Third E-4A to E-4B	October 1981
N.	Full Operational Capability (four E-4Bs)	January 1985

Project #2211 | Title: E-4 Block I
Program Element: #11312 | Title: Post Attack Command and Control System
DoD Mission Area: Strategic Command and Control #331 | Budget Activity: Strategic Programs #3

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	6,400	3,300	5,200	7,000		376,400
Procurement (Aircraft)	140,500	107,800				470,700

8. (U) Comparison with FY 1981 Budget Data:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDT&E	7,000	3,400				365,100
Procurement (Aircraft)	145,400	111,600	290,100		290,800	1,061,300

The change in the fiscal year 1983 RDT&E funding is the result of the need for an additional year of Contractor Support services for the development E-4B and the addition of another Electromagnetic Pulse test. These two factors are also responsible for the total estimated cost increase. The deletion of procurement funds is the result of a decision not to procure additional E-4B aircraft for CINCSAC. This also accounts for the large decrease in the total estimated procurement costs.

Project Number: #2212
Program Element: #11312F
DOD Mission Area: Strategic Command and Control, #331

Title: E-4 Block II
Title: Post Attack Command and Control System (E-4)
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: Block II of the E-4 program will insure that the E-4 maintains compatibility with existing and evolving elements of the Worldwide Military Command and Control System, update logistically outdated equipment and provide improved capabilities. The command, control, and communications environment is continually evolving to meet new threats or increased threats, improve connectivities, and streamline operations. In reality Block II actually represents modifications that are developed and justified independent of the E-4 Program. There are currently five separate programs that are considered to be Block II efforts in that they provide a new capability for the E-4B or improve an existing capability. These programs are Automated Data Processing, replacement High Frequency Radios, multiple Super High Frequency satellite channels, improved Low Frequency receive capability, and a Single Channel Transponder message transmit capability. Of these five items, only the multiple Super High Frequency Satellite Channels and the Single Channel Transponder message injection capability require significant amounts of RDT&E funding within the E-4 program. This is due to the complexity of the integration for these two items.

(U) RELATED ACTIVITIES: Strategic Air Command Communications, Program Element 11316F; Air Force Satellite Communication Program, Program Element 33601F; System Survivability, Program Element 64711F; Electromagnetic Radiation Test Facilities, PE 64747F; National Emergency Airborne Command Post, Program Element 32015F; Air Force Support to Minimum Essential Emergency Communications Network, Program Element 33131F; the Defense Support Program, Program Element 12431F; and Worldwide Military Command and Control System Automated Data Processing/E-4, Program Element 32010F.

(U) WORK PERFORMED BY: Block II efforts will be implemented in different ways. The Automated Data Processing System is being developed through the Air Force Logistics Command, Worldwide Airborne Command Post Program Office, Tinker Air Force Base, OK, and will be a contractor effort. The Air Force Systems Command, Electronic Systems Division, Hanscom Air Force Base, MA, has responsibility for the E-4 program and will also acquire Block II items through the prime retrofit contractor, the Boeing Company, Seattle, WA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In September 1980, a Joint User Prioritized List for the E-4 was signed by the Chairman of the Joint Chiefs of Staff. This list serves as the departure point for acquiring systems necessary to insure E-4 compatibility. Additional studies by the Defense Communications Agency have provided other candidate items for consideration. Initial selection of items for Block II implementation was made based on requirements, logistics considerations and technology. These items are Automated Data Processing, Multiple Super High Frequency satellite channels, improved Low Frequency receive capability, replacement High Frequency radios, and a Single Channel Transponder message transmit capability. Planning for the integration of these tasks was accomplished in FY 1981 to include the preparation of a consolidated plan with detailed cost estimates.

Project Number: #2212 Title: E-4 Block II
Program Element: #11312F Title: Post Attack Command and Control System (E-4)
DOD Mission Area: Strategic Command and Control, #331 Budget Activity: Strategic Programs, #3

2. (U) FY 1982 Program: Engineering and development required to support the incorporation of four additional Super High Frequency Satellite channels into the existing single channel satellite terminal will begin. This program will allow the E-4B to simultaneously transmit and receive up to five separate data circuits without being tied to existing ground entry points. In addition, the individual circuits can be terminated at diffe.ent satellite ground terminals providing protection against single point failures. Planning for other Block II efforts will continue as required. The prototype Automated Data Processing System (developed under a separate program) will be installed on the development E-4B aircraft.

3. (U) FY 1983 Planned Program: Continues engineering and development for the multiple Super High Frequency Satellite channels. Initiates the engineering and development required to support incorporation of a Single Channel Transponder message transmit capability. This system will not only provide Ultra-High Frequency links to Defense Satellite Communicatins System Satellites and Satellite Data System Satellites but will also provide super high frequency uplinks for improved performance in a nuclear and/or jamming environment. This task requires a complex interaction between two existing satellite terminals and a totally revised antenna pointing capability. Procurement of two Automated Data Processing kits (developed under a separate program) will occur. The Automated Data Processing program was begun in Program Element 32010F. Effective in FY 1983, funding for this modification has been consolidated into Program Element 11312F.

4. (U) FY Planned 1984 Program: Continues the engineering and development for the incorporation of the Multiple Super High Frequency Satellite Channels and the Single Channel Transponder message transmit capability. Procurement of the final Automated Data Processing kit will occur.

5. (U) Program to Completion: Modifications to the E-4B to insure compatibility with the evolving Worldwide Military Command and Control System will continue for the life of the E-4B System making this a continuing program. The automated data processing installation will occur in 1985. The prototype multiple super high frequency satellite channel modification will take place in 1985 and all aircraft are expected to be completed in late 1986. The single channel transponder message transmit modification will begin in 1985 and is planned for completion in mid 1987.

6. (U) Milestones:	Date
A. Joint User Prioritized List	September 1980
B. Initial Implementation Plan	January 1981
C. Prototype ADP System	March 1982
D. Initiate Development SHF Channels	March 1982
E. Initiate Development for SCT	October 1982
F. Final Operational Capability ADP (4 aircraft)	March 1985
G. Prototype for SHF Channels	March 1985
H. Prototype for SCT	June 1985
I. Final Operational Capability for SHF Channels (4 aircraft)	September 1986
J. Final Operational Capability for SCT(4 aircraft)	June 1987

Project Number: #2212
Program Element: #11312F
DOD Mission Area: Strategic Command and Control, #331

Title: E-4 Block II
Title: Post Attack Command and Control System (E-4)
Budget Activity: Strategic Programs, #3

7. (U) RESOURCES ($ in Thousands):

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Cost
RDT&E		6,065	18,834	27,366	Continuing	N/A
Procurement (Aircraft)	200	200	7,800	10,700	Continuing	N/A

8. (U) COMPARISON WITH FY82 BUDGET DATA:

RDT&E	1,100	6,200	3,700		Continuing	N/A
Procurement (Aircraft)	800	800	7,700		Continuing	N/A

The increased Research Development Test and Evaluation funding in fiscal year 1983 results from a detailed review of Block II tasks and the development required to integrate these items into the E-4B. Similar integration efforts accomplished during aircraft refurbishment provided a basis for developing this revised estimate.

Budget Activity: Strategic Programs, #3
Program Element: #11312F, Post Attack Command and Control System (E-4)

Test and Evaluation Data

1. (U) Development Test and Evaluation: Phase 1A - Modification of the first airframe with the interim Command Control and Communications was completed in September 1974 by E-Systems, Greenville, TX. Development Test and Evaluation and Initial Operational Test and Evaluation were completed in December 1974. Federal Aviation Administration recertification of the aircraft was accomplished. The installed Command Control and Communications mission equipment was removed from the EC-135 National Emergency Airborne Command Post aircraft. Development Test and Evaluation of this equipment included electromagnetic interference and compromising emanations investigation as well as total system evaluation. The second and third aircraft were delivered for operational use after two months of acceptance testing.

(U) Phase 1B - The E-4B Development Test and Evaluation program concentrated primarily on the integration and installation of the advanced command control and communications package and subsequent system level testing of the operational aircraft. Testing of the Boeing 747 airframe with structural modifications (including in-flight refueling, antenna mountings, new aircraft generators) was also accomplished to maintain Federal Aviation Administration certification. In addition, low level electromagnetic pulse tests were conducted on the E-4A type airframe to assist in evaluation of later testing of the electromagnetic pulse hardened E-4B system. Development Test and Evaluation of the advanced command control and communications package was initiated in early 1977 with the pretesting of selected components and subsystems by the prime development contractor, the Boeing Company, Seattle, WA. Initial aircraft testing, both ground and airborne, was accomplished during the latter part of 1977 by the major subcontractor, E-Systems of Greenville, TX after installation of equipment racks, wiring, fixtures, environmental control system, and selected mission equipment. The testing at E-Systems verified the aircraft modifications and substantiated the performance of selected mission subsystems.

(U) Systems Level Test - The testbed aircraft was delivered to the Boeing Plant in January 1978 for installation of the Super High Frequency Satellite Communications terminal, antenna radome, and the Very Low Frequency/Low Frequency communications subsystem. System level ground tests began in February 1978 and airborne tests of the system began in June 1978. Special test instrumentation, which was used to verify specification performance, was removed from the aircraft in September 1978 prior to starting the final operational verification of the total airborne system. Development Test and Evaluation was concluded on 17 December 1978 after completing a total of forty test flights. A system level electromagnetic pulse test was conducted between February and June of 1979 at Kirtland Air Force Base, New Mexico. Additional ground and airborne tests were conducted between October and December 1979. These tests were to verify performance of systems added during refurbishment such as a new satellite terminal and an improved low frequency communications system. This final phase of Development Test and Evaluation was concluded on 15 December 1979 with a total of eight flights. The E-4B was delivered to the Air Force on 21 December 1979 and turned over to the Strategic Air Command for operational use on 7 January 1980. While some problems were discovered during this extensive Development Test and Evaluation, the problems were resolved and subsequent testing has verified that the E-4B performs in accordance with system specifications.

Budget Activity: Strategic Programs, #3
Program Element: #11312F, Post Attack Command and Control System (E-4)

(U) Phase 1C - With the exception of Electromagnetic Pulse testing, no significant Development Test and Evaluation will be required during this phase; however, acceptance testing of all aircraft will be accomplished after installation of the advanced command control and communications configuration. The Defense System Acquisition Review Council III Decision Memorandum of 5 June 1980 approved production of the E-4B. It also directed additional electromagnetic pulse testing be conducted to take advantage of improved test facilities and methodology over what was available at the time of the original system level eletromagnetic pulse test. It is currently planned to conduct this additional testing in calendar year 1985.

2. (U) Operational Test and Evaluation: The operational test and evaluation of the E-4 is being conducted in phases as appropriate for the various phases of the E-4 program. The testing phases with the test objectives and the results (if completed) are as follows:

(U) An Initial Operational Test and Evaluation of the E-4A was conducted by Headquarters Command and the Organization of the Joint Chiefs of Staff on the first Phase 1A interim aircraft at Andrews Air Force Base, Maryland, in December 1974. The primary objective of that Initial Operational Test and Evaluation was to determine if the E-4A could effectively perform the National Emergency Airborne Command Post mission and be operated and maintained using existing assigned personnel, interim base facilities, and contractor logistics support. Upon completion of initial Operational Test and Evaluation, it was concluded that the E-4A system could perform the basic National Emergency Airborne Command Post mission while being operated and maintained as planned.

(U) Initial Operational Test and Evaluation of the Phase 1B test bed E-4B aircraft, conducted by the Air Force Test and Evaluation Center, began in combination with Development Test and Evaluation ground tests at E-Systems from September to December 1977. It continued from January through December 1978 as part of the combined Development Test and Evaluation and Initial Operational Test and Evaluation at The Boeing Company in Seattle, WA. A 47-day separate Initial Operational Test and Evaluation beginning 27 December 1978 at Offutt Air Force Base, NE, followed the combined Development Test and Evaluation/Initial Operational Test and Evaluation The separate Initial Operational Test and Evaluation testing included 13 flights (125.7 hours) in the operational environment with deployments to Andrews Air Force Base, MD, (the National Emergency Airborne Command Post forward operating base) for ground alert evaluation and to Howard Air Force Base, Canal Zone, for hot weather selfsustained ground alert evaluation. During this test period, the E-4B particiapted in both a Joint Chiefs of Staff POLO HAT exercise and a Strategic Air Command GIANT STAFF exercise. These exercises closely simulated the operational environment, and allowed a side-by-side comparison with currently operational aircraft, the E-4A and EC-135. During the separate Initial Operational Test and Evaluation the aircraft was operated and maintained by Air Force personnel from the Strategic Air Command, Office of the Joint Chiefs of Staff, and Air Force Communications Command. The separate Initial Operational Test and Evaluation was completed on 11 February 1979 with a test flight that delivered the aircraft to Kirtland Air Force Base, New Mexico, for start of the system-level electromagnetic pulse Development Test and Evaluation Testing at the Air Force Weapons Laboratory.

Budget Activity: Strategic Programs, #3
Program Element: #11312F, Post Attack Command and Control System (E-4)

(U) The Initial Operational Test and Evaluation test team ws composed of personnel from the Air Force Test and Evaluation Center, Air Force Logistics Command, Air Force Systems Command, Air Training Command, Air Force Communications Command, Strategic Air Command, Office of Joint Chiefs of Staff, Air Force Security Service, and the School of Aerospace Medicine. The operational mission requirements of both the Strategic Air Command and the Office of Joint Chiefs of Staff/National Emergency Airborne Command Post served as the basis for the evaluation. Major objectives were to estimate operational effectiveness and suitability, and to identify deficiencies.

(U) As a result of the Initial Operational Test and Evaluation, it was concluded that the E-4B aircraft will provide an improved command, control, and communications capability for the airborne command post missions of the Joint Chiefs of Staff and the Strategic Air Command. The test bed aircraft, as configured during Initial Operational Test and Evaluation, demonstrated satisfactory operational effectiveness, but was deficient in reliability, maintainability and availability. Test results are contained in the Advanced Airborne Command Post (E-4B) Initial Operational Test and Evaluation Final Report(S) dated November 1979.

(U) Operational deficiencies were discovered in certain subsystems during the Initial Operational Test and Evaluation phase; however extensive efforts were taken to correct these deficiencies. Appropriate fixes were incorporated for the majority of these problems during the aircraft refurbishment phase, and resolution of any remaining problems ise being accomplished as engineering solutions are developed. In addition, several new subsystems were installed during this same refurbishment period to attain the production configuration. Following the successful completion of the postrefurbishment testing, Air Force Test and Evaluation Center found the operational effectiveness to be satisfactory and projected the operational suitability (reliability, maintainability, and availability) to be satisfactory based on satisfactory correction of several deficiencies in the suitability area. The E-4B program was presented at Defense Systems Acquisition Review Council III on 1 May 1980. DSARC III on 5 May 1980. Postrefurbishment test results are contained in the Advanced Airborne Command Post (E-4B) Initial Operational Test and Evaluation Final Report Annex A (S) dated May 1980. As a result of data obtained during the IOT&E and the EMP DT&E testing, the overall survivability of the E-4B was rated satisfactory. Test results are contained in the Advanced Airborne Command Post (E-4B) Initial Operational Test and Evaluation Final Report Annex B (S) dated March 1981.

(U) A Follow-on Operational Test and Evaluation, occuring between May 1980 and August 1981, was conducted by SAC and OJCS and monitored by AFTEC. The purpose of the FOT&E was to refine initial operational suitability and operational effectiveness estimates and to verify correction of operational deficiencies identified during IOT&E. Test data are still being analyzed and the results will be published in December 1981.

Budget Activity: Strategic Programs, #3
Program Element: #11312F, Post Attack Command and Control System (E-4)

3. (U) System Characteristics: The significant E-4B performance objectives and demonstrated performance are shown below. All objectives were demonstrated during Development Test and Evaluation.

(U) Operational	Objective	Demonstrated Performance
Unrefuled Time on Station (hours)	12	12
Maximum Payload (pounds) (E-4B)	150,000	150,000
Maximum Personnel Complement	94	94
Maximum Gross Taxi Weight (pounds) (E-4B)	803,000	803,000
Maximum Take-off Thrust (pounds)	201,400	201,400
(U) Technical		
Electrical Power (Kilo Volt Amperes)	1200	1200
Ultra High Frequency Satellite Communications		
a. Bandwidth (Kilo Hertz)	5	5
b. Bit Error Rate/Bits Per Second	10^{-3}/75	10^{-3}/75*
Super High Frequency Satellite Communications (Bit Error Rate/Bits Per Second)	10^{-3}/75 10^{-6}/1200 10^{-5}/2400 10^{-3}/9600	10^{-3}/75* 10^{-6}/1200* 10^{-5}/2400* 10^{-3}/9600*
Command Radio Power (Watts)	30	30
Automatic Switching System Connections (Lines)	111	111
Automatic Digital Network Terminal (Bit Error Rate/Bits Per Second)	10^{-5}/2400	10^{-5}/2400*
Low Frequency/Very Low Frequency Power Output (Kilo Watts)	200	200*

*Meets or exceeds contractural guarantees

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11316F
DoD Mission Area: Strategic Communications #333

Title: SAC Communications
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
1136	SAC Digital Network	24,937	29,489	28,096	188	564	125,081

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Strategic Air Command (SAC) Digital Network (SACDIN) Program will upgrade and modernize SAC's printed copy command and control communications system. The specific objectives are to: (1) provide two-way, direct, secure communications with enhanced survivability from the National Command Authorities and the Commander-in-Chief SAC to dispersed missile crew commanders and aircraft wing commanders; (2) provide the capacity and flexibility to interface with other planned systems; (3) provide growth potential to support future printed copy requirements; and (4) replace existing command and control data transmission subsystem which uses 1950's technology.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Software development will be completed. Initial Operational Test and Evaluation (IOT&E) will be conducted and deficiencies identified will be corrected. Preparation will be made for the Air Force Systems Acquisition Review Council assessment prior to entering into full production. Cost estimates are based on fixed price incentive contracts negotiated in May 1981 by Electronic Systems Division.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	23,000	30,100	2,500		800	118,100
Procurement, Other		25,500	102,000		5,500	133,300

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement, Other		22,268		124,751	2,894	149,913

Project: #1136
Program Element: #11316F
DoD Mission Area: Strategic Communications, #333

Title: SAC Digital Network - SACDIN
Title: SAC Communications
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The SAC Digital Network (SACDIN) Program includes the design, acquisition and implementation of a command and control data communications system for the Commander-in-Chief SAC. The system will significantly improve current communications capabilities from both operational and maintenance standpoints. SACDIN will replace the SAC Automated Total Information Network (SATIN) I computer and key elements of the Data Transmission Subsystem of SAC's Automated Command Control System (SACCS). It will interface with the SACCS Data Display Subsystem. ITT Corporation is the prime contractor with total system performance responsibility. Maximum possible use will be made of off-the-shelf equipment. Modifications to hardware and new hardware/software procurement will be made only where operational requirements dictate. Minimum changes to present equipment will be made to meet the presently defined and validated operational requirements.

(U) RELATED ACTIVITIES: Program Element 11213F will accomplish SACDIN integration into the Minuteman Weapon Systems. Automatic Digital Network (AUTODIN) II (Program Element 33126F, Defense Communications System Long Haul Communications) provides major network trunking support for SACDIN.

(U) WORK PERFORMED BY: Electronic Systems Division, Hanscom Air Force Base, MA, for total program management; MITRE Corporation, Bedford, MA, for technical support; Air Force Weapons Laboratory for electromagnetic pulse criteria, analysis and testing; Rome Air Development Center for reliability testing and Automatic Voice Network (AUTOVON) and AUTODIN II acceptance criteria; Air Force Test and Evaluation Center for IOT&E, and ITT, Defense Communications Division, Nutley, NJ, as prime contractor. The Air Force Communications Command will develop application software.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A SAC Total Information Network (SATIN) IV contract was awarded to ITT on 15 March 1977 to upgrade the SACCS system; however, the House/Senate Defense Appropriations Conference deleted the SATIN IV Program in its review of the FY 1978 budget in August 1977. Congress agreed that a valid need existed for an improved SAC Communications System and encouraged the Air Force to restudy its needs and to resubmit to Congress a less expensive system with greater use of standard equipment and non-dedicated circuits. An Air Force conducted redefinition was accomplished, and $1.939 million of FY 1977 RDT&E funds was reprogrammed to continue the detailed redefinition to obtain cost, schedule and technical information from the contractor. The program redefinition, which satisfied the concerns of Congress and the defined and validated communications requirement of SAC, was completed in January 1978. The January 1978 Air Force Systems Acquisition Review Council approved the restructured program and recommended reprogramming $8.5M of FY 1978 funds. Congressional approval was obtained in June 1978. In FY 1978 and FY 1979, the System Design Review was conducted and the contractor began the prototype development effort, including development of the communications processor. This processor will meet stringent security and environmental requirements of SAC and will be the heart of the SACDIN terminal at 137 SAC missile and aircraft locations. Other prototype hardware, primarily off-the-shelf, was also ordered during FY 1979. Concurrent with the hardware efforts, the contractor initiated a

Project: #1136 Title: SAC Digital Network - SACDIN
Program Element: #11316F Title: SAC Communications
DoD Mission Area: Strategic Communications, #333 Budget Activity: Strategic Programs, #3

total software design effort. Initial efforts were aimed at developing a software mechanism to ensure system security. Software Development, Test and Evaluation (DT&E) was started during FY 1980 while the start of hardware DT&E was rescheduled for the beginning of FY 1981. Hardware design continued as planned in FY 1980 with fabrication of the prototype equipment delayed due to a budgetary reduction. This rephasing was accomplished without impact to the System DT&E scheduled for the end of FY 1981. The development of some Computer Program Configuration Items was completed during FY 1980 and development continued on others. Adjustment of some software development was also necessary to react to the FY 1980 shortfall; however, major schedule milestones were not affected. During FY 1981, additional functional prototype hardware was fabricated, assembled, and integrated to reflect all combinations of operational configurations. Testing has been performed on the assembled racks to verify that the equipment meets its environmental and electromagnetic compatability requirements. The software effort for the functional prototype has continued and the software is being used in system level integration with hardware. This will ensure that the functional prototype has, in fact, reduced or eliminated the technical risks identified with the development program. Contract award for the second phase of the program was made in June 1981.

2. (U) FY 1982 Program: In FY 1982 the prototype system development, including the formally developed software, primarily associated with external interfaces and off-line diagonstics, will be completed. In addition, automatic test equipment (ATE) and ATE software will be developed to support the prototype hardware. A low rate initial production (LRIP option will be exercised to produce Air Training Command (ATC) hardware/software. In addition, long lead for the production contract will be initiated in third quarter FY 1982.

3. (U) FY 1983 Planned Program: In FY 1983, the prototype system development, including the final software elements will undergo in-plant testing and field qualification to verify external interface interoperability. The FY 1983 RDT&E program increased 25.825 million from that in the FY 1982 descriptive summary due to labor and material cost increases and other associated factors. The rationale for those cost increases was provided in a 10 July 1981 letter to the Chairman, Subcommittee on Defense, Committee on Appropriations. The decrease in FY 1983 procurement funds is due to program slippage directly associated with the above mentioned cost increases.

4. (U) FY 1984 Planned Program: The full production contract is scheduled to be awarded in the first quarter of FY 1984. Initial deliveries are scheduled for the fourth quarter of FY 1984 and will continue into FY 1985.

5. (U) Program to Completion: Significant RDT&E funding activity ends in FY 1983 with completion of IOT&E. The production option, aimed at achieving a full operational capability in December of 1985, will be exercised following an Air Force Systems Acquisition Review Council III review. The program for FY 1985 and FY 1986, therefore, will encompass end item production delivery, installation and transition to full operation.

Project: #1136
Program Element: #11316F
DoD Mission Area: Strategic Communications, #333

Title: SAC Digital Network - SACDIN
Title: SAC Communications
Budget Activity: Strategic Programs, #3

6. (U) Milestones:

A.	Program Redefinition Complete/ Air Force Acquisition Review Council Approval	January 1978
B.	Congress Approved Reprogramming	June 1978
C.	Contract Date	July 1978
D.	Restart Work	August 1978
E.	Start In-Plant Test and Evaluation	October 1980
F.	Program Review (Secretary of the Air Force)/ Start Phase II Follow-on Research and Development	June 1981
G.	Program Review (Secretary of the Air Force)	March 1982
H.	Start Field Development Test and Evaluation/ Initial Operational Test and Evaluation	April 1982
I.	Air Force Systems Acquisition Review Council III	July-September 1983
J.	Production Decision/Contract Option Award	October 1983
K.	Final Operational Capability	December 1985

7. (U) Resources: N/A

8. (U) Comparision with FY 1981 Budget Data: N/A

Budget Activity: #3 Strategic Programs

Program Element: 11316F, Strategic Air Command Digital Network (SACDIN)

Test and Evaluation Data

1. (U) Development Test and Evaluation: During the development phase, Strategic Air Command Digital Network (SACDIN) tests will include response time, accuracy, and human factors. Individual subsystems have been fabricated and assembled into a prototype of the SACDIN. This prototype will be tested to determine the accuracy, response, hardness, and security characteristics and to insure that the subsystems properly function together. Simulation will be used to exercise the prototype during system tests. The Development Test & Evaluation (DT&E) testing period will last from approximately the fourth quarter, fiscal year 1979 to the second quarter, fiscal year 1982. ITT Defense Communications Division, Nutley, NJ, is the Prime Contractor.

(U) The prototype consists of the same hardware as production units (keyboards, printers, processors). In addition the prototype contains hardened equipment for the Intercontinental Ballistic Missile Launch Control Centers that is also the same as the production equipment. After in-plant testing, SACDIN equipment will be installed at Offutt Air Force Base and Vandenberg Air Force Base and DT&E will be conducted using the actual external interfaces. All DT&E will be completed prior to the production decision. Acceptance testing and checkout will be conducted during production and deployment.

2. (U) Operational Test and Evaluation: The Air Force Test and Evaluation Center (AFTEC) will conduct Initial Operational Test and Evaluation (IOT&E) of the SACDIN equipment installed at SAC operational locations (Offutt Air Force Base, and Vandenberg Air Force Base), and the contractor's plant, (ITT Nutley, NJ), and the Air Force Communications Computer Programming Center (AFCCPC). There will be 60 days of separate IOT&E (March and April 1983). The AFTEC test team will use the test network to run exercises simulating SAC operational communications and to evaluate SACDIN operational effectiveness and suitability. Objectives will include system performance, system control, interoperability, human interface, safety, electromagnetic compatibility, and security, to the extent allowed by the prototype configuration. The test team will consist of personnel from AFTEC, SAC, Air Force Communications Command (AFCC), AFCCPC, Air Force Logistics Command (AFLC), Electronic Security Command (ESC), and the National Security Agency (NSA). In addition to conducting separate IOT&E, the test team will participate in and observe the contractor's DT&E efforts from December 1981 to February 1982. Data gathered during the DT&E tests will also be used to meet IOT&E objectives as appropriate. Air Force Systems Acquisition Review Council (AFSARC) III is scheduled for June 1983.

Budget Activity: #3 Strategic Programs

Program Element: 11316F, Strategic Air Command Digital Network

3. (U) Systems Characteristics

CHARACTERISTIC	OBJECTIVE		DEMONSTRATED
Response time:			
Transmit Emergency Action Message	15 Seconds	(99.9 percent confidence)	To be determined
Low Precedence Traffic	60 Seconds	(70 percent confidence)	
Accuracy:			
Undetected Character Errors	$1:10^8$		
Availability:			
Minuteman Path (7 hours per year)	0.999195		
TITAN Path (14.5 hours per year)	0.998214		
Maintainability:			
Mean Time to Repair (Organizational)	15 Minutes		
Mean Time Between Maintenance			
Missile Base Communications Processor	1125 Hours		
Hard User Terminal Element	2250 Hours		
Security:			
To the Executing Commanders	Multilevel Secure		
Traffic:			
Peak Load at Offutt Switch	11 Million Characters/Hour		
Flexibility:	Manual Reconfiguration		
Hardness:			
For Hard Installation	Consistent with installation/location in the missile weapon system launch control center.		
Growth:			
Hardware & Software	Modular Design.		

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12310F
DOD Mission Area: Strategic Information Systems, #334

Title: WWMCCS ADP - NORAD/ADCOM
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	2391	6,232	9,956	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The World Wide Military Command and Control System Automatic Data Processing - NORAD/ADCOM program initiates actions to upgrade the Communications System Segment of CINCNORAD's 427M Command and Control system. The existing Communications System Segment,

(U) BASIS FOR FY 1983 RDT&E REQUEST: Provides funds for initial software development effort to provide a distributed processor computer system to perform the NORAD Cheyenne Mountain Complex's communications processing tasks. Estimated costs are based on ADCOM projected automation requirements (PAR) 80-3-2 and 80-3-3.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		2400	TBD	TBD	TBD	TBD

(U) OTHER APPROPRIATION FUNDS:	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (other)				698	1886	2600
Operations and Maintenance				500	1400	1900

Program Element: 312310F

DOD Mission Area: Strategic Information Systems, #334

Title: WWMCCS ADP - NORAD/ADCOM

Budget Activity: Strategic Programs #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The NORAD Cheyenne Mountain Complex is the centralized command and control center supporting the NORAD/ADCOM/ADC mission. This facility operates a variety of computer systems, acquired under program 427M, which are the primary means of achieving required mission capabilities. The Communications System Segment is the computer system that provides the communications for 427M and integrates the individual components into a cohesive system. The Communications System Segment provides essential communications support for the tactical warning and attack assessment mission and the space defense mission by handling complete message processing, formatting, line code conversion and the routing of internal and external user messages. The Communications System Segment interfaces with essentially all external facilities serving or served by the NORAD Cheyenne Mountain Complex. As such, it is the single most critical element in the NORAD computer suite.

CINCNORAD's ability to provide reliable warning and assessment of aerospace attack is

(U) RELATED ACTIVITIES: As the communications hub for the NORAD Cheyenne Mountain Complex, the Communications System Segment interfaces with virtually all surveillance and/or warning systems. These interfaces are, however, clearly defined and should result in little impact among systems.

(U) WORK PERFORMED BY: Air Force Systems Command's Electronics Systems Division (ESD) will provide overall program management. Contractors have not yet been chosen, but probable bidders include: Ford Aerospace Communications Corporation, Colorado Springs, CO; Martin Marietta Corporation, Denver, CO; and System Development Corporation, Santa Monica, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Planned Program: Competitive concept definition contracts will be negotiated to develop a design concept for a 427M Communications System Segment replacement. Design solution will include state-of-the-art hardware and software and will consider provisions to encourage modularity of both hardware and software, provide automatic fault recovery or fail-soft operation, and provide techniques to enhance error isolation and more readily permit changes and improvements to the computer data base and program.

3. (U) FY 1983 Planned Program: The winning contractor of the competitive concept definition effort will be awarded a fixed price incentive contract to start the design and development of this proposed system.

4. (U) FY 1984 Planned Program: Delivery of the off-site test facility (OSTF) hardware will be completed in FY 1984. Software development efforts for both the OSTF and the NORAD Cheyenne Mountain Complex (NCMC) will continue.

Program Element: #12310F
DOD Mission Area: Strategic Information Systems, #133

Title: WWMCCS ADP - NORAD/ADCOM
Budget Activity: Strategic Programs #3

5. (U) Program to Completion: NCMC hardware will be installed and tested during FY 1985. Software development will continue during FY 1985, with an initial operating capability (IOC) goal of March 1986.

6. (U) Milestones: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12311F

Title: NORAD Combat Operations Center/Space Defense Operations Center

DOD Mission Area: Strategic Information Systems, #334

Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	15,954	23,511	25,378	35,097	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops the Space Defense Command and Control System consisting of a Space Defense Operations Center (SPADOC) and the necessary communications systems. The Space Defense Command and Control System is required to satisfy Presidential and Secretary of Defense directives to improve, in a balanced manner, the space defense capabilities of the United States. This program will develop the Space Defense Command and Control System in a phased approach to support the evolving space defense capabilities of the United States.

(U) BASIS FOR FY 1983 RDT&E REQUEST: SPADOC IV, Block A procurement will be initiated. This procurement will include both off-site test facility (OSTF) and operational hardware, and a select subset of the necessary software. The evolutionary concept used in the SPADOC procurement allows tailoring of the software contract(s) to meet the most critical needs in a time-phased manner.

(U) COMPARISION WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	16,200	23,493	27,616		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Procurement (Other)		4,000	17,300			22,100
Operations and Maintenance		1,400	2,500	2,800	Continuing	Not Applicable

Program Element: #12311F

Title: NORAD Combat Operations Center/ Space Defense Operations Center

DoD Mission Area: Strategic Information Systems, #334

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION:

To remedy this shortfall, the Air Force is aggressively improving and developing space defense capabilities, including: Space Surveillance Systems, Satellite Survivability Systems, and anti-satellite systems. For these elements to be operationally employed in an integrated and coordinated manner, an effective command and control system is essential.

During both peace and conflict, United States military operations will require assessment of the situation in space, its impact on terrestrial forces and the ability of the National Command Authorities to respond rapidly to changes in that situation. Responses to a changing situation might include:

The selection of which of these responses is appropriate is dependent on a fully integrated command and control system, usable in both peacetime and under stressed conditions. Effective command and control is the key to meeting any potential threat in space.

A program was initiated in Fiscal Year 1978 for the phased development of the Space Defense Operations Center. Phase I was initiated 1 Oct 1979 using existing North American Air Defense Command Combat Operations Center resources. In the future, a number of incremental improvements

will be incorporated into ongoing space defense operations as they become available. A Prototype Mission Operations Center is being developed to support the development and operational testing of the Miniature Air-Launched Antisatellite system. This mission operations center will also provide the command and control for the antisatellite system operations during the period of limited operational capability. At the time of initial operational capability of the antisatellite system, the Space Defense Operations Center (Phase IV) will perform all anti-satellite command and control and also all force management. When the Space Defense Center is fully operational (currently planned for Fiscal Year 1988), it will plan, coordinate, and advise the National Command Authority on all Space Defense Operations. In turn, it will disseminate decisions/directives of the National Command Authority to the concerned agencies. Some typical responsibilities of the Space Defense Center include: continuously monitoring United States satellite and ground system status, providing satellite attack warning and verification; reporting hostilities in space as they occur; monitoring satellite interference, verification of data outputs; maintaining status of friendly surveillance assets and their availability for tasking; notifying users of potential critical satellite support loss; providing notification to satellite command and control ground stations during hostilities/disaster; recommending execution of replacement launch; maintaining status of Soviet satellites; planning,

(U) RELATED ACTIVITIES: This program is part of the Space Defense Systems Program involving four functional areas: space survivability, space surveillance, antisatellite, and command and control. Those program elements that are directly related are the following: Program Element 63428F, Space Surveillance Technology; 12424F, SPACETRACK; 63438F, Satellite System Survivability; and 64406F, Space Defense System. Also, the Consolidated Space Operations Center, Program Element 35130, will interface with the Space Defense Operations Center to provide the link between Space Defense Operations and the satellite operators for survivability and warning information.

Program Element: #12311F

DoD Mission Area: Strategic Information Systems, #334

Title: NORAD Combat Operations Center/Space Defense Operations Center

Budget Activity: Strategic Programs, #3

(U) WORK PERFORMED BY: Air Force System Command's Space Division in Los Angeles, CA, is responsible for overall management of the Space Defense Command and Control System development. The Prototype Mission Operations Center is being developed by Boeing, Seattle, WA. The concept definition contracts for the Space Defense Operations Center were awarded to Martin Marietta Corporation, Denver, CO and Ford Aerospace Communications Corporation, Colorado Springs, CO. Follow-on development contract award is expected in January 1983. The primary support contractors are Science Applications Incorporated, La Jolla, CA; Aerospace Corporation, Los Angeles, CA, and MITRE Corporation, Boston, MA.

PROGRAM ACOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Improvements to the North American Air Defense Command's Cheyenne Mountain Complex have been accomplished during the last several years. In 1979, an initial Space Defense Operations Center capability was established at the direction of the Assistant Secretary of Defense (Communications Command Control and Intelligence), using existing resources. Detailed system architecture and conceptual design studies were initiated in Fiscal Year 1978 for the Space Defense Command and Control System addressing the following areas: (1) status data requirements and interfaces for United States satellite elements; (2) information requirements, flows, and interfaces; (3) decision logic sequences and development of option planning; (4) system implementation options/trade-offs and recommended configurational capabilities; (5) survivability and life cycle cost; (6) evolution of the system coupled with a roadmap of increasing capabilities and functions to support improved surveillance systems, satellite attack warning, and warning of Soviet satellite reconnaissance; and (7) a program implementation plan and specifications. These efforts were continued in 1979 and 1980. During Fiscal Year 1980, the Space Defense Operations Center Phase IV architecture was refined and system specifications developed to begin procurement of the system. Also, support to near-term Space Defense Operations Center improvements (SPACETRACK and Satellite Attack Warning/Verification upgrades) was provided. During FY 1981, the Space Defense Operations Center Phase IV procurement effort began.

The system design requirements of the Prototype Mission Operations Center for the Anti-satellite system were established during Fiscal Year 1979. This effort included both the miniature anti-satellite vehicle Development Test and Evaluation/Operational Test and Evaluation, and Limited Operational Capability support requirements. During Fiscal Year 1980, the Mission Operation Center design was finalized and construction of the deliverable hardware and software was begun. This effort is essential for the Prototype Mission Operations Center to be available to support Anti-satellite testing.

2. (U) FY 1982 Program: During Fiscal Year 1982, the Space Defense Operations Center Phase IV procurement will continue. Source selection will be completed and the design concept contract awarded in December 1981. Detailed design efforts will address software modification requirements, displays, interfaces with existing systems, external/internal communications and long-lead hardware items. The foreign launch assessment satellite attack warning upgrade will also be integrated into the Space Defense Center operations. Additionally in 1982 the Prototype Mission Operations Center hardware will be installed in Cheyenne Mountain and software development and test will continue.

Program Element: # 12311F

Title: NORAD Combat Operations Center/Space Defense Operations Center

DOD Mission Area: Strategic Information Systems, 334

Budget Activity: Strategic Programs, #3

3. FY 1983 Planned Program: Prototype Mission Operations Center development will be completed with

The Space Defense Operations Center Phase IV development will be fully underway. The detailed design will be firmed and early subsystem and component building and test will be performed. The command and control support for the defensive countermeasures demonstration will be integrated into the Space Defense operations.

4. FY 1984 Planned Program: The completed Prototype Mission Operations Center will support

The Space Defense Operations Center development and deployment will continue.

5. Program to Completion:

The Prototype Mission Operations Center will be used to provide command and control during this period. The Space Defense Operations Center development and deployment efforts will continue. The initial operational capability of Phase IV Space Defense Center is planned to be achieved by Fiscal Year 1985. The Space Defense Operations Center is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12313F Title: Ballistic Missile Tactical Warning/Assessment
DOD Mission Area: Strategic Surveillance and Warning, #332 Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT			1283	1658	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Ballistic Missile Tactical Warning/Attack Assessment (TW/AA) System consists of three major segments: (1) Sensors to detect missile launch; (2) Computer centers and communications links to analyze and distribute the data from the warning sensors; and (3) Command posts where the implications of the the warning information are assessed and appropriate actions directed. The Air Force in the past has not recognized nor managed its TW/AA elements as a complete system. Management of the TW/AA assets as an integrated system is necessary to provide accurate, timely, and unambiguous warning and assessment information to support force survivability actions and national decision making.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Provides funds for TW/AA system engineering analysis. Integration of the TW/AA systems will be ensured by development of standards/techniques for sensor, communication and computer hardware and software design. Additionally, a directorate level organization to manage TW/AA acquisitions will be established at Air Force Systems Command's Electronic System Division (ESD).

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not applicable; this is an FY 83 new start.

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Other)			1100	1100	Continuing	N/A
Operations and Maintenance			4400	4700	Continuing	N/A
Manpower			1400	1400	Continuing	N/A

Program Element: #12313F
DOD Mission Area: Strategic Surveillance and Warning, #332

Title: Ballistic Missile Tactical Warning/Assessment
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The major finding of the Special Management Review of USAF support to the Tactical Warning and Attack Assessment (TW/AA) System (3 July - 2 September 1980) was that the Air Force's TW/AA elements were not recognized nor managed as a complete system. Recommendations were formulated to address this principal finding and related observations/conclusions, and an 8 October 1980 letter directed their implementation. Principal among these recommendations were the formation of a General Officers Steering Group, establishment of an overall TW/AA Executive Management Structure, and the creation of a directorate level organization within an Air Force Systems Command Product Division to manage TW/AA acquisition efforts.

(U) RELATED ACTIVITIES: The direction provided by the Chief of Staff of the Air Force specifically called for direct involvement by a single Air Force System Command Product Division Directorate in all program elements dealing with tactical warning and attack assessment.

(U) WORK PERFORMED BY: All RDT&E funds against this program element are specifically programmed to pay for MITRE support. MITRE Corporation is a Federal Contract Research Center (FCRC) headquartered in Bedford, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable.

2. (U) FY 1982 Program: Not applicable.

3. (U) FY 1983 Planned Program: Initiate design and development of an improved Continental United States (CONUS) TW/AA system based on currently programmed sensor improvements. Develop and deliver improved hardware, software and display specifications.

4. (U) FY 1984 Planned Program: Continue CONUS TW/AA evaluation, design and development for improved, integrated and more enduring TW/AA information. Evaluate contributions and integration of new or improved sensors and/or communication sub-systems. Initiate extension of CONUS efforts to support a worldwide TW/AA mission for crisis and force management.

5. (U) Program to Completion: This is a continuing program. The TW/AA directorate will continue acting as a central management and coordination agency for all future Air Force TW/AA acquisitions.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 12325F — Title: Joint Surveillance System (JSS)
DOD Mission Area: Strategic Air Defense, #122 — Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs **
	TOTAL FOR PROGRAM ELEMENT	9,661	1,295	1,187			45,541*

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Joint Surveillance System (JSS) is to replace the existing Semi-Automatic Ground Environment (SAGE), Back-up Intercept Control (BUIC) and manual air defense systems and to provide air surveillance and airspace sovereignty. The objective of this program is large cost avoidance in radar operation and operation center support through the elimination of redundancy in the civilian and military radar nets, and replacement of the SAGE/BUIC systems which are expensive to maintain and operate. The system will use radar data from a single net of Federal Aviation Administration (FAA) and military radars in the Continental United States, Alaska and Hawaii to input to FAA Air Route Traffic Control Centers and Air Force Region Operations Control Centers (ROCCs). Two ROCCs will be provided to Canada via Foreign Military Sales.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Emphasis will be placed on integration and testing leading to Initial Operational Capability (IOC) of the first Region Operations Control Center (ROCC) in early 1983. Program Office engineering support will continue. The cost estimate provided by the System Program Office is based on historical experience.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs **
RDT&E	9,700	1,357	942			45,387
Other Procurement	1,940	3,235	2,844		2,760	123,011

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Other Procurement	13,893****	3,143	2,580	1,982	2,150	135,980***
(Quantity ROCC)						(5)
Military Construction						37,800

* Additional RDT&E to be programmed in FY 1984 President's Budget due to add of ROCC in Hawaii
** Totals include FY 1980 & Prior Funding
*** Includes spares
**** FY 1981 Procurement increased due to add of $12.0M in FY 1981 Supplemental Approriations Act to upgrade Hawaiian air defense

Program Element: # 12325F

DoD Mission Area: Strategic Air Defense, #122

Title: Joint Surveillance System (JSS)

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Joint Surveillance System (JSS) is to replace the Semi-Automatic Ground Environment/Back-up Intercept Control (SAGE/BUIC) and manual air defense systems and to provide air surveillance and airspace sovereignty. The objective of this program is cost avoidance of over $100 million/year in radar operation and operation center support as well as manpower reductions through the elimination of redundancy in the civilian and military radar nets, and replacement of SAGE/ BUIC operations centers which are expensive to operate and maintain. The program will implement a system which uses radar data from a single radar net of Federal Aviation Administration (FAA) and military radars in the Continental United States (CONUS) and Alaska as input to the FAA Air Route Traffic Control Centers and Air Force Region Operations Control Centers (ROCCs). JSS will provide four ROCCs in the CONUS and one each in Alaska and Hawaii which will be equipped with modern off-the shelf computers, displays, and peripheral equipment to perform surveillance and air sovereignty operations. Canada will install a similar system with two ROCCs acquired through Foreign Military Sales. Although JSS is a low risk program utilizing mainly off-the-shelf components, a large amount of unique computer software development was undertaken. For this reason JSS production was preceded by a seventeen month Design Verification Period (DVP) to minimize any remaining risk. During DVP, the contractor performed the initial design and integration in critical software areas. After verification to insure the technical adequacy of the design, a contract was awarded in June 1979 for acquisition of the ROCC hardware/software during the Implementation Period. Thus, DVP allowed the Air Force to develop confidence that the critical areas had been examined prior to committing procurement funding.

(U) RELATED ACTIVITIES: JSS is related to the SAGE/BUIC systems which it will replace. JSS is also related to the CONUS Over-the-Horizon (OTH-B) Radar (PE 12417F), Alaskan Radar Stations (SEEK IGLOO PE 12411F), Dew Radar Stations (PE 12412F), and the E-3A programs. JSS will provide command and control of air defense forces as the tactical situation dictates for as long as it survives. The E-3A, as the more survivable element of air defense, will provide command and control during crisis and wartime. Coordination on all major activities is obtained from Tactical Air Command Air Force Logistics Command, Alaskan Air Command, Pacific Air Forces, North American Aerospace Defense Command and the Air Force Communications Command. Coordination is also obtained from FAA on radar sensor portions of the program. Close coordination is maintained with Canada by having Canadian officers assigned to the Program Office.

(U) WORK PERFORMED BY: Program management is provided by the Electronics System Division of the Air Force Systems Command. The prime contractor is Hughes Aircraft Corporation, Fullerton, CA. Engineering support is provided by Input/Output Computer Sciences, Waltham, MA; Logicon Incorporated, Lexington, MA; MITRE Corporation, Bedford, MA; and Support Systems Associates Inc, Burlington, MA.

Program Element: # 12325F
DoD Mission Area: Strategic Air Defense, #122

Title: Joint Surveillance System (JSS)
Budget Activity: Strategic Programs, #3

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: FY 1980 and FY 1981 funds were utilized for executing the Implementation Period (IP) contract for the remaining US Region Operations Control Centers (ROCCs) awarded 29 October 1979. FY 1979 funds completed the seventeen month DVP contractual effort, commenced the Implementation Period (IP) contract for one ROCC awarded 29 June 1979, and continued Program Office contract engineering support.

2. (U) FY 1982 Program: The IP contractual effort will continue. Funding will be applied to that non-critical software effort remaining after DVP, and to hardware/software integration and testing. Program Office engineering support will continue.

3. (U) FY 1983 Planned Program: The Implementation Period contract effort will continue. Software efforts, integration and test will receive priority attention leading to IOC of the first ROCC in early 1983. Acquisition of Hawaiian ROCC (HIROCC) will commence. Program office engineering support will continue. FY 1983 RDT&E increased due to added program office support funds and FY 1983 Procurement decreased due to the net effect of an OSD reduction of funds for engineering changes and an adjustment to initial spares.

4. (U) FY 1984 Planned Program: Test and integration activities for the remaining US ROCCs will continue with emphasis placed on system testing. System deployment is scheduled to be completed.

5. (U) Program to Completion: No additional RDT&E funds are planned to be used on the JSS program.

6. (U) Milestones: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12411F
DOD Mission Area: Strategic Air Defense, #122

Title: Surveillance Radar Stations/Sites
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	8,289	4,284	1,147	1,123	1,100	38,043
2433	SEEK IGLOO	8,289	4,284	1,147	1,123	1,100	38,043

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element supports the thirteen Alaskan Air Command air surveillance radar sites. The RDT&E project, SEEK IGLOO, will enhance the surveillance and air space control capability of Alaskan Air Command and reduce support costs. SEEK IGLOO will develop a minimally attended radar, using current technology to replace the existing separate surveillance and height finder radars. The new radar will have integral height finding capability and improved performance in the presence of clutter, and will be maintained by significantly fewer personnel than are required today.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The request includes funds to implement production and continue program office support. Program cost estimates are based on negotiated contract prices and contractor performance data.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	8,500	4,400	1,200		2,400	38,490
Procurement (Other)		46,777	47,294		4,371	98,442*

*Includes initial spares

(U) OTHER APPROPRIATION FUNDS:

	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Other)	57,854	37,264	8,592		103,710
(Quantity, including prototype retrofit)	(9)	(4)			
Military Construction	40,250	43,600			83,850

Project: #2433
Program Element: #12411F
DOD Mission Area: Strategic Air Defense, #122

Title: SEEK IGLOO
Title: Surveillance Radar Stations/Sites
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: Automation of the Alaskan Air Command and Control System is planned under the Joint Surveillance System program. In addition, the Air Force had previously planned a program to improve surveillance radar clutter rejection performance with a minor modification and an extensive military construction program to replace deficient support buildings at the radar sites. A study of alternative methods of radar improvement has shown that radar replacement with a new, minimally attended (no more than three radar technicians) radar and site equipment, using current technology, is the most cost effective means of providing the required capability. The new equipment will provide the required performance and significantly reduce maintenance costs. It will also greatly reduce the number of site personnel required thereby reducing the military construction program. The reduced military construction program and maintenance costs are expected to rapidly compensate for the investment in new equipment.

(U) RELATED ACTIVITIES: The study of alternatives and definition of technical requirements were performed under Program Element 12325F, Joint Surveillance System. The new radars are being designed to interface with the Joint Surveillance System equipment. The SEEK IGLOO minimally attended radars could also be used to enhance performance and logistics supportability of the Distant Early Warning Line, to replace Joint Surveillance System military radars to improve logistic supportability and to improve the current North American tactical warning and air defense system. One SEEK IGLOO radar will be diverted to satisfy an urgent requirement to replace an aged radar in Berlin, Germany. Reimbursement to replace the Alaskan asset will be provided by the Federal Republic of Germany.

(U) WORK PERFORMED BY: This effort is managed by the Electronics Systems Division, Hanscom AFB, MA. MITRE Corporation, Burlington, MA; Rome Air Development Center, Griffiss AFB, NY; and the Electromagnetic Compatibility Analysis Center, Annapolis, MD, are supporting the effort. Design competition contracts were awarded to: General Electric Company, Syracuse, NY; ITT Gilfillan, Inc., Van Nuys, CA; and Westinghouse Electric Corp., Baltimore, MD. After evaluation of design proposals, a contract option to fabricate and test two preproduction prototypes was exercised in July 1979 with General Electric Co.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Program alternatives were studied and the minimally attended radar was selected for acquisition. A request for proposal for design, development and test was released and three six-month design competition contracts were awarded on 1 August 1978. The design competition was completed and General Electric Co. was selected in July 1979 to fabricate and test preproduction prototype radar equipment. Fabrication of subassemblies and radar groups began in early FY 1980. Development test and evaluation at the subassembly level began in September 1980. System Development Test and Evaluation was conducted at the contractor's plant. Planning for Development Test and Evaluation at a government test range in Verona, NY and Development Test and Evaluation and Initial Operational Test and Evaluation in Alaska was completed.

Project: #2433
Program Element: #12411F
DOD Mission Area: Strategic Air Defense, #122

Title: SEEK IGLOO
Title: Surveillance Radar Stations/Sites
Budget Activity: Strategic Programs, #3

2. (U) FY 1982 Planned Program: After completion of Development Test and Evaluation in Verona, NY, Alaskan Development Test and Evaluation and Initial Operational Test and Evaluation will be conducted at King Salmon Air Force Station, AK. Results will be evaluated prior to production of eight radars planned to begin in May 1982. The preproduction equipment will be refurbished to the production configuration and remain onsite as the first operational radar. The military construction program to consolidate, replace, and upgrade essential site support facilities such as composite buildings and prime power generators will begin.

3. (U) FY 1983 Planned Program: The first radar is planned to be operational in November 1982. Production of four minimally attended radars will be initiated. A decrease in FY 1983 procurement funds offsets a corresponding increase in FY 1982. A FY 1982 Amended Budget returned the program to original production quantities and prices negotiated in 1979 with net cost avoidance.

4. (U) FY 1984 Planned Program: Radar production and installation is planned for completion by September 1984.

5. (U) Program to Completion: Not Applicable. Completed in FY 1984.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12412F　　　Title: DEW Radar Stations
DoD Mission Area: Strategic Surveillance and Warning, #332　　　Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT			7,995	38,468	44,800	90,263

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element supports the 31 Distant Early Warning (DEW) Line radar stations. The DEW Line provides tactical warning of a bomber or cruise missile carrier penetrating the air-space of the North American Continent through a line from the northern Alaskan Coast to the east coast of Greenland. The warning provides the National Command Authorities with time for decision making and survival actions, permits the launch of offensive and command and control aircraft for survival and alerts the air defense network. The present DEW Line

Because of its age, the existing system is increasingly difficult and costly to operate and maintain. The program objective is to [ ] reducing operations and maintenance costs.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds to complete an overall system engineering design that integrates long range radars, short range radars, communications equipment and control centers. The request also includes funds to begin engineering design and development of a short range gap-filler radar. A planning estimate for a northern surveillance solution was compiled in December 1980. Program cost was estimated in September 1981.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable. This is an FY 1983 new start.

Program Element: #12412F

DoD Mission Area: Strategic Surveillance and Warning, #332

Title: DEW Radar Stations

Budget Activity: Strategic Programs, #3

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
Procurement (Other)			31,244	51,865	344,700	427,800*
(Quantity)			(4)	(7)		
Military Construction				8,255	107,700	116,000

*includes initial spares

Program Element: #12412F Title: DEW Radar Stations
DoD Mission Area: Strategic Surveillance and Warning, #332 Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The present Distant Early Warning (DEW) Line has [
the twenty-five year old equipment is increasingly more costly to operate and maintain. When tests showed that an over-the-horizon radar would not provide reliable northern radar coverage, alternatives were examined and a ground based radar replacement for the DEW Line was selected as the most cost effective approach to provide tactical warning of an atmospheric attack from the north. Detailed design studies of unattended/minimally attended radars and unattended radar sites led to a selection of a mix of minimally attended radars (developed in PE 12411F, Surveillance Radar Stations/Sites) and unattended gap filler radars to provide the most cost effective solution to DEW Line improvement. The selection of a mix of radars greatly simplified the design, and thus lowered the cost and risk, of unattended radar development.

(U) RELATED ACTIVITIES: Design study contracts for the unattended radar (part of the Unattended/Minimally Attended Radar Study) and total unattended site were funded in PE 63101F (Preliminary Design and Development). The minimally attended radar developed under PE 12411F (Surveillance Radar Stations/Sites, Project SEEK IGLOO) is planned for use in the DEW Line improvement program via an increase in production quantity. Radar coverage will be contiguous with the radar coverage provided by CONUS Over-the-Horizon Backscatter (OTH-B) radars in PE 12417F. The DEW Line is an integral part of North American Air Defense tactical warning systems and a US-Canadian Government-to-Government Agreement precludes unilateral phaseout of the system. The Air Force Air Defense Master Plan completed in Jan 1981, stated air defense and tactical warning requirements and identified alternative programs to satisfy those needs. A DEW Line improvement program has been selected by the Air Force as the preferred acquisition approach. FY 1980 funds to improve the DEW Line were deferred pending Congressional receipt of an air defense/warning plan.

(U) WORK PERFORMED BY: This effort is managed by the Electronic Systems Division, Hanscom AFB, MA. MITRE Corporation, Burlington, MA; Rome Air Development Center, Griffiss AFB, NY; and the Electromagnetic Compatibility Analysis Center, Annapolis, MD are supporting the effort.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Program: Not Applicable

3. (U) FY 1983 Planned Program: After evaluating competitive proposals, award a contract for overall DEW Line systems design and integration, communications design and short range radar station design, engineering, fabrication and test. In addition, four long range radars will be procured by continuing AN/FPS-117 minimally attended radar production.

Program Element: #12412F   Title: DEW Radar Stations
DoD Mission Area: Strategic Surveillance and Warning, #332   Budget Activity: Strategic Program #3

4. (U) FY 1984 Planned Program: Fabrication of four short range prototype radars will begin. Communications equipment and seven additional long range AN/FPS-117 radars will be procured. Construction of the first of five new AN/FPS-117 radar sites will be initiated.

5. Program to Completion: Production of short range radars is planned to start in FY 1985. Installation of radars will be accomplished in two phases The first phase, with a planned completion date of will improve the existing capability by integrating radar surveillance data from modern AN/FPS-117 long range radars, four prototype short range radars and 17 existing AN/FPS-19 radars and communications to enable processing of surveillance data within Region Operations Control Centers. The second phase, to be complete in would complete replacement of the existing obsolete AN/FPS-19 radars and

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable. This is an FY 1983 new start.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 12417F
DoD Mission Area: Strategic Surveillance and Warning, #332

Title: CONUS Over-the-Horizon Radar System
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	17,235	79,175	103,991	66,800	267,200

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the development of an Over-the-Horizon Backscatter radar to improve our present limited capabilities for providing tactical early warning against attack on North America by bombers and air-to-surface missiles. Development of an Over-the-Horizon Backscatter radar to provide long-range surveillance down to the surface would: provide coverage of the coastal approaches from approximately 500 nautical miles out to 1800 nautical miles; increase warning time for survival of retaliatory forces; provide decision time for National Command Authorities consistent with missile warning requirements; and significantly enhance redeployment options of available defense forces. In prior years, OTH-B research and development was accomplished in the 63703F Program Element. The planned acquisition is for two 180 degree coverage sites, one on each North American coast. Extension of coverage to the south is a future option.

(U) BASIS FOR FY 1983 RDT&E REQUEST: FY 1983 funds will be used to continue final development of the 60 degree northeast operational Over-The-Horizon Backscatter radar site. The existing experimental radar system, located in Maine, will be modified and augmented to bring it to operational status. Transmitter and receiver hardware will be modified where necessary, equipment for additional frequency bands will be developed and integrated for full use of the high frequency spectrum, operational software will be developed and tested with the new and modified hardware, and a supportable tactical operations center will be developed for interface with the Canadian and Northeast Region Operations Control Center. Preliminary Design Review of hardware and software development is planned for late FY 83. In addition to providing the required engineering and test support, this program also continues the technical level-of-effort designed to maintain acceptable program risk levels and supplements the radar development in design areas promising high payoff in the operational radar system. Cost estimates for the planned east-west coverage system are derived from an Independent Cost study performed in September 1981 to support the AFSARC review.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	0	21,700	15,200		Continuing	To be determined

(U) OTHER APPROPRIATION FUNDS:

Military Construction	0	0	7,200	21,057	64,700	93,000
Procurement (Other)	0	0	0	192,105	283,300	475,400

Program Element: #12417F   Title: CONUS Over-the-Horizon Radar System

DoD Mission Area: Strategic Surveillance and Warning, #332   Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Continental United States Over-the-Horizon Backscatter radar system will provide long range surveillance and tactical early warning to alert National Command Authorities of potentially hostile aircraft in the coastal approaches to North America. Present radars are line-of-sight. These radars have a useful range of only 200 nm against high altitude targets and are limited to a few tens of miles against low altitude targets. Their low altitude coverage is not contiguous. The present radar system, while important for air sovereignty, does not provide tactical warning needed for survival of our retaliatory forces. Deployment of an all altitude, long range and wide area Over-The-Horizon Backscatter radar, in association with improvements to the Dew Line system, will provide tactical early warning for east, west, south and north approaches to North America; will increase warning time to permit survival of our retaliatory forces; will provide decision time for the National Command Authorities consistent with missile warning requirements; and will significantly enhance redeployment options of defense forces. The initial phase, development and feasibility testing of an experimental Over-The-Horizon radar, was approved by the Defense System Acquisition Review Council and concurred with by the Worldwide Military Command and Control System Council in 1974. A contract for a prototype radar system was awarded in March of 1975. Due to projected cost and schedule problems, the program was restructured in FY 1976. The restructured program reduced the operational capability of the planned prototype and the test scope to an experimental radar and definitive test program necessary to demonstrate technical feasibility. Operational configuration and "ilities" were deferred in implementing the design for the technical feasibility test.

(U) RELATED ACTIVITIES: The CONUS OTH-B radar system is being developed to provide all-altitude tactical early warning in support of our strategic air defense mission. Compatibility with related programs such as the Distant Early Warning Radars, the Joint Surveillance System, the E-3A Airborne Warning and Control System and air defense interceptors is planned. Related OTH system developments by the Office of Naval Research and the Naval Research Laboratory in the areas of ship detection and weather/sea state determination are monitored by the Air Force. Agreements with the Federal Aviation Agency and the Canadian Departments of National Defence and Transportation exist to provide North American air traffic control data. Acquisition of the operational Over-The-Horizon radars is accomplished with Program Elements 63703F (FY 82 only) and 12417F.

(U) WORK PERFORMED BY: The development of the CONUS OTH-B radar system and supporting OTH technical efforts are managed by the Air Force Electronics System Division, Hanscom AFB, MA. The radar prime contractor is the General Electric Co., Syracuse, NY. Major subcontractors include Continental Electronics, Dallas, TX, for the transmitter subsystem and TRW, Redondo Beach, CA, for the software development. Subcontractors for the site preparation and construction efforts are awarded to local Maine contractors in the Moscow/Caratunk area (transmitter site) and in the Washington County area (receiver site). Continuing OTH technical efforts, analysis, engineering studies and support are provided by: Rome Air Development Center, Griffiss Air Force Base, NY; SRI International, Remote Measurements Laboratory, Menlo Park, CA; Naval Research Laboratory, Washington, D.C.; MITRE Corporation, Burlington, MA; and the Air Force Geophysics Laboratory, Hanscom Air Force Base, MA.

Program Element: # 12417F | Title: CONUS Over-the-Horizon Radar System
DoD Mission Area: Strategic Surveillance and Warning, #332 | Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The program was restructured in FY 1976 to reduce the prototype design implementation and test scope to an experimental radar required to demonstrate technical feasibility. Site preparation, erection of buildings and support services, and partial construction of the antennas were completed at both the transmitter and receiver sites in Maine. Configuration acceptance tests were completed on major hardware items and software design was verified and coded. Technology efforts were initiated in the areas of low-sidelobe antenna development, ionospheric modeling and prediction, adaptive beamforming, and radar performance assessment/management technologies. Development of the experimental radar system was continued in FY 1979. Site construction was finished and on-site system level integration and testing in preparation for the feasibility demonstration were completed in 1980. Technology efforts were continued to evaluate alternative signal processing/radar control algorithms. System level acceptance tests were accomplished during the second quarter of fiscal year 1980 and the Experimental Radar System was delivered to the Air Force in May of 1980. The nine month system performance test started in June 1980 and was completed in February 1981. In these tests, technical feasibility of the OTH-B radar system was demonstrated and addressed the following: probability of detection, relative position accuracy, velocity resolution, track maintenance, radar propagation outages, radio frequency interference susceptibility and compatibility, and real-time identification and correlation of targets. Subsequent to the nine month system performance tests, a limited Initial Operational Test and Evaluation on the Experimental Radar System was conducted from 1 March to 4 June 1981 by the Air Force Test and Evaluation Center (AFTEC). Independent estimates were made of operational effectiveness and suitability and deficiencies identified for subsequent corrective action during development of the Initial Operating Sector. Additional experiments and analyses were made to determine the utility of northlooking OTH-B. Preparations were made for the November 1981 Air Force Systems Acquisition Review Council (AFSARC).

2. (U) FY 1982 Program: The November 1981 AFSARC provided a development and deployment decision on east and west coast operational radar systems. Preparation for a final development program is underway. The experimental radar system will be upgraded to a fully operational 60 degree Initial Operating Sector. The Maine transmitter and receiver facilities will be expanded and modified where necessary and improved for operational use. Frequency range is to be increased and operational software development will begin for radar management, target detection, tracking, correlation and identification, declaration of unknowns, and for computer interface with external agencies. A separate operations center will be designed for integration into existing communications/warning networks. Continued technical support efforts are directed at system risk reduction and design to control life cycle costs.

3. (U) FY 1983 Planned Program: Development will continue to upgrade the experimental system to a fully operational 60 degree coverage Initial Operating Sector (IOS). Design of upgraded radar hardware will be completed and formal design reviews conducted. Fabrication of key hardware items will begin, along with acquisition of vendor-furnished hardware, displays and computers. Testing will begin on critical subsystems to include receivers, transmitters, and the signal processor. Software design will be completed and formal design reviews conducted. Tests on key computer program components will be accomplished. Clearing and grading of the IOS transmit and receive sites will begin. Design of technical facilities will be completed. Technical efforts to reduce risk and control life cycle costs will continue. Funding level compared to that in FY 82 Descriptive Summary represents consolidation of all funding in one Program element. $61.8M in FY 83 was formerly included in PE 63703F.

Program Element: # 12417F
DoD Mission Area: Strategic Surveillance and Warning, #332

Title: CONUS Over-the-Horizon Radar System
Budget Activity: Strategic Programs, #3

4. (U) FY 1984 Planned Program: Developed components and subassemblies will be integrated into transmitter and receiver units. Testing and software independent verification and validation will continue. The initial phase to replicate two additional 60 degree sectors on the east coast will begin.

5. ' Program to Completion: Development will be completed in fiscal year [ ] with the upgraded first 60 degree sector operating. Initial Operational Test and Evaluation of the first sector (Initial Operating Sector) will be complete in early fiscal year [ ] Additional 60 degree sectors will be completed on each coast until the two 180 degree over-the-horizon backscatter radar fans are complete in [ ] Exercise option for south coverage in accordance with the DOD Air Defense Master Plan.

6. (U) Milestones:

Milestone	Date
A. (U) System Definition Complete	Nov 1973
B. (U) Prototype Contract Award	Mar 1975
C. (U) Initiate Program Restructuring	Dec 1976
D. (U) Conclude Technical Feasibility Test	Feb 1981
E. (U) Conclude IOT&E	Jun 1981
F. (U) AFSARC Review	Nov 1981
G. (U) Development Decision	Jan 1982
H. (U) Development Contract Award	Apr 1982
I. (U) Program Review	Apr 1983
J. (Initial Operational Capability (East & West 180°)	[ ]
K. (Full Operational Capability (South 120°)	[ ]

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12423F Title: Ballistic Missile Early Warning System
DoD Mission Area: Strategic Surveillance and Warning, #332 Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	9,630	12,752	10,262	9,670	Continuing	Not applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Ballistic Missile Early Warning System is being modernized. Planned improvements to radars and data processing equipment will increase the system's capability.

In addition, ongoing replacements of the site computers will stop the deterioration in reliability caused by system aging and the nonavailability of spare parts.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Requested funds will allow the Air Force to complete the procurement of new Missile Impact Predictor computers for all three Ballistic Missile Early Warning Sites, with scheduled deliveries in September and December of 1982 and April 1983. It will allow us to initiate the procurement of an Ultra High Frequency upgrade to the Detection and Tracking Radars at the Thule, Greenland and Fylingdales England sites. A solicitation will be released to industry in January 1982 for a competitive, design to budget, contract definition phase to start in April 1982. Award of a final acquisition contract is expected in January 198[illegible] for final delivery in late 1986.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	9,100	13,600	6,300		Continuing	Not Applicable
Procurement (Other)	44,996	12,954	0		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Procurement	42,328	35,349	4,200	0	Continuing	Not Applicable
Operation and Maintenance	8,600	2,916	3,126	5,739		

Program Element: #12423F   Title: Ballistic Missile Early Warning System
DoD Mission Area: Strategic Surveillance and Warning, #332   Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The Ballistic Missile Early Warning System (BMEWS) was designed and built in the late 1950s and early 1960s. At the time, a mass missile raid was defined as 20 or more missiles each having only one warhead; and our national nuclear retaliatory strategy was massive retaliation. Twenty years of system aging and a much larger and more complex missile threat now

The Ballistic Missile Early Warning System was originally designed

The current system is capable of providing
Thus, it can provide adequate warning of an all out Soviet attack. It is also able, with the aid of site tracking radars, to a greater accuracy of This informati is used to provide a rudimentary characterization of the magnitude and objective of the enemy attack. in a less than all out attack, with limited objectives,

The proposed modifications to the detection and tracking radars at the Thule and Fylingdales sites would reduce the size of the range resolution cell by changing the radar bandwidth. This would allow the radar to discriminate and track individual objects which are much closer together With this improvement in discrimination and an appropriate increase in the capacity of site computers, the sites will be able to track a much greater portion of the missile raid and provide considerably more accurate data for assessing the attack. The system will still not, however, be able to

To do this will require additional modifications to the radars.

(U) In addition to the Thule and Fylingdales radar modifications, work will continue on the replacement of the Missile Impact Predictor at all three sites to assure continued overall system reliability.

Program Element: #12423F
DoD Mission Area: Strategic Surveillance and Warning, #332

Title: Ballistic Missile Early Warning System
Budget Activity: Strategic Programs, #3

(U) RELATED ACTIVITIES:

The Ballistic Missile Early Warning System is part of the national system for Tactical Warning and Attack Assessment. It provides confirmation of initial launch detection information provided by the satellites and complements the information provided by the Sea Launched Ballistic Missile Detection and Warning, Aircraft Surveillance and Warning Systems and NORAD Space Detection and Tracking System. Ballistic Missile Early Warning Systems data is provided to the National Military Command Center, the Strategic Air Command Command Center and other users via the North American Air Defense Command (NORAD) 427M system and World Wide Military Command and Control System.

(U) WORK PERFORMED BY: Air Force Systems Command, Electronic Systems Division, Bedford, MA in conjunction with NORAD/Aerospace Defense Command, The Aerospace Defense Center, Strategic Air Command, and Air Force Communications Command. General system engineering is being provided by the Mitre Corporation of Bedford, MA. The Missile Impact Predictor computer replacement is under contract to Federal Electric Corporation of Paramus, NJ with major subcontracts to Control Data Corporation of Los Angeles, CA and Science Applications Incorporated of Huntsville, AL. Potential contractors interested in the radar modifications are Federal Electric Corporation, Raytheon, and General Electric Corporation and International Business Machines Company.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A contract for replacement of the Missile Impact Predictor (MIP) computers at all 3 BMEWS sites was awarded in August 1980. Delivery of those computers originally scheduled for April, June and October of 1982 has been delayed by contract problems and is now expected in September and December of 1982 and April of 1983. The contract for replacement of the Tactical operations Room (TOR) consoles at the 3 sites was canceled in 1981 because the system delivered failed to meet user operatonal requirements. We now plan to replace these consoles as part of the radar upgrade effort.

2. (U) FY 1982 Program: Completion of the MIP replacement at the Clear Alaska and Thule, Greenland sites. Award of a competitive contract definition and preliminary design contract for the Ultra High Frequency (UHF) modifications to the Thule radars. Differences in funding between the FY 1982 and 1983 summaries are due to the inclusion of additional funding for Fylingdales radar modifications in the Reagan FY 1982 budget amendment.

3. (U) FY 1983 Planned Program. Award a contract to the offeror with the most cost effective modification design and begin work on the Thule and Fylingdales radar upgrades.

4. (U) FY 1984 Planned Program. Continuation of the Thule and Fylingdales radar modifications.

5. (U) Program to Completion: Completion of the radar modifications at the Thule and Fylingdales sites is expected in early 1986.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12424F Title: SPACETRACK
DoD Mission Area: Strategic Surveillance and Warning, #332 Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	6,658	7,970	5,542	5,146	Continuing	Not Applicable
2295	Ground-Based Electro-Optical Deep Space Surveillance System	1,200	2,270	1,187	1,200	Continuing	Not Applicable
0002	Ground-Based Sensors	5,458	5,700	4,355	3,946	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program incorporates near and far term operational systems into SPACETRACK in support of satellite attack warning and verification, rapid alerting for These research and development efforts will (1) support the deployment of a five-site global Ground-Based Electro-Optical Deep Space Surveillance(GEODSS) system to out to synchronous altitude and beyond; (2) through the Pacific corridor with Pacific radars: Defense Advanced Research Projects Agency Long-Range Tracking and Identification Radar (ALTA R) on Kwajalein and GPS-10 radar (3) provide rapid and accurate calibration of all SPACETRACK radars using the Navy Transit satellites; (4) transition the Defense Advanced Research Projects Agency Maui Optical Site and HAYSTACK space object identification facilities to SPACETRACK for operational uses; (5) and provide extended range capability for selected SPACETRACK radars. Mission need is described in SecDef Mission Element Need Statement for Space Defense (Anti-satellite), Mar 1981, and USAF Mission Element Need Statement for Space Defense (Surveillance), 11 March 1981.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The five-site GEODSS system started in FY 1977 will be continued. Research, development, test and evaluation funding for GEODSS is for software development, system/site engineering and testing, and support improvements, including charge-coupled device sensor replacement of GEODSS camera tubes. SPACETRACK modifications will be continued on existing sensors to more precisely and rapidly determine satellite orbits, to extend detection range of sensors using coherent data processing techniques, and to transition the HAYSTACK radar imaging capability to SPACETRACK for rapid tactical assessment of satellite missions. GPS-10 radar redeployment will continue. Cost estimates are based on negotiated contracts and/or contractor inputs as modified by program office review and analysis.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
RDT&E	6,700	8,200	5,800		Continuing	Not Applicable
Procurement (Other)	6,600	20,900	4,000		Continuing	Not Applicable
Operations and Maintenance	44,909	60,652	75,366		Continuing	Not Applicable

Program Element: #12424F
DoD Mission Area: Strategic Surveillance and Warning, #332

Title: SPACETRACK
Budget Activity: Strategic Programs, # 3

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
2295						
Procurement (Other)* (Quantity)	1,200	17,167 (1)	2,914	958	Continuing	Not Applicable (5)
Military Construction				9,370	Continuing	Not Applicable
Operations and Maintenance	1,193	10,100	17,490	23,090	Continuing	Not Applicable
0002						
Procurement (Other)*	5,450	2,997	1,001	784	Continuing	Not Applicable
Military Construction	1,150		1,750			
Operations and Maintenance	40,157	55,584	56,032	56,704	Continuing	Not Applicable

*Does not include initial spares. Procurement is for projects with research and development activity only.

Program Element: # 12424F
DoD Mission Area: Strategic Surveillance and Warning, #332

Title: SPACETRACK
Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: This program incorporates near-term operational improvements into SPACETRACK in support of satellite attack warning and verification, rapid alerting for

To support these requirements, four classes of improvements are required:

(3) an accurate orbit prediction capability that is less sensitive to the random variations experienced in atmospheric density; and (4) timely assessment of satellite missions. This program will also support the far-term deployment of an system being developed under Program Element 63428F, Space Surveillance Technology.

This program element funds activities that will correct the above deficiencies within the geographical limitation of ground-based systems. These activities will: (1) provide a five-site global Ground-Based Electro-Optical Deep Space Surveillance capability that will detect and track all satellites from roughly 3,000 nautical miles to synchronous altitude, and beyond, and augment radar coverage at lower altitudes; (2) provide rapid and accurate calibration of all SPACETRACK radars using the Navy Transit satellites; (3) provide range extension to synchronous altitude for selected SPACETRACK radars; (4) transition the Defense Advanced Research Projects Agency Maui Optical Tracking and Identification Facility tactical mission assessment capability to SPACETRACK for operational use; (5) provide additional radar systems for

(U) RELATED ACTIVITIES: The baseline and technology for the Ground-based Electro-Optical Deep Space Surveillance (GEODSS) system and SPACETRACK calibration, extended range and radar imaging capabilities were developed and demonstrated under Program Element 63428F, Space Surveillance Technology. This program element is integrated with those programs that comprise the Space Defense System Program: Program Element 63438F, Satellite Systems Survivability; Program Element 12311F, North American Air Defense Combat Operations Center; Program Element 64406F, Space Defense System; Program Element 12450F, Space Defense Operations Center and Program Element 63128F, Space Surveillance Technology.

(U) WORK PERFORMED BY: Program management is provided by the Electronic Systems Division, Hanscom Air Force Base, MA and Space Division, Los Angeles, CA. The GEODSS contractor is TRW, Newbury Park, CA. AVCO Everett Research Laboratories, Everett, MA supports the Maui Optical Tracking and Identification Facility. General systems engineering support is provided by MITRE Corporation, Bedford, MA and MIT/Lincoln Laboratories, Lexington, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The requirements for

were reviewed, resulting in the network design. Design and performance parameters were developed for the southwest Pacific radars. Operational testing and evaluation were conducted for ALTAIR on Kwajalein.

The GEODSS development and acquisition contract was awarded in FY 1978 and system critical design review was completed in FY 1979. During FY 1980 and FY 1981 the GEODSS system in-plant and site one development test and evaluation of software and hardware were conducted, and charge-coupled devices were examined for improving system performance and long-term supportability. Design changes were considered to modify the fourth and fifth GEODSS sites to a relocatable configuration to reduce the difficulty with foreign siting, and detailed design of the relocatable facilities was completed. Diego Garcia was chosen for site four. Negotiations with

Program Element: # 12424F Title: SPACETRACK
DoD Mission Area: Strategic Surveillance and Warning, #332 Budget Activity: Strategic Programs, #3

An existing SPACETRACK radar at Clear, Alaska, was modified and tested in 1979 to operationally evaluate the improved accuracy through calibration using the Navy Transit satellites. This technique was developed under Program Element 63428F Space Surveillance Technology. Contracts were awarded for the extended range modification of the radar at Diyarbakir, Turkey, and for improved calibration modifications to SPACETRACK radars.

2. (U) FY 1982 Planned Program: The first Ground-Based Electro-Optical Deep Space Surveillance (GEODSS) site will undergo initial operational test and evaluation in this period and reach an initial operational capability. System deployment will continue with the deployment of two additional sites. The ground-based sensors project will continue, including modification of HAYSTACK radar to improve its imaging capability and tactical responsiveness. Modifications/upgrades on the DARPA Long-Range Tracking and Identification Radar (ALTAIR) on Kwajalein will be completed. Calibration and range extension improvements at selected SPACETRACK radars will continue.

3. (U) FY 1983 Planned Program: Development of charge-coupled devices and other upgrades will continue. The ground-based sensors project will continue with data processing, calibration and range extension modifications at selected SPACETRACK radars. A deep space network operations control processor to provide system-level-coordinated opperations of the deep space radars (ALTAIR, Millstone, Diyarbakir) and GEODSS sites will be developed. Redeployment of the GPS-10 radar to San Miguel, the Philippines, will be completed.

4. (U) FY 1984 Planned Program: The Ground-Based Electro-Optical Deep Space Surveillance system deployment will continue with delivery of one site. Charge-coupled device sensor upgrades will continue. Data processing, calibration and space object identification modifications will continue for selected SPACETRACK radars.

5. Program to Completion: Final operational capability of the GEODSS system is planned for [ ] contingent upon obtaining foreign site agreements and funding to complete fifth site procurement and deployment. Continuing improvements to the SPACETRACK system will be made to support space defense requirements for [ ] Survivability of SPACETRACK ground-based sensors will be increased by improvements to communications, electronic warfare countermeasures and physical security. A requirement for surveillance of [ ] has been validated. This program element will also support the far term deployment of an [ ]

6. (U) Milestones: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12431F
DOD Mission Area: Strategic Surveillance

Title: Defense Support Program
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	87,570	145,750	120,447	50,275	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Defense Support Program is the key element of the It is a space-based surveillance system that The system consists of three satellites in geostationary orbit, two large processing stations, one simplified processing station, one multi-purpose facility, and a ground communications network. The Defense Support Program provides

BASIS FOR FY 1983 RDT&E REQUEST: Funds are included to complete the design and development of satellites 14 and beyond with survivability upgrades. Long lead procurement for satellites 14 - 17 will start in FY 1982 for those components which are not new and do not require major redesign. Satellite production will begin in FY 1983. Continuation of modifications for compatibility with Shuttle/Titan III(34)D/Inertial Upper Stage is included. Two satellites scheduled for a FY 1982 delivery will be Shuttle/Inertial Upper Stage compatible. Mobile Ground Terminal (MGT) and the associated user interface design will be completed in FY 1982. Design of Jam Resistant Secure Communication interfaces and repackaging is included in FY 1983. The Mobile Ground Terminals are scheduled for an Initial Operational Capability Funds are also included for General Systems Engineering/Integration. Cost data were derived by the Air Force Systems Command's Program Office using a combination of contractor estimates and past experience.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	87,570	146,300	TBD		Continuing	Not Applicable
Procurement (Missile)	52,000	230,254	200,260		Continuing	Not Applicable
Procurement (Other)	70,305	101,806	9,357		Continuing	Not Applicable
Operations and Maintenance	50,835	53,434	63,118		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Procurement (Missile)	52,000	241,354	407,500	366,300	Continuing	Not Applicable
(Quantity, Satellites)		Long lead	(2)	(2)		

Program Element: #12431F

DOD Mission Area: Strategic Surveillance

Title: Defense Support Program

Budget Activity: Strategic Programs, #3

(U) OTHER APPROPRIATION FUNDS:	FY 1981	Estimate	Estimate	Estimate	to Completion	Costs
Procurement (Other)(Includes initial spares)	70,305	101,140	89,292	5,345	Continuing	Not Applicable
(Quantity, Mobile Ground Terminals)	(1 MGT)	(2 MGTs)	(3 MGTs)			
Operations and Maintenance	44,659	53,920	60,641	57,799	Continuing	Not Applicable
Military Construction Program	0	0	1,900	0	Continuing	Not Applicable

Program Element: #12431F

DOD Mission Area: Strategic Surveillance

Title: Defense Support Program

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The Defense Support Program (DSP) was developed as an outgrowth of the and other related developments. DSP satellites contain The system is operational and provides near real time to the National Command Authorities (NCA) and other designated users. The system also provides these more specific data: In addition, DSP is replacing the satellite program and provides data on The system's current deployment consists of Two dedicated ground stations, one overseas and one within the Continental United States (CONUS), receive, process, and transmit The Simplified Processing Station provides a backup capability to the current ground stations to enhance mission data survivability and increase the probability that data will be available. It is currently deployed in the CONUS, but can be moved overseas to back up the Overseas Ground Station. The Multi-Purpose Facility provides training, analysis, software maintenance/integration and The Joint Chiefs of Staff have designated the Aerospace Defense Command, Strategic Air Command, National Military Command System, Atlantic Command, Pacific Command, European Command, as users of DSP data. Evolutionary satellite improvements are intended to prolong the useful life of each satellite, make the satellite more survivable in environments, increase the viewing area of each satellite, and increase the accuracy of data provided on to more precisely define the for the NCA decision-making process. Modifications under development will ensure that the DSP payloads are compatible with Shuttle/Titan III(34)D/Inertial Upper Stage (IUS) capabilities. The Mobile Ground Terminals will provide DSP data survivability by deploying a truck mounted data processing and communication capability Future satellites scheduled for delivery starting in FY 1986 will include significant data survivability improvements. These improvements are

RELATED ACTIVITIES: Program were predecessor programs. Program were prior program designators. are developing the technology for an endurable system capable of Appropriate procurement phasing with the follow-on DSP program is being addressed in program planning. Defense Satellite Communications System (P.E. 33110F) provides primary communications routing for DSP overseas data and will help provide Mobile Ground Terminal communications. Space Boosters (P.E. 35119F) provides launch support. Space Vehicle Subsystems Advanced Development (P.E. 63401F) is developing technology for improved satellite navigation, power, and propulsion systems.

DSP is the key element of the Worldwide Military Command and Control Systems (WWMCCS) and is related to the other elements of the network (WWMCCS Architecture P.E. 63735F). The WWMCCS Architecture also provides systems engineering and integration technical support to the

Program Element: #12431F

DOD Mission Area: Strategic Surveillance [ ]

Title: Defense Support Program

Budget Activity: Strategic Programs, #3

[ ] After transition to the Space Shuttle, Space Launch Support Program (P.E. 35171F) will provide Inertial Upper Stages and Space Shuttle flights for DSP missions. DSP Communications (P.E. 12447F) provides operations and maintenance for the DSP Ground Communication Network.

WORK PERFORMED BY: Commander-in-Chief, Aerospace Defense Command, maintains operational control of Defense Support Program (DSP) for the Joint Chiefs of Staff. Strategic Air Command and the Air Force Communications Command are the system operators and maintainers of the DSP ground stations. Air Force Systems Command's Space Division, Los Angeles, CA, has overall development and procurement management responsibility and program management of the satellites. The Air Force Logistics Command provides engineering and logistics support. Air Force Weapons Laboratory, Kirtland Air Force Base, NM, will provide facility support. The Air Force Test and Evaluation Center, Kirtland Air Force Base, NM, participates in test and evaluation of selected system segments. TRW, Redondo Beach, CA, is the prime contractor for the spacecraft and satellite integration. Aerojet Electro Systems Company, Azusa, CA, is the prime contractor for the infrared sensor and the computer replacement. The Martin-Marietta Aerospace Company, Denver, CO, is the integration contractor for the Titan III boosters. The Department of Energy (Sandia Corporation) has responsibility for the [ ] IBM, Thousand Oaks, CA, is the prime contractor for all software efforts as well as the prime contractor on the Simplified Processing Station and Mobile Ground Terminals. The Aerospace Corporation, Inglewood, CA, furnishes general systems engineering/integration for the DSP System Program Office.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Significant accomplishments to date include procurement of 13 satellites and 12 Titan IIIC boosters, construction of two data processing facilities, and provision of user displays, software, communications and a training facility (also used for software development and mission data analysis), completion of Research and Development (R&D) for modifications to satellites 10-12 to improve survivability in a [ ] environment and to provide data survivability, completion of R&D for [ ] and completion of development of hardware and software for the Simplified Processing Station. Development, initiated in FY 1976, continues on an improved sensor to provide [ ] and more accurate [ ] In June 1976, a software package was delivered which enables the system [ ] Development of modifications for satellite retrofit to improve survivability in [ ] environment was initiated. R&D support for DSP augmentation was completed. Ground station modifications for compatibility with a satellite anti-jam command capability were completed. Satellite Tracking Set Training Equipment was delivered. [

Program Element: #12431F
DoD Mission Area: Strategic Surveillance

Title: Defense Support Program
Budget Activity: Strategic Programs, #3

Critical Design Review was conducted in June 1978 on a new sensor which is to provide more accurate data on . The retrofit of two satellites with an improved infrared sensor continues. Funding ensuring Titan III(34)D/Shuttle/Inertial Upper Stage (IUS) compatibility continues. In December 1978 the Simplified Processing Station (SPS) was shipped to for Initial Operational Test and Evaluation. The testing was completed in June 1979. An antenna left over from the prototype Simplified Processing Station Program Satellite calibration and masking effects verification experiments were performed to determine infrared sensor responsivity. In June 1980 a contract was awarded to replace the computers in the Defense Support Program (DSP) ground stations and the training and development facilities. This replacement is necessary to provide processing capability for new satellites and to avoid obsolescence. In April 1981 a contract was awarded to procure one Mobile Ground Terminal with options to buy two more plus the support capability in FY 1982 and three more in FY 1983. Contracts were awarded in August 1981 and October 1981 for the satellite 14-17 sensor and spacecraft full scale engineering development.

2. FY 1982 Program: A Milestone I Defense Systems Acquisition Review Council (DSARC) for the was held in December 1979. The purpose of this DSARC was to review alternatives for increasing The two primary alternatives were: (1) to start the advance development of the or (2) to improve the survivability of the current DSP. In February 1980 the Deputy Secretary of Defense chose the option that increased the survivability of the current DSP, primarily because of the greater technological risk of These survivability upgrades include the following: (1) Mobile Ground Terminals and associated Jam Resistant Secure Communications (JRSC) Terminals will provide survivability to the ground processing and communication of satellite data (2) a satellite-to-satellite crosslink (3) a Mission Data Message rebroadcast capability (4) a limited (5) and the satellite Design of the Mobile Ground Terminals will be completed in FY 1982. The basic computers and software will be the same as those used in the Simplified Processing Station. The design funds will be used primarily for the repackaging of the components, the new antenna subsystem, and to ensure that the mobility requirements are met. A total of six Mobile Ground Terminals are required to ensure survivability of DSP data with today's threat. The System Operational Concept calls for One MGT is being procured in FY 1981. Two plus support are being procured in FY 1982. Also the design and development of the survivability upgrades,

Program Element: #12431F
DOD Mission Area: Strategic Surveillance

Title: Defense Support Program
Budget Activity: Strategic Programs, #3

which will be incorporated on satellite 14 and beyond, will continue. In FY 1982, the satellite 14 sensor design will be completed. The satelite 14 spacecraft design will be completed in FY 1983. Long lead items for four of these satellites will be procured in FY 1982. Survivable DSP data will insure Expenditures include the contination of the DSP satellite compatibility development with the Shuttle/Titan III(34)D/IUS and the Titan III(34)D/Transtage. This development is necessary to ensure that the DSP satellites are compatible with the IUS interfaces and support the program transition to a Shuttle launch capability. The development efforts will be applied to insure that the system design will incorporate launch and recovery loads, safety requirements, interface compatibility and contamination protection. The current plan for DSP satellite launches is as follows: one more Titan IIIC launch, one Titan III(34)D/Transtage launch and one Titan III(34)D/Inertial Upper Stage (IUS) launch, and all subsequent launches on Shuttle/IUS. Orbital operations data analysis, survivability and satellite improvement efforts will continue.

3. FY 1983 Planned Program: The satellite 14 and beyond spacecraft design will be completed in FY 1983 with the last Critical Design Review in May 1983. This spacecraft design will include many redesigned components necessitated by obsolescence of parts, Shuttle compatibility, Based on the new sensor design, which includes satellites 14 and 15 will be procured on a fully funded basis. The development of the satellite/Titan III(34)D/Shuttle/Inertial Upper Stage and satellite/ Titan III(34)D/Transtage compatibility will continue Three production Mobile Ground Terminals will be procured. The primary communication capability for the Mobile Ground Terminals is through the Defense Satellite Communication System using a mobile Jam-Resistant Secure Communication terminal built by the Army. These units, as delivered by the Army, will not be completely compatible with the Mobile Ground Terminals. In order to ensure proper communication interfaces with the Mobile Ground Terminals, compatible set-up and tear-down times, and the Jam Resistant Secure Communication terminals will be repackaged. Orbital operations support, survivability improvements, computer software modification to support new satellites and satellite/ground station upgrade will continue. Funding changes from the FY 1982 submission reflect: full funding of satellites 14-17 vice incremental funding in missile procurement, addition of the peripheral replacement in the ground station, and funding of Mobile Ground Terminals 4-6 in other procurement. A main operating base will be built in the United States for the Mobile Ground terminals.

4. (U) FY 1984 Planned Program: Satellites 16 and 17 will be procured. The development of the payload/Titan III(34)D/Shuttle/Inertial Upper Stage compatibility will continue. General system engineering/integration will continue, as well as orbital operations support, survivability, computer software improvements and satellite improvement efforts. Ground station design for satellites 14-17 will start.

5. (U) Program to Completion: This is a continuing program. RDT&E funding will support continuing satellite/system development in support of Department of Defense requirements. Primary emphasis will be directed toward eliminating or minimizing operational employment deficiencies, the use of the Space Shuttle and/or Titan III(34)D/Inertial Upper Stage in lieu of the Titan IIIC, the development of a survivable DSP system through Mobile Ground Terminals and satellite upgrades, and the adequacy of the ground station data processing capability.

Program Element: #12431F
DOD Mission Area: Strategic Surveillance

Title: Defense Support Program
Budget Activity: Strategic Programs, #3

6. Milestones: Date

A.		
B.		
C.		
D.	Delivery of Satellite #5	Mar 1973
E.		
F.	Delivery of Satellite #6	Jul 1973
G.	Delivery of Dual Satellite Software	Feb 1974
H.	Delivery of Satellite #8	May 1974
I.	Delivery of Satellite #7	Oct 1974
J.	Delivery of Satellite #9	Mar 1975
K.		
L.		
M.		
N.	Delivery of Simplified Processing Station (SPS)	Dec 1978
O.		
P.		
Q.	Retrofit of Titan III(34)D/Inertial Upper Stage (IUS) Compatible Satellite Complete	Jun 1981
R.		
S.	Retrofit of Shuttle IUS Compatible Satellite Complete *(3Q CY 1982)	4Q CY 1982
T.	Completion of Computer Replacement	2Q CY 1983
U.		
V.	Satellite #14 Delivery	4Q CY 1985
W.	Satellite Launches	As required

*Date presented in FY 1982 Descriptive Summary. Explanation of milestone changes follow:

P. Launch actually took place on
S. Satellite delivery has slipped due to solder joint problem in the sensor.
U. IOC has slipped to allow time for Initial Operational Test and Evaluation.

7. (U) Resources: Not applicable.

8. (U) Comparsion with FY 1982 Descriptive Summary: Not applicable.

Budget Activity: Strategic Programs, #3
Program Element: #12431F, Defense Support Program

Test and Evaluation Data

1. Development Test and Evaluation: The Defense Support Program has been designed, developed, tested and deployed as an operational system in the early 1970's. The system is a classified space program consisting of ground control and readout stations that receive data from satellites, process the data, and present [ ] information to the National Command Authorities and military commanders for decision-making purposes. Development. Test and Evaluation/Initial Operational Test and Evaluation on the prototype Simplified Processing Station was completed in 1978. Over the next several years three major system upgrades will require Development Test, and Evaluation. They are the Sensor Evolutionary Development and [ ] upgrades; the Mobile Ground Terminals; and the Satellite 14 and beyond survivability upgrades. The Sensor Evolutionary Development satellites will have an increased number of [ ] The major system improvements resulting from this increase is as follows: [

] These upgrades have three different elements: the satellite, the software modifications and the ground station upgrade which involves replacing the computers. The sensor portion of the satellite is being produced by Aerojet ElectroSystems Corporation, the [ ] sensor are produced by the Sandia Corporation, and the spacecraft is being produced and integrated by TRW, Incorporated. Development, Test and Evaluation will be performed at the Aerojet ElectroSystems Corporation and TRW facilities prior to government acceptance, which is scheduled for fiscal year 1982. The satellites will then be stored until there is a launch requirement. The computers are being replaced at all Defense Support Program locations by Aerojet ElectroSystems Corporation. This replacement is scheduled to be completed by fiscal year 1983. Development, Test and Evaluation will be accomplished on this replacement in conjunction with acceptance testing. The system software is being modified to accommodate the Sensor Evolutionary Development satellites by International Business Machines Corporation. Development, Test and Evaluation will be accomplished prior to turnover to Strategic Air Command (scheduled for fiscal year 1982) who will integrate the software into the operational system. This initial software installation will process data from the current satellite configuration. When the first Sensor Evolutionary Development satellite is launched, Air Force Systems Command will accomplish a system level Development, Test and Evaluation to insure that all elements of the system work together, including the satellite, the ground station hardware and the software. The purpose of the Mobile Ground Terminals is to provide survivability to the Defense Support Program ground processing and communication elements through mobility. They will use the same computer hardware and software as the Simplified Processing Station. The prime contractor will be International Business Machines Corporation. Development, Test and Evaluation will be accomplished on the antenna which is new and at the Mobile Ground Terminal system level to ensure that the Mobile Ground Terminal can meet its mobility and communication goals. Satellite 14 and beyond will include several survivability upgrades directed by a Defense System Acquisition Review Council. [

Budget Activity: Strategic Programs, #3
Program Element: #12431F, Defense Support Program

Development of these satellites started in late fiscal year 1981 and the first will be delivered in late fiscal year 1986. The ground station and software modifications have not been defined. The Development, Test and Evaluation program for these upgrades will be very similar to the Sensor Evolutionary Development, Test and Evaluation program.

2. (U) Operational Test and Evaluation:

a. Combined Development Test and Evaluation (DT&E) and Initial Operational Test and Evaluation (IOT&E) was performed on the Defense Support Program (DSP) prototype Simplified Processing Station (SPS) from 26 August 1978 to 6 November 1978 at Vandenberg Air Force Base, California. This combined test was then followed by dedicated IOT&E from The Space and Missile System Organization (SAMSO) was responsible for DT&E while the Air Force Test and Evaluation Center (AFTEC), assisted by personnel from the Aerospace Defense Command (operating command for DSP), managed and conducted IOT&E.

b. (U) IOT&E was conducted using simulated and "real world" events with prototype SPS hardware and software. The objectives were to evaluate the system's performance and to estimate the reliability, availability and maintainability of an operationally deployed system. The IOT&E report, October 1979, identified three major deficiencies which would prevent the SPS from being operationally useful. These were:

(1)

(2)

(3) (U) Excessive computer-generated message error rate - Mission messages were periodically rejected at the data distribution center because of parity error. As a result, mission messages were lost.

c. Additionally, the IOT&E operational availability was

d. Phase I follow-on test and evaluation (FOT&E) of the SPS was conducted by AFTEC The purpose of the Phase I FOT&E was to confirm correction of the deficiencies identified during IOT&E; however, the SPS continued to exhibit

e. Phase II FOT&E of the SPS was conducted by SAC As indicated above, AFTEC managed the IOT&E and Phase I FOT&E for the SPS

Budget Activity: Strategic Programs, #3
Program Element: #12431F, Defense Support Program

Preparation of SAC's final Phase II FOT&E test report is in progress. Test team briefings to the SAC staff, ADCOM and NORAD on test results are to be completed by October 1981.

f. The total SPS OT&E effort identified

g. (U) OT&E for the Sensor Evolutionary Development Satellites and Mobile Ground Terminals, and Satellite 14 and beyond is currently in advance planning.

3. System Characteristics:

Characteristics	Objectives	Demonstrated
For the current operational system		
		Simulation/ Live Events
		Simulation/Live Events
		Simulation/Live Events
		Simulation/Live Events
		Operational
		Operational
		Simulation/Live Events
		Simulation/ Limited Live Events

Improvement for Sensor Evolutionary Development and

Budget Activity: Strategic Programs, #3
Program Element: #12431F, Defense Support Program

For the Simplified Processing Station

Characteristics	Objectives	Demonstrated
		Simulation
		Operational Test and Evaluation
		Operational Test and Evaluation
		Simulation
		Simulation

Satellite 14 and Beyond Improvements

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12432F — Title: PAVE PAWS Expansion

DoD Mission Area: Strategic Surveillance & Warning, # 332 — Budget Activity: Strategic Programs #3

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimate Costs
	TOTAL FOR PROGRAM ELEMENT	0	3,786	2,570	4,295	Continuing	Not applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:

The PAVE PAWS Sea Launched Ballistic Missile (SLBM) early warning system is being expanded [

] The expansion will consist of two new PAVE PAWS phased array radars, one each in the SE and SW. These will complement the two sites now in operation at Otis AFB, MA and Beale AFB, CA; and will complete the planned four-site system.

(U) BASIS FOR FY 1983 RDT&E REQUEST:

Funds requested in FY 83 will allow us to award a contract and begin deployment of the Southeast site. FY 83 will support hardware development, new software generation and program office management support.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated costs

RDT&E: The Air Force did not request funds for this project in FY 82, but the Congress added $3.8M of RDT&E funds to the FY 82 appropriation.
Procurement: No procurement funds were added in FY 82

(U) OTHER APPROPRIATION FUNDS:

Procurement (Other)	0.0	0.0	69,433	113,981	Continuing	Not applicable

Program Element: #12432F
DoD Mission Area: Strategic Surveillance & Warning, # 332

Title: PAVE PAWS Expansion
Budget Activity: Strategic Programs #3

(U) DETAILED BACKGROUND AND DESCRIPTION:

Initial action to deploy a PAVE PAWS Phased Array SLBM detection and warning system began in 1973 when the Secretary of Defense directed the Air Force to develop and deploy a system which would counter the [ ]

The first new PAVE PAWS site at Otis AFB MA was completed in 1980 and the second site at Beale AFB CA became operational in 1981. Upon final Air Force acceptance of the Otis and Beale sites, all of the 474L sites, except one, were closed. The FSS-7 radar at the MacDill AFB, FL remained on the air to [ ]

The first two PAVE PAWS sites were designed to detect and provide warning of a [ ] The sites track primarily the rocket bodies of the missiles and thus provide tactical warning and very limited attack assessment information. They can also track [ ] thus providing some additional attack assessment information late in a raid. The two initial sites each have the built-in potential for growth by 10db of power aperture product. This growth, if exercised, would substantially improve their attack assessment capability.

The existing SLBM detection and warning system consists of the Otis and Beale PAVE PAWS, the MacDill FSS-7, the PARCS radar in North Dakota and the FPS-85. [

(U) The proposed two new sites will close these warning gaps in the SE and SW and provide significantly improved tactical warning and attack assessment. In addition, when the SE site is fully grown to the 10db configuration it can assume the NORAD space tracking mission now being done by the FPS-85. This will allow us to close that site along with the MacDill site.

(U) RELATED ACTIVITIES:

The PAVE PAWS SLBM Early Warning System is part of the national system for Tactical Warning and Attack Assessment. It provides confirmation of initial launch detection information provided by the [ ] and complements the information provided by the Ballistic Missile Early Warning System (BMEWS), Aircraft surveillance and Warning Systems and NORAD Space Detection and Tracking System. PAVE PAWS data is provided directly to NORAD and the National Military Command Center, and the Strategic Air Command Command Center and to other users via the North American Air Defense Command (NORAD) 427M system and World Wide Military Command and Control System. (WWMCCS)

Program Element: #12432F
DoD Mission Area: Strategic Surveillance & Warning, # 332

Title: PAVE PAWS Expansion
Budget Activity: Strategic Programs #3

(U) WORK PERFORMED BY: Air Force Systems Command, Electronic Systems Division, Bedford, MA in conjunction with NORAD/ Aerospace Defense Command. The Aerospace Defense Center, Strategic Air Command, and Air Force Communications Command. General system engineering will be provided by the Mitre Corporation of Bedford, MA. Completion will be solicited for the building of the two new sites. However, the new sites will be very similar to the first two, and Raytheon Corp. of Wayland, MA, which was the prime contractor for the Otis and Beale sites, may be the only respondent.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: None

2. (U) FY 1982 Program: RDT&E funds added to the FY 82 budget by Congress will be used to re-establish a PAVE PAWS System Program Office to prepare a detailed solicitation to industry and to select a contractor for a planned early FY 83 start on actual site deployment. Funds will also be used for long-lead-time development support, such as final site selection and environmental impact analysis. Preliminary sites selected are Robbins AFB, GA and Goodfellow AFB, TX.

3. (U) FY 1983 Planned Program: In FY 83 we will award a contract and begin construction of the Southeast site.

4. (U) FY 1984 Planned Program: Begin deployment of a Basic Southwest PAVE PAWS site, and upgrade the Southeast site by 6db.

5. (U) Program to Completion: In FY 85 the SE site will be upgraded to its full 10db configuration. IOC for the SE site is expected in early FY 86 and the SW site in early FY 87. Once the 10db SE site is accepted by the using command, the FPS-85 radar at Eglin AFB FL will be closed resulting in an operations and maintenance savings and avoidance of the cost of modernizing the 1960 vintage FPS-85 radar.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12433F/31357F

Title: Integrated Operational NUDETS Detection System (IONDS)

DoD Mission Area: Strategic Surveillance and Warning, #332
General Defense Intelligence Programs, #312

Budget Activity: Strategic Programs, #3
Intelligence and Communications, #5

(U)RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
31357F		0	4,500	1,926	1,099	Continuing	Not Applicable
12433F		4,000	6,974	19,885	9,470	Continuing	Not Applicable

(U)BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Development of an Integrated Operational Nuclear Detonation Detection System (IONDS) is being pursued in this element. The IONDS is being developed to provide a capability to detect, locate, and report in near real time tactical nuclear detonations on a global basis. IONDS will provide data to satisfy [ ] The program plan calls for sensors on [ ] and NAVSTAR Global Positioning System (GPS) satellites and ground readout and display equipment for several users: the National Command Authorities, commanders of theaters and unified/specified commands, Air Force Technical Applications Center, and others as may be designated. [ ] support are the primary wartime benefits of data derived from the IONDS sensor network.

(U)BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program will support integration of IONDS sensors on NAVSTAR Global Positioning System (GPS) satellites and continues development of a prototype user terminal, a satellite-to-satellite data crosslink, and an [ ] sensor. The data crosslink will assure transmission of IONDS data in near real time on a global basis and the [ ] sensor will improve IONDS location accuracy to provide a [ ] strike/damage assessment capability.

(U)COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

		FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
31357F	RDT&E	11,953	4,500	2,047			
	Msl Proc		16,435	22,526			
12433F	RDT&E	4,000	7,000	2,900			
	Other Proc			11,300			

(U)OTHER APPROPRIATION FUNDS:

		FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Missile Procurement	(PE 31357F)	16,435	22,455	20,638	Continuing	Not Applicable
Other Procurement	(PE 12433F)			21,253	Continuing	Not Applicable

Program Element: #12433F/31357F

DoD Mission Area: Strategic Surveillance and Warning, #332
General Defense Intelligence Programs, #312

Title: Integrated Operational NUDETS Detection System (IONDS)

Budget Activity: Strategic Programs, #3
Intelligence and Communications, #5

DETAILED BACKGROUND AND DESCRIPTION: The U.S. nuclear detonations (NUDETS) reporting system is comprised of sensors and reporting elements which were developed primarily for technical intelligence reporting. The effectiveness of these systems in reporting NUDET events during limited or general war will degrade rapidly during the opening phases of an attack. The objective of this program is to remove deficiencies resulting from Soviet technological advances and limitations inherent in current U.S. surveillance systems. A study was performed in FY 1975 by Air Force Systems Command, with Strategic Air Command, Aerospace Defense Command, and Air Force Technical Applications Center (AFTAC) participation, to evaluate current systems and determine sensor capabilities required to provide the National Command Authorities (NCA) information on which to base the selection of appropriate trans attack responses and to support effective strategic force management during all phases of a nuclear conflict. The study concluded that a highly survivable nuclear detonation system is required to enhance the ability of the NCA and theater commanders to assess the nature of attacks on the Continental United States and on our overseas forces. A [ ] space based nuclear detonation detection and diagnostic system exists today. This system consists of radiation detection sensors on [ ] satellites, bhangmeters on other program satellites, and ground elements of the [ ] and the Satellite Control Facility. Bhangmeters will be deployed on [ ] satellites as replacement satellites are required. Of the current systems, the [ ] provides [ ] NUDET detection and location data to the NCA, designated Commanders-in-Chief, and other users. [ ] Current space assets will be combined with additional resources, where practical, to partially satisfy NCA and theater NUDET surveillance requirements, while continuing to provide limited data for [ ] The IONDS system, as planned, will consist of improved sensors on [ ] and sensors on Global Positioning System (GPS) satellites with ground/airborne readout and processing equipment for the system users. In FY 1976 a contracted effort, by Ford Aerospace and Electronics Co., evaluated parametrically how best to accomplish the IONDS requirements and then produced a system design definition. Concurrently, a contract with Rockwell International defined the GPS interface modification requirements to support IONDS. Rockwell International completed the contract to identify specific interface and subsystem designs for IONDS and performed testing to validate that there would be no mission impact on GPS satellites incorporating IONDS subsystems.

RELATED ACTIVITIES: Development of the IONDS was previously pursued under Program Element (P.E.) 12433F in FY 1978 and P.E. 63435F in FY 1979 and FY 1980. NUDET sensors are currently deployed on [ ] and improved sensors will be deployed on those satellites as IONDS becomes operational. As an interim step in achieving the IONDS full operational capability, sensors were deployed on satellites of the [ ] starting with the [ ] satellite launch in [ ] IONDS sensors are planned for deployment on GPS (P.E. 64778F) as early as the launch of the refurbished Qualification Test Vehicle in FY 1982. Development and production of the NUDET sensors for IONDS/GPS is being funded by the Department of Energy with support from [

Program Element: #12433F/31357F

Title: Integrated Operational NUDETS Detection System (IONDS)

DoD Mission Area: Strategic Surveillance and Warning, #332
General Defense Intelligence Programs, #312

Budget Activity: Strategic Programs, #3
Intelligence and Communications, #5

(U)WORK PERFORMED BY: Development and procurement s accomplished by Hq Space Division, Los Angeles, Ca with the assistance of the Air Force Technical Applications Center, Patrick AFB, Fl. Rockwell International, Downey, Ca completed preliminary Global Positioning System/IONDS interface studies during FY 1976 and is currently under contract to integrate IONDS sensors on GPS atellites. Ford Aerospace and Electronics Co., Palo Alto, Ca performed System Definition Studies in FY 1976 and is continuing to provide systems engineering support. Sandia Corporation, Albuquerque, NM will develop and produce the nuclear detonations sensors.

(U)PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U)FY 1981 and Prior Accomplishments: In response to an evolving requirement for an increased NUDET detection capability, an IONDS/NAVSTAR GPS study was performed by the NAVSTAR GPS payload contractor under Project 2124 of P.E. 63424F in FY 1975. This study concluded that a relatively simple sensor package could be accommodated within the weight, power, and physical constraints of the predicted GPS Phase II satellites. In FY 1976 Ford Aerospace and Electronics Co. conducted a contracted study to parametrically explore feasible alternatives to performing the IONDS task. This study also sized the system and produced a preliminary design definition. Also in FY 1976, Rockwell International conducted a study to further define the IONDS/GPS interface requirements. A study was also performed to define performance and costs for a change to the GPS launch vehicle if one is required because of increased weight from the incorporation of secondary payloads on the GPS Phase II satellites. Contract work with Rockwell continued in FY 1977 to modify the GPS Development Test Vehicle to include the IONDS payloads and perform integrated functional and electromagnetic compatibility tests at the spacecraft level. This effort was time phased to be completed prior to the generation of the GPS Request for Proposal for the FY 1979 buy of satellites. Integrated functional and thermal vacuum tests using qualification model sensors have been performed. During FY 1978 a single channel IONDS receiving terminal was delivered by Ford Aerospace and specifications for the prototype operational receiving terminal (8 channel/8 satellite) were developed. During FY 1979 a positive decision was made relative to the incorporation of an IONDS flight payload on the GPS Qualification Test Vehicle (QTV) satellite. With that decision, integration of the IONDS payload onto the QTV was initiated and tests performed. Long lead items were procured for inclusion of IONDS on GPS satellites to be purchased in FY 1979.

During FY 1979, qualification testing of the IONDS payload on the GPS QTV was completed. Based upon these and prior test results, the decision to deploy IONDS on the full GPS constellation was made at the GPS Defense Systems Acquisition Review Council II in June 1979. The IONDS program was transferred to the General Defense Intelligence Program early in FY 1980 with the new program element 31357F. This transfer was recommended by OMB, supported by Air Force Intelligence, and agreed to by the Secretary of Defense in December 1979. The Director of Central Intelligence identified funding to support integration of the IONDS sensors on the GPS satellites. Design changes for the incorporation of IONDS on the GPS Phase II satellites were developed and modifications were made on unlaunched

Program Element: #12433F/31357F

DoD Mission Area: Strategic Surveillance and Warning, #332
General Defense Intelligence Programs, #312

Title: Integrated Operational NUDETS Detection System (IONDS)

Budget Activity: Strategic Programs, #3
Intelligence and Communications, #5

satellites, as required. Program element 12433F was reactivated to support development of the data cross-link subsystem, the EMP sensor, and development of the receiving terminal. The terminal will be designed to be compatible with the E-4B and EC-135 airborne command posts and ground based command centers.

2. (U)FY 1982 Planned Program: A competitive selection of a contractor for development of the IONDS operational ground/airborne receiving terminal will be made and a contract awarded the winner in FY 1982. Preparations will continue for launch of IONDS sensors on GPS Phase II satellites, beginning late in the fiscal year. Development of the data cross-link will be completed during this year.

3. FY 1983 Planned Program: User terminal development will continue as will launch of an IONDS sensor to complete launch of the Phase II block of satellites. Procurement and integration of cross-link units will be incorporated with the IONDS sensor units on each satellite. FY 1983 funding increase over last year supports further development of a satellite-to-satellite data crosslink, an [ ] sensor for [ ] strike/damage assessment, and engineering design of user terminal interfaces with EC-135 and E-4B command post aircraft.

4. (U)FY 1984 Planned Program: Testing of the IONDS prototype terminal on an EC-135 will be completed. Procurement of operational user terminals will continue, with delivery for aircraft integration planned for FY 1985. Integration of IONDS sensors onto NAVSTAR GPS operational satellites will continue.

5. (U)Program to Completion: This is a continuing program. Design and development activities are keyed to the GPS schedule. The Initial Operational Capability (IOC) will be achieved when 12 IONDS configured GPS satellites are on orbit.

6. (U)Milestones: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12450F
DoD Mission Area: Space Defense, #123

Title: Space Defense Operations (Antisatellite)
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
-	TOTAL FOR PROGRAM ELEMENT	14,433	1,096	6,470	2,902	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is the companion program to the antisatellite (ASAT) development effort funded under Program Element (PE) 64406F, Space Defense Systems (Antisatellite) and provides for the operational deployment of the production ASAT capability. This requires the production of ASAT interceptors, modification of aircraft and the procurement of special handling and test equipment. In addition, RDT&E funding is required for development of training aids and manuals, transition of test software to operational formats and support of Initial Operational Test and Evaluation efforts.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Operational unique studies and trade-offs will continue and Prototype Miniature Air-Launched System operational deficiencies will be investigated and solutions developed. Cost estimates are based on System Program Office analyses and contractor cost proposals.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	14,508	1,100	2,100	-	0	

(U) OTHER APPROPRIATION FUNDS:

-Missile Procurement	0	0	0	32,600	Continuing	Not Applicable

THIS PAGE IS UNCLASSIFIED

Program Element: #12450F | Title: Space Defense Operations
DoD Mission Area: Space Defense, #123 | Budget Area: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: Baseline planning for the initial Air Force nonnuclear antisatellite (ASAT) capability envisions deployment of] modified F-15 air-defense interceptors at [ ] stateside bases. These F-15's will serve jointly as air-defense interceptors and ASAT carrier aircraft. Preliminary planning calls for procurement of in excess of] Prototype Miniature Air-Launched Systems (PMALS) ASAT missiles to support operational deployment. Prior to Initial Operational Capability (IOC), special support and test equipment unique to the ASAT mission must be designed and developed. Training programs and technical publications to prepare the operating command to assume responsibility for the weapon system will be developed. A combined development test and evaluation and Initial Operational Test and Evaluation (IOT&E) effort is planned and will require engineering and technical support from the development agency and contractors. As development test results are available, minor changes in ASAT design may be required. RDT&E funding in this Program Element (PE) will support design modifications of the ASAT to an operational configuration. Finally, ASAT computer software modifications dictated by flight-test results will be funded within this PE.

(U) RELATED ACTIVITIES: This program supports Space Defense Systems, PE 64406F, and other program elements in the Space Defense Systems Program: PE 63428F, Space Surveillance Technology; PE 63438F, Satellite Survivability; PE 12424F, SPACETRACK; PE 12311F; North American Air Defense Command Combat Operations Center.

(U) WORK PERFORMED BY: This program is managed by Air Force Systems Command Space Divison, Los Angeles, CA. Primary contractors are Vought Corporation, Grand Prairie, TX and Boeing Aerospace Corporation, Seattle, WA. Aerospace Corporation, El Segundo, CA provides technical support. Aircraft modifications will be contracted to McDonnell Douglas Aircraft Corporation, St. Louis, MO.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Operational unique studies and trade-offs have been conducted for the PMALS mission. This includes correction of operational-related deficiencies uncovered during the PMALS development.

2. (U) FY 1982 Program: PMALS operational-related deficiencies will continue to be investigated and trade-offs developed.

3. FY 1983 Planned Program: [

] The increase in FY 1983 funding relative to amount shown in FY 1982 Descriptive Summary reflects transfer of funds within this Program Element from Aircraft Modification account to RDT&E for modification of test aircraft.

4. FY 1984 Planned Program: PMALS [

]

5. (U) Program to Completion: RDT&E support will continue as required.

6. Milestones: Initial Operational Capability (IOC): [ ] (See PE 64406F for additional Milestones).

Program Element: #12450F
DoD Mission Area: Space Defense, #123

Title: Space Defense Operations
Budget Activity: Strategic Programs, #3

7. (U) Resources: Not applicable

8. (U) Comparison with FY 1982 Budget Data: Not applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 33131F   Title: Minimum Essential Emergency Communications Network (MEECN)
DOD Mission Area: Strategic Communications, #333   Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	Total for Program Element	14,780	45,429	49,606	39,993	Continuing	Not applicable
2832	VLF/LF Improvements	14,780	32,300	39,214	27,270	Continuing	Not applicable
2834	Proliferated Groundwave Communications System		10,000	8,000	7,000	5,700	30,700
2833	Adaptive High Frequency Communications		3,129	2,392	5,723	24,540	37,029

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This element is the Air Force portion of a continuing program supporting the Chairman, Joint Chiefs of Staff, who is responsible for delivery of decisions of the National Command Authority in a precise and timely manner to [ ] Current emphasis is on improved command and control communications in the very-low-frequency, low-frequency, and high-frequency bands to improve survivability, endurability, and performance under adverse nuclear and jamming conditions.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds to continue the development of several communications systems. In the low-frequency regime, development of a system of proliferated relay stations will continue, with the primary early objectives being establishment and testing of a prototype network and then its expansion into a "thin-line" network spanning the continental United States. FY 83 funds will also be applied to the development of a new generation of high-frequency radio equipment. A system concept is envisioned where radios will be "programmed" to maintain connectivity with a minimum of operator attention. In the very-low-frequency and low-frequency category, upgrades to our current Survivable Low Frequency Communications System (487L) will be undertaken. These include a new receiver for bomber aircraft and an automatic message processing capability to be incorporated into our current receiver systems in ground command centers, missile launch control facilities, and airborne command posts. This capability will reduce errors in critical data messages which will extend the range of acceptable performance. The funding amounts requested are based in part on forecasts to complete development already under contract, in part upon engineering estimates, and in part upon parametric studies by Air Force cost analysts.

Program Element: # 33131F   Title: Minimum Essential Emergency Communications Network (MEECN)
DOD Mission Area: Strategic Communications, #333   Budget Activity: Strategic Programs, #3

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	14,352	45,600	TBD	Not Applicable	Continuing	Not Applicable
Procurement (Other)	-	-	TBD	Not Applicable	Continuing	Not Applicable
Procurement (Aircraft)	-	11,900	TBD	Not Applicable	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Other)				89,935	Continuing	Not Applicable
Procurement (Aircraft)						
PE 11142F		(12,500) 1/	(14,700)	(17,200)	Continuing	Not Applicable
PE 11312F				(2,700)	Continuing	Not Applicable

1/ Parentheses indicate that funding is in program elements other than 33131F.

Project: #2832 Title: VLF/LF Improvements
Program Element: #33131F Title: Minimum Essential Emergency Communications Network (MEECN)
DOD Mission Area: Strategic Communications, #333 Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The Minimum Essential Emergency Communications Network consists of systems specifically designed to

Communications in the very-low-frequency and low-frequency regions of the spectrum have attributes useful in strategic communications. These include low ambient propagation loss, significant penetration of sea water, and relatively good performance in a nuclear disturbed environment. This project consists of improvements to our existing very-low-frequency/low-frequency communications system to extend range, improve resistance to jamming and nuclear effects, and increase message accuracy at all ranges. The system consists of (1) airborne transmitters and receivers in EC-135 and E-4 airborne command post aircraft; (2) transmitters and receivers at fixed ground locations at Silver Creek, Nebraska, and at Hawes, California; and (3) receivers at Strategic Air Command wing command posts, intercontinental ballistic missile launch control centers, and northern area radio relay sites. The system improvements are based upon validated requirements of the Strategic Air Command and the other Single Integrated Operational Plan Commanders-in-Chief, system deficiencies as reported by the Defense Communications Agency, and priorities of the Joint Chiefs of Staff.

(U) RELATED ACTIVITIES: This program is coordinated with work by the Defense Communications Agency, Navy, and Army in complementary portions of the Minimum Essential Emergency Communications Network Program Element 33131. Modification funding for installation of the system improvements is contained in PE 11142, KC-135 Squadrons, and in PE 11312F, Post Attack Command and Control System. Demodulators to provide jamming resistance were procured with FY 1979 and FY 1980 funds, and these demodulators will be installed in missile launch control centers using funds programmed in PE 11213F, Minuteman Squadrons.

(U) WORK PERFORMED BY: Electronic Systems Division located at Hanscom Air Force Base, Massachusetts, has managerial responsibility for the Research, Development, Test, and Evaluation, with support from the Rome Air Development Center, Air Force Logistics Command, Strategic Air Command, and other Air Force major commands. Supporting contractors are Westinghouse Electric Corporation, Defense and Electronic Systems Center, Baltimore, Maryland (jam-resistant modulators/demodulators and high-power (100-kilowatt) airborne transmitter for EC-135 aircraft); Spears Associates, Norwood, Massachusetts (horizontally polarized airborne receive antenna); Sonicraft, Incorporated, Chicago, Illinois (diversity reception equipment); and Analytical Systems Engineering Corporation, Burlington, Massachusetts (system engineering support),

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Development of jam-resistant modulators and demodulators was completed in August, 1978 and a production contract was awarded to Westinghouse in November, 1978. Subsequently, the Silver Creek, Nebraska and Hawes, California, fixed transmitter sites were modified and the E-4B National Emergency Airborne Command Post and EC-135 airborne command post modification programs were initiated. A 200-kilowatt

Project: #2832 Title VLF/LF Improvements
Program Element: #33131F TITLE: Minimum Essential Emergency Communications Network (MEECN)
DOD Mission Area: Strategic Communications, #333 Budget Activity: Strategic Programs, #3

amplifier was also installed in the E-4B aircraft by the Boeing Company, Seattle, Washington. Two feasibility models of 100-kilowatt transmitters were fabricated and tested at ground installations, with the development of modification kits to install 100-kilowatt transmitters on the EC-135 aircraft as the ultimate objective. A contract was awarded to Westinghouse Electric Corporation in October, 1979 for full scale development of these high-power transmitters. This development will improve connectivity with ground, sea, and airborne elements of the Air Force, Navy, and Army supporting the Minimum Essential Emergency Communications Network. The Preliminary Design Review and the Critical Design Review were completed in 1980. Development of the high-power transmitter continued during FY 1981. Airborne tests of propagation of the horizontally-polarized component of very-low-frequency signals were conducted in 1976-1978 and revealed that significant jam-resistance and range improvements are possible by (a) using antennas oriented to receive the horizontally-polarized signal components, (b) automatically combining the horizontally-polarized signals with the currently-received vertically-polarized signals, and (c) producing composite messages automatically by combining the result of the two polarized inputs with repeated transmission of the same message. A contract was awarded in July, 1980, for full-scale development of the horizontally-polarized antenna, and plans were made during 1980 for full-scale development of Diversity Reception Equipment to do the automatic combining and signal processing of the two polarized signals and the message repetitions described above. During FY 1981, the Preliminary Design Review and the Critical Design Review for the horizontally-polarized antenna were completed. A preliminary contract was awarded to a disadvantaged, small business contractor (Sonicraft, Incorporated) for structuring the Diversity Reception Equipment development program. The full-scale development will be conducted through the Small Business Administration.

(2) FY 1982 Program: Development and testing will be completed for the horizontally polarized antenna and the 100-kilowatt transmitter. Full scale development will begin on the Diversity Reception Equipment and on a new miniaturized receiver for installation on bomber aircraft. Receivers on bombers will permit direct reception of emergency action messages being transmitted by EC-135 and E-4 airborne command posts. Analyses have indicated that a[ ]

(3) (U) FY 1983 Planned Program: Primary efforts during FY 1983 will be continuation of the full-scale development of the Diversity Reception Equipment under the auspices of the Small Business Administration and continuing of the validation phase of the development program for bomber receivers.

4. (U) FY 1984 Planned Program: The validation phase of the bomber receiver terminal will be completed during FY 1984 and the program will transition into full-scale development. The Critical Design Review is scheduled for the Diversity Reception Equipment.

5. (U) Program to Completion: The development programs for the bomber receiver and the Diversity Reception Equipment will be completed; however, this is a continuing program which must assure that a high probability of successful communications to strategic forces is maintained as the threat to such communications evolves.

Project: #2832 Title: VLF/LF Improvements
Program Element: #33131F Title: Minimum Essential Emergency Communications Network (MEECN)
DOD Mission Area: Strategic Communications, #333 Budget Activity: Strategic Programs, #3

6. (U) Milestones: Not applicable

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	14,780	32,300	39,214	27,270	Continuing	Not Applicable
Procurement (Other)				1,175	Continuing	Not Applicable
Procurement (Aircraft)						
PE 11142F		(12,500) 1/	(14,700)	(17,200)	Continuing	Not Applicable
PE 11312F				(2,700)	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: 2/

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	14,352	32,200	TBD	Not Applicable	Continuing	Not Applicable
Procurement (Other)			TBD	Not Applicable	Continuing	Not Applicable
Procurement (Aircraft/PE11142F)		11,900	TBD	Not Applicable	Continuing	Not Applicable

Notes: 1/ Parentheses indicate that funding is in program elements other that 33131F.

2/ This project was not identified by number separately from the others in this program element at the time the FY 1982 Descriptive Summary was prepared.

Project: #2834 Title: Proliferated Groundwave Communications System
Program Element: #33131F Title: Minimum Essential Emergency Communications Network (MEECN)
DOD Mission Area: Strategic Communications, #333 Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The Minimum Essential Emergency Communications Network consists of systems specifically designed to [ ] Communications in the low-frequency region of the spectrum have attributes useful in strategic communications. These include low ambient propagation loss and relatively good performance in a nuclear disturbed environment. This project will define, develop, test, and deploy a proliferated groundwave communications system. The purpose of this system is to provide US strategic forces with the ability to maintain critical CONUS long range command and control communications connectivity despite disruptions induced by physical damage as well as ionospheric disturbances caused by nuclear detonations in the trans-attack phase. Survivability for this system is provided primarily by proliferated relay nodes, using unmanned, EMP-hardened, jam-resistant, groundwave, radio equipment collocated with existing commercial/government broadcast towers where feasible. Strategic force commanders and units (equipped with EMP-hardened, jam-resistant, secure radio equipment) interact with nearby relay nodes for participation in the overall network. The Proliferated Groundwave Communications System program will be structured to provide survivable and enduring connectivity for tactical warning, positive control launch of the bomber forces, emergency action message (EAM) dissemination to CONUS commanders and forces [ ] of a nuclear conflict and to serve as an orderwire for [ ] strategic forces [ ]

(U) RELATED ACTIVITIES: A proof of concept demonstration will be conducted by the Air Force Weapons Laboratory under Program Element 64711F System Survivability.

(U) WORK PERFORMED BY: Electronic Systems Division, Hanscom AFB, Massachusetts will be responsible for monitoring contractual effort to acquire this system. The Joint Strategic Connectivity Staff is developing the Operations Concept. The Air Force Weapons Laboratory and Defense Communications Agency will provide technical support.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable.

2. (U) FY 1982 Program: The proof-of-concept demonstration being conducted by the Air Force Weapons Laboratory will be expanded by the addition of a fourth station. This will permit early investigation of automated diverse routing technology. A system definition effort will be conducted and acquisition of equipment made for a prototype network of relay nodes and strategic terminal equipment. The prototype system will include all major system characteristics except for jam-resistance and COMSEC; however, provisions will be made to permit retrofit with these capabilities.

3. FY 1983 Planned Program: Installation of the prototype system will be completed by the [ ] Planning will be conducted for installation in FY 1984 of additional relay and terminal equipment.

Project: #2834 Title: Proliferated Groundwave Communications System
Program Element: #33131F Title: Minimum Essential Emergency Communications Network (MEECN)
DOD Mission Area: Strategic Communications, #333 Budget Activity: Strategic Programs, #3

4. FY 1984 Planned Program: Initial operational capability (IOC) will be achieved in [ ] Provisions will be made to permit follow on retrofit with COMSEC and antijam capabilities.

5. Program to Completion: Final operational capability will be achieved by the proliferation of additional relay nodes until sufficient alternative paths are available[ ] The system will be retrofitted with jam-resistance and COMSEC capabilities.

6. (U) Milestones. Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		10,000	8,000	7,000	5,700	30,700
Procurement (Other)				88,760	TBD	N/A

8. (U) Comparison with FY 1982 Descriptive Summary: 1/

RDT&E		10,000	-	-	-	-

1/ Note: This project was not identified by number separately from the others in this program element at the time the FY 1982 Descriptive Summary was prepared.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33152F
DOD Mission Area: 334 STRATEGIC INFORMATION SYSTEM

TITLE: WWMCCS INFORMATION SYSTEM
Budget Activity: 3, STRATEGIC PROGRAMS

(U) RESOURCES:

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	0	6,366	7,287	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: PE includes manpower authorizations, peculiar and common support equipment, necessary facilities and the associated costs for all resources directly associated with, planning, designing, developing, procuring, leasing, programming, operating and maintaining new Automated Data Processing (ADP) facilities for the World Wide Military Command & Control System (WWMCCS) Information System (WIS). The existing WWMCCS ADP System, which was acquired in the early 1970s is rapidly becoming obsolete and increasingly difficult and uneconomical to maintain and operate. Modernization/replacement of the Honeywell ADP as well as revision of existing reporting procedures is needed to provide a responsive command and control system for the National Command Authority, the Joint Chiefs of Staff (JCS) and the Commanders in Chief (CINC).

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds for the support of the requirements definition study, associated with WIS transition at AF sites. Includes funds for system engineering, architectural definition and initiation of system design specifications. Fund estimate is based on efforts conducted by similar program offices.

(U) COMPARISION WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Procurement	Continuing	Not Applicable
Military Construction	Continuing	Not Applicable
Operation and Maintenance	Continuing	Not Applicable

Program Element: #33152 F
DOD Mission Area: 334 STRATEGIC INFORMATION SYSTEM

Title: WWMCCS INFORMATION SYSTEM
Budget Activity: 3, STRATEGIC PROGRAMS

(U) DETAILED BACKGROUND AND DESCRIPTION: WIS is a modernization effort aimed at replacing existing WWMCCS ADP Honeywell equipment. The new system will provide interactive, on-line, state-of-the-art technology to the National Command Authorities, JCS, the CINCs, as well as other designated users. The new system will provide an Automated Message Handling capability as well as a "friendly" man-machine interface.

(U) RELATED ACTIVITIES: PE 33151F, funds the current WWMCCS ADP system within the AF. PE 33152F will fund for the procurement of all WIS ADP for the AF in the 1986-1990 time frame and also for the development of the joint portions of the WIS. PE 63735 identifies additional R&D funds for WIS transition efforts, in support of AF sites.

(U) WORK PERFORMED BY: The AF effort, is managed by Electronic Systems Division Hanscom AFB, Ma.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Program: Not Applicable

3. (U) FY 1983 Planned Program: Funding will continue the planning and technical support for an interface with the WIS Joint Program Manager (JPM). The JPM is tasked with developing the joint portions of the WIS. Assessments will be made concerning the potential impact of these WIS activities on the AF sites. Funding will provide for accomplishment of schedules and planning efforts in support of HQ USAF programmatic and budgetary actions. Funding will also permit the WIS JPM to perform overall system engineering and architecture refinement necessary for the WIS program acquisition. Detailed System Specification for the Resource and Unit Monitoring (RUM), Conventional Planning and Execution (CP&E), and associated elements of the Nuclear Planning and Execution application sofware program will be initiated. Design Specifications for the WIS Command Information Support (CIS) element will be completed and initial prototype development will be started. Selective site protoype/pilot developments will be undertaken and evaluated. Interface control specifications and requirements analysis efforts shall be continued. Management and integration of the current system upgrade will continue.

4. (U) FY 1984 Planned Program: The FY 84 WIS development efforts will be concentrated in the development of the CIS prototype system and full scale development of the detailed specifications for RUM and CP&E applications software families. Detailed specifications for RUM and CP&E host processors will be developed and an RFP for hardware and support software will be initiated. Competition for development of the RUM and CP&E software will be initiated.

Program Element: #33152 F
DOD Mission Area: 334 STRATEGIC INFORMATION SYSTEM

Title: WWMCCS INFORMATION SYSTEM
Budget Activity: 3, STRATEGIC PROGRAMS

5. (U) Program to Completion: Full-scale development effort to modernize the existing ADP equipment and procedures. Continued R&D to enhance the system and integrate state-of-the-art technology where possible. System design efforts to interface AF unique systems with the WIS.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33601F — Title: Air Force Satellite Communications (AFSATCOM) System
DoD Mission Area: Strategic Communications, #333 — Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	Total for Program Element	25,901	80,114	50,901	29,945	Continuing	Not Applicable
2478	Air Force Satellite Communications	25,901	80,114	50,901	29,945	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program consolidates the development, procurement and installation of the ground, aircraft and satellite communications equipments needed to satisfy critical needs of the National Command Authorities and the military Commanders-in-Chief for reliable, worldwide communications for command and control of the Single Integrated Operational Plan and other designated forces.

(U) BASIS FOR FY 1983 RESEARCH DEVELOPMENT TEST AND EVALUATION REQUEST: Includes funds to continue development of: (1) single channel transponders and associated ground/airborne Emergency Action Message transmit and receive subsystems, (2) operational monitoring aids, (3) hardware and software maintenance tools, (4) the upgrade to missile launch control centers for improved performance in a nuclear environment, (5) improvements for increased resistance to jamming, (6) upgrades to service more users with limited channels, and (7) improvements to connectivity from airborne command posts to nuclear weapons storage sites. Funds are also included for evaluation of airborne relays for contingency restoral of UHF satellite communications. The cost estimates for these efforts were obtained by using in-house cost estimating relationships and contractor estimates.

(U) COMPARISON WITH AMENDED FY 82 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
Research Development Test and Evaluation	31,355	50,100	TBD		Continuing	Not Applicable
Procurement (Missile)	15,454	0	0		Continuing	Not Applicable
Procurement (Other)	27,288	14,140			Continuing	Not Applicable

Project Number: #2478 Title: Air Force Satellite Communications (AFSATCOM) System
Program Element: #33601F Title: Air Force Satellite Communications (AFSATCOM) System
DoD Mission Area: Strategic Communications, #333 Budget Activity: Strategic Programs, #3

(U) OTHER APPROPRIATION FUNDS:

Procurement (Missile)	5,000	0	28,600	31,500	Continuing	Not Applicable
Quantities (Satellite Transponders)	1	0	1	1		
Procurement (Other)*(includes initial spares)	24,175	14,443	10,448	67,240	Continuing	Not Applicable
Quantities (Terminals/Terminal Modifications)	46	8	5/215	75		

Project Number: #2478 | Title: Air Force Satellite Communications (AFSATCOM) System
Program Element: #33601F | Title: Air Force Satellite Communications (AFSATCOM) System
DoD Mission Area: Strategic Communications, #333 | Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The Air Force Satellite Communications System program is an ultra high frequency communications system that provides command and control communications to the National Command Authorities, the Joint Chiefs of Staff, the military Commanders-in-Chief, the nuclear and supportive forces and selected high priority users. The wartime mission of this System is to: (1) disseminate Emergency Action Messages, (2) provide conferencing communications to Commanders-in-Chief from their worldwide locations, (3) direct the forces, (4) report status and (5) terminate hostilities. In peacetime this system is used during training exercises, contingency operations, crisis management, search and rescue, humanitarian missions, and for relay of reconnaissance information and missile testing data. Terminals will be installed in B-52's and FB-111's, in Intercontinental Ballistic Missile launch control centers and in airborne/ground command posts, tankers (KC-10), reconnaissance and surveillance aircraft, and ground based cruise missile launch centers. The space segment consists of multi-channel transponders on the Satellite Data System, Fleet Satellite Communications System and classified host spacecraft. Single channel transponders are being developed for improved assurance of transmitting the Emergency Action Messages to the forces and will be deployed on several host spacecraft including the Defense Satellite Communication System and the Satellite Data System satellites. To achieve the survivable two way, worldwide communications needed to provide command and control through crisis management and all phases of nuclear war, improvements to the Air Force Satellite Communications System are needed. These required improvements are higher availability of service, increased capacity to serve the growing terminal population, and improved electromagnetic and physical survivability. Many different types of communications system candidates were examined to provide these improvements; however, the Defense System Acquisition Review Council approved a new satellite system in January 1979. Initial developmental funding for these new satellites and associated terminal improvements was disapproved by Congress in 1979, 1980, and 1981. In October 1980, the Assistant Secretary of Defense for Communications, Command, Control and Intelligence (ASD/C3I) initiated a joint communications satellite architecture study. As a result, on 16 April 1981, a new communication satellite architecture was approved. This new architecture includes a new strategic/tactical satellite system, to be called MILSTAR, and associated terminals.

To supplement the transponders will be procured within the AFSATCOM program element for integration on host satellites.

(U) RELATED ACTIVITIES: Aircraft terminals are funded in the weapons system program. Approved Air Force users include the following program elements: 11113F, B-52; 11142F, EC- and RC-135; 11115F, FB-111; 32015F, E-4; 27222F, KC-10A; 11212F, Titan; and 11213F, Minuteman Launch Control Centers. The Minuteman and Titan Intercontinental Ballistic Missile programs will integrate the satellite terminals into the launch control facilities. Additional users include the Navy TACAMO Program and Army Nuclear Weapons Storage Sites. Program Element 6343.F, Advanced Space Communications, provides centralized planning for improved satellite communications and develops and demonstrates technology to increase the reliability and survivability of space communications. That technology is transferred to this Program for operational development. Program Element 33110F, Defense Satellite Communications System, funds host spacecraft and will fund and procure the single channel transponders in FY 1982. The Satellite Data System, Program Element 35158F, and Program Element 33109N, Navy Satellite Communications, are the major satellite systems hosting Air Force Satellite Communications System equipment. Additional Fleet Satellite Communications satellites are programmed in PE 33109N.

Project Number: #2478 Title: Air Force Satellite Communications (AFSATCOM) System
Program Element: #33601F Title: Air Force Satellite Communications (AFSATCOM) System
DoD Mission Area: Strategic Communications, #333 Budget Activity: Strategic Programs, #3

(U) WORK PERFORMED BY: The Air Force Satellite Communications System is managed by the Space Division, Los Angeles Air Force Station, CA. Support facilities include the Camp Parks, CA, Satellite Test Facility. The transponders on the Satellite Data System are built by Hughes Aircraft Company, EL Segundo, CA, and on the Fleet Satellite Communications System by TRW INC, Redondo Beach, CA. The terminal development/production is managed by the Electronics Systems Division, Hanscom AFB, MA. Terminal development was conducted by the Collins Telecommunications Products Division of Rockwell International, Cedar Rapids, IA. Terminal production is managed by the Collins Communications Systems Division of Rockwell International, Newport Beach, CA. System modems are produced by LINKABIT Corp, La Jolla, CA. The transponders that will be deployed on the Defense Satellite Communications System spacecraft were developed by General Electric, Valley Forge, PA. Federal Contract Research Center support is provided by the Aerospace Corporation, Los Angeles, CA; MITRE Corporation, Bedford, MA and Lincoln Laboratory, Lexington, MA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Initial Operational Test and Evaluation was completed in October 1975 using a host transponder in polar orbit and pre-production terminals. A terminal production decision was received on 30 June 1976 and delivery of airborne and command post terminals began in July 1978. [

Fleet Satellite Communications System satellites were launched successfully in February 1978, May 1979, January and October 1980. The fifth Fleet Satellite Communications satellite, launched on 6 August 1981, failed to achieve operational status. Interfaces between this system and other command and control systems were developed to assure interconnectivity, and the consolidated ground terminal effort was initiated to reduce the number of major ground terminals required for the system. Initial Operational Capability was achieved in May 1979. Over 300 terminals have been installed in B-52. FB-111, EC/RC-135, and E-4B aircraft and selected ground command posts.

2. (U) FY 1982 PROGRAM: FY 82 funding will continue the multi-year ground terminal consolidation and remoting projects, development of an encryption capability with the National Security Agency, and the multi-year development of the Defense Satellite Communications System Phase III single channel transponder and its message injection subsystem. Production of the ground portion of the single channel transponder injection subsystem will begin. The single channel transponder on the Defense Satellite Communications System spacecraft increases both electromagnetic and physical survivability of Emergency Action Message dissemination. Electromagnetic survivability is provided by higher frequency uplinks and physical survivability is attained by employing multiple transponders. The production of launch control center terminals will be completed. The installation of terminals in B-52, EC-135 and FB-111 aircraft and ground command centers will continue. Components to permit the terminals to use the improved modulation and faster frequency hopping will be developed. Full scale development of capabilities to transmit Emergency Action Messages with improved jam-resistance from command posts, to improve connectivity from airborne command posts to the nuclear weapons storage sites and to improve message reception at the missile launch control facilities will begin. Initial design studies of an airborne relay system for contingency restoral of UHF satellite communications will begin. Terminal installations in B-52H, FB-111, EC-135, and the majority of B-52G, RC-135, command posts, and missile launch control centers will be completed. The results of the Follow-On Operational Test and Evaluation effort will be documented and essential system changes made. Concept validation, risk reduction efforts, and initial research and development will begin on a new multi-mission communications satellite (MILSTAR) to operate at extremely high frequency (EHF).

Project Number: #2478 Title: Air Force Satellite Communications (SATCOM) System
Program Element: #33601F Title: Air Force Satellite Communications (SATCOM) System
DoD Mission Area: Strategic Communications, #333 Budget Activity: Strategic Programs, #3

3. FY 1983 PLANNED PROGRAM: Development of capabilities to improve system jam-resistance, improve connectivity from airborne command posts to the nuclear weapons storage sites in Europe, provide service to more users with limited channels, and improve the receive capability for missile launch control centers will continue. Production of the single channel transponder terminal subsystem will continue and production will begin on the system operational monitoring/maintenance hardware. Terminal installations in B-52G aircraft, missile launch control centers, and RC-135 aircraft will be completed. The Air Force Satellite Communications System ground terminal program will be completed.

4. FY 1984 PLANNED PROGRAM: The development of the more jam-resistant airborne subsystems and improvement to the European airborne command posts will continue. Completion of development and initial procurement of the upgrades to the terminals in the missile launch control centers is planned. Completion of production of the single channel transponder terminal subsystem hardware and system monitoring hardware is also planned.

5. (U) PROGRAM TO COMPLETION: This is a continuing program to provide highly jam resistant and survivable command and control communications for the nuclear capable forces and other high priority users.

o. Milestones:	DATE
A. Development Start	Jan 1973
B. Test and Evaluation Complete	Oct 1975
C. Terminal Production Decision	Jul 1976
D. Terminal Production Start	Dec 1976
E. First Terminal Delivery	Jul 1978
I. Fleet Satellite Communications System (F-1) Launch	Feb 1978
K. Lincoln Experimental Satellites (demonstrated advanced technology)	Mar 1976
L. Mission Element Need Statement	Oct 1978
M. First Strategic Satellite System Defense System Acquisition Review Council I	Jan 1979
O. Fleet Satellite Communications System (F-2) Launch	May 1979
P. Initial Operational Capability Milestone	May 1979
Q. Fleet Satellite Communications System (F-3) Launch	Jan 1980
R. Fleet Satellite Communications System (F-4) Launch	Oct 1980

Project Number: #2478 Title: Air Force Satellite Communications (AFSATCOM) System
Program Element: #33601F Title: Air Force Satellite Communications (AFSATCOM) System
DoD Mission Area: Strategic Communications, #333 Budget Activity: Strategic Programs, #3

Milestones:	Date
T. Fleet Satellite Communications System (F-5) Launch	Aug 1981
V. Full Operational Capability for Air Force Satellite Communications System	Dec 1983

EXPLANATION OF MILESTONE CHANGES

* These are dates when the Satellite Data System payloads are available to be launched. Specific launch dates are dependent upon replenishment requirements.

7. (U) RESOURCES: Not applicable

Program Element: #33601F
Budget Activity: Military Astronautics and Related Equipment, #4

Program Element: 33601F - Air Force Satellite Communications System

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The Air Force Satellite Communications System Terminals were developed by Collins Radio Company, Cedar Rapids, Iowa. The terminals are designed on the modular concept, with capabilities ranging from single channel to simultaneous multi-channel, multiple satellite communications. Increases in capability are achieved by exchanging or adding modules. DT&E was conducted in two phases: (1) on-going in-plant DT&E, and (2) as part of a Combined DT&E/Initial Operational Test and Evaluation (IOT&E) in CY 1975. Special features include high component commonality between airborne and ground terminals as well as between terminals with different capabilities, high reliability and built-in test equipment to isolate faults and permit rapid component replacement. The in-plant DT&E is continuing on additional terminal configurations including component and subsystem qualification and performance testing. Deficiency corrections have been tested both in-plant and at Electronic Systems Division (ESD), Hanscom AFB, MA, for incorporation in the production terminals. The first transponder completed development tests, was integrated on a spacecraft, launched and used for combined DT&E/IOT&E.

2. (U) Operational Test and Evaluation: The Initial Operational Test and Evaluation (IOT&E), managed by the Air Force Test and Evaluation Center (AFTEC), was combined with the Development Test and Evaluation (DT&E). The combined test and evaluation program began on 1 February 1975, and IOT&E was concluded in September 1975. DT&E was extended to verify design fixes for identified equipment deficiencies.

(U) The IOT&E objectives were accomplished in six categories of tests or phases: (1) demonstrations of basic system/terminal functional capabilities; (2) performance tests; (3) network tests; (4) B-52, EC-135 network demonstrations; (5) logistic supportability tests, and (6) RC-135 special operability/compatibility tests. The first test category demonstrated basic operational capabilities and limitations of the system, terminals, and terminal subsystems. The second and third test categories together provided an estimate of effectiveness and suitability of actual AFSATCOM network operation in an operational environment. The fourth test category served to verify that the results of the first three categories were applicable to two specific operational installations. The fifth test category evaluated logistics supportability under conditions approximating those anticipated when the AFSATCOM system becomes operational. The final test category evaluated special RC-135 limited test objectives. As the combined test program progressed from initial periods of largely technical testing, emphasis shifted to operational testing. Technical and operational tests were performed concurrently when such testing could be conducted on a non-interference basis. Airborne technical performance testing provided operational performance data which was correlated with network test data. The IOT&E involved seven test sites (no ranges), six test aircraft, nine pre-production terminals, one satellite and a satellite simulator. Airborne terminals were installed on both test and operational aircraft, while all four ground terminals were used in an operational configuration. Air Force personnel, with formal or on-the-job training, operated the terminals to provide realistic operator/terminal interface evaluations. The number of operators participating during any one test was the

Budget Activity: Military Astronautics and Related Equipment, #4

Program Element: #33601F - Air Force Satellite Communications System

same as that expected during normal operational conditions for that terminal configuration. Trained operators were provided by the Strategic Air Command (SAC), Military Airlift Command (MAC), Air Force Communications Command (AFCC), Electronic Security Command (ESC), 9th Airborne Command and Control Squadron (ACCS) and the 6th ACCS. Contractor personnel were present to perform maintenance.

(U) The sixty-seven deficiencies identified during initial operational test and evaluation (IOT&E) were prioritized by the using commands and provided to the System Program Office for resolution. Sixty-six of these have been corrected and officially closed. The remaining deficiency is an electromagnetic compatibility (EMC) problem between the AFSATCOM terminals and other systems already on-board the B-52 aircraft. The fixes for all deficiencies identified during IOT&E are being evaluated during the follow-on operational test and evaluation (FOT&E.)

(U) On 1 July 1976, the Secretary of the Air Force/Installations and Logistics made a decision to proceed with production provided that fixes for the deficiencies identified during IOT&E were included in the production contract which was subsequently awarded to Rockwell International.

(U) Follow-on operational test and evaluation (FOT&E) on the production terminals began in January 1980. HQ AFTEC is conducting phases I and II of the FOT&E (verification of fixes for IOT&E deficiencies and wideband network performance). HQ SAC will conduct and AFTEC will monitor Phases III and IV (continued evaluation of operational effectiveness and suitability with continually increasing network complexity as more production terminals are fielded). According to the current schedule, Phases I and II will end in June 82, and Phases III and IV in June 83. The FOT&E is being conducted using AFSATCOM transponders on the Satellite Data System and Fleet Satellite Communications System (FLTSATCOM) operational satellites; production terminal equipments installed in B-52, FB-111 and EC-135 aircraft; and operational procedures developed by the using commands. The objectives are to evaluate performance in an operational environment and to verify reliability, maintainability and fixes to deficiencies. The FOT&E is using operational assets employed on normal training missions, to the extent practical. SAC is the primary participant in the test. The operational terminals are being operated and maintained by the appropriate using agency personnel.

(U) Beginning in October 1981, the AFTEC AFSATCOM test team at Offutt AFB conducted a two-month operational assessment of the Single Channel Transponder Injection Subsystem (SCTIS). The SCTIS is the terminal equipment for the AFSATCOM Single Channel Transponder (SCT) on the DSCS III spacecraft. The SCT on the DSCS III satellites has anti-jam improvements that will allow the Emergency Action Messages to be transmitted at Super High Frequency (SHF) from DSCS terminals. The SCTIS equipment at Offutt AFB NE, and Sunnyvale AFS CA was connected by telephone lines to a satellite simulator for the operational assessment. Hardware at Camp Parks Radiometric Station, CA was connected via Lincoln Experimental Satellite Number 9 (LES-9) to the SCTIS equipment at Offutt for transmission of test messages to SAC bombers. Preliminary results of this test indicate the SCTIS equipment performed all of its required functions; however, there are some technical, procedural and technical data deficiencies that will be corrected. The final report from AFTEC is expected in late February 1982.

Budget Activity: Military Astronautics and Related Equipment, #4

Program Element: 33601F - Air Force Satellite Communications System

3. System Characteristics

Characteristics	Objectives	Demonstrated	Demonstrated By
Data rate (Words/Minute)	100	100	Operational Test
Error Rate			Operational Test
Anti-Jam Protection (decibel/watt			Development Test
Air Force Satellite Communications System			
Single Channel Transponder			
Ultra High Frequency		To be determined	Development Test
Super High Frequency		To be determined	Development Test
Mean time between failure	100 to 1,000 hours depending on terminal configuration	Yes	Development Test

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 33603F
DOD Mission Area: Strategic Communictions, #333

Title: MILSTAR SATCOM System
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT			79,784	256,990	Continuing	N/A

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The MILSTAR Satellite Communications System will provide worldwide satellite communications for command and control of tactical and strategic forces of all services. The MILSTAR Satellit System is needed to (1) provide anti-jam communications to a wide variety of strategic and tactical military users (2) achieve survivability and endurance in a nuclear war environment (3) improve connectivity to mobile users and small units (4) [ ] (5) [ ] to tactical/mobile users and (6) improve interoperability amoung service components. MILSTAR is also a major component of a program to [ ] Accordingly, it will include a survivable and enduring mission and network control segment.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds to initiate the Full Scale Engineering Development of a new communications satellite (MILSTAR) and associated airborne terminals for command and control of strategic and tactical forces.

(U) COMPARISON WITH 1982 DESCRIPTIVE SUMMARY: The program is a new start in FY 1983. No descriptive summary was prepared for FY 1982.

(U) OTHER APPROPRIATIONS FUNDS:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
Procurement (Aircraft) (Quantity)					Continuing	N/A
Procurement (Missile) (Quantity)					Continuing	N/A
Procurement (Other) (Quantity)					Continuing	N/A

Program Element: #33603F   Title: MILSTAR SATCOM System
DOD Mission Area: Strategic Communications, #333   Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: MILSTAR will be designed to serve the critical command, control, and communications requirements of the National Command Authority, Air Force, Army, and Navy. MILSTAR will be composed of satellites in geostationary and polar orbits. The satellites will be crosslinked for worldwide coverage and connectivity. The system will be optimized to achieve high anti-jam performance through use of the EHF frequency band (44 Ghz uplink 20 Ghz downlink). Interoperability will be insured through the use of a common transmission format. Survivability and endurance of the space segment will be enhanced over previous systems through the use of [ ] and other techniques which might be necessary to counter an evolving threat. User terminals will be developed and procured by each service to meet mission peculiar needs under the management of a Joint Terminal Program Office. Terminals planned for the Air Force include those for the B-1B, MX, and Airborne and Ground Command Posts. Funding for development of Air Force terminals only is included in this descriptive summary.

DOD has directed that the MILSTAR program is to achieve an [ ] Actions are underway within USAF to determine the amount and types of funding that will be required to accomplish this DOD directed IOC.

(U) RELATED ACTIVITY: Work on the MILSTAR concept will begin in FY 1982 within PE 63431F, the Advanced Space Communications Program ($16M) and within PE 33601F, the Air Force Satellite Communications System Program ($25M). During FY 1982 contractors teams will perform parallel studies to refine the MILSTAR system concept and costs, and prepare the system for Full Scale Engineering Development. In addition, FLTSATCOM vehicle #7 and possibly #8 will incorporate a small EHF package that will be used for test proposes.

(U) WORK PERFORMED BY: The development of the space segment for the MILSTAR system will be managed by the Air Force Systems Command's Space Division, Los Angeles AFS, CA. The airborne terminal segment development will be managed by the Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable.

2. (U) FY 1982 Program: A Concept Validation Study will be conducted using funds from the Advanced Space Communications Program (PE 63431F) and the Air Force Satellite Communications Program (PE 33601F).

3. (U) FY 1983 Planned Program: Planned efforts include the completion of the Concept Validation Study and the beginning of Full Scale Engineering Development for the satellite and the Air Force terminals.

4. (U) FY 1984 Planned Program: Development of the MILSTAR satellite and Air Force MILSTAR terminals will continue with Preliminary Design Reviews occurring in FY 1984. A survivable and enduring mission and network control segment will be a major focus of the FY84 and subsequent year programs.

5. Program to Completion: The remainder of the program will include the completion of the satellite and terminal development phase, test and evaluation, production and deployment of [ ]

Program Element: #33603F

DOD Mission Area: Strategic Communications, #333

Title: MILSTAR SATCOM System

Budget Activity: Strategic Programs, #3

6. Milestones:

Milestones	Date
A. Program Start	April 1981
B. Concept Validation Phase	1982
C. Full Scale Engineering Development Start	1983
D. Directed Interim Operational Capability (IOC)	

(U) EXPLANATION OF MILESTONE CHANGES: N/A

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35158F
DoD Mission Area: Strategic Communications, #333

Title: Satellite Data System
Budget Activity: Strategic Programs, #3

RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
N/A	TOTAL FOR PROGRAM ELEMENT	43,104	28,393	7,886	2,614		

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Satellite Data System is a multi-payload, communications satellite which provides reliable communications The Satellite Data System provides a portion of the coverage required by the Air Force Satellite Communications System for essential command and control communications to our nuclear capable forces. It also provides a high speed link between Air Force Satellite Control Facility remote tracking stations for command and control of national space assets and

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds for completing the multi-year design and development efforts to improve the anti-jam capabilities of the Air Force Satellite Communications System payload. Also included is the multi-year development necessary to produce a Space Shuttle optimized satellite. Sustaining engineering support and the System Program Office, required on a continuing basis, are also included. These estimates are based on contractor proposals and past experience for the sustaining engineering support.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	43,200	29,100	[illegible]5,600		Continuing	Not Applicable
Procurement (MISSILE)	95,500	43,200	161,900		Continuing	Not Applicable
OTHER APPROPRIATION FUNDS:						
Procurement (MISSILE)	95,300	41,770	22,518	10,200		
(Quantity)	([illegible])					
Operation and Maintenance	9,941	11,106	11,750	12,376	Continuing	Not Applicable

Program Element: #35158F | Title: Satellite Data System
DoD Mission Area: Strategic Communications, #333 | Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The Satellite Data System provides critical, real-time command, control, and communications for Strategic Air Command Single Integrated Operational Plan and other nuclear capable forces. It is an integral part of the Air Force Satellite Communications System which also includes the Ultra High Frequency communications capability on the geosynchronous Fleet Satellite Communications satellites, piggy-back transponders on selected host satellites, and airborne/ground radio terminals. As such, the Satellite Data System complements the Fleet Satellite Communications coverage by providing polar coverage which the other satellites cannot provide. The Satellite Data System began an operational Additionally, the Satellite Data System supports the Air Force Satellite Control Facility requirement for reliable, two-way high data rate communications with its remote tracking stations.

The direct benefits of the Satellite Data System are reliable and secure direct communications which will result in greatly improved command and control of our nuclear capable forces, elimination of the dependence on some of the vulnerable Air Force Satellite Control Facility communications, and

RELATED ACTIVITIES: The space segment of the Fleet Satellite Communications System was developed, procured, and launched under the Navy's Program Element, 33109N. The Air Force ground Ultra High Frequency radio terminals needed for operation with the Fleet Satellite Communications and Satellite Data System satellites are funded within the Air Force Satellite Communications System Program Element, 33601F. Terminals installed in aircraft were funded in the specific weapons system/aircraft Program Element. The Air Force Satellite Control Facility network is funded under Program Element, 35110F. Space Shuttle flights for the Satellite Data System satellites are provided by the Space Launch Support Program, Program Element, 35171F. MILSTAR, a new highly jam-resistant satellite is being developed under Program Element, 33603F.

(U) WORK PERFORMED BY: Air Force Systems Command's Space Division, Los Angeles, CA, is responsible for the Satellite Data System. The prime contractor is Hughes Aircraft Company, El Segundo, CA. General Systems Engineering and Integration is performed by the Aerospace Corporation, El Segundo, CA.

Program Element: #35158F | Title: Satellite Data System
DoD Mission Area: Strategic Communications, #333 | Budget Activity: Strategic Programs, #3

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The technology phase of the program was completed in FY 1971. This was followed by a contract definition phase in FY 1972 which established the system configuration. The system acquisition contractor was selected by competitive source selection and a system development contract was awarded in June 1972. The system Critical Design Review was successfully completed in March 1974 with all critical specifications being met or exceeded. The structural model satellite testing was finished in May 1975. A qualification model satellite was built and tested to fully qualify the satellite prior to production. The first satellite was launched on] the second satellite on [All payloads were fully checked out on-orbit. Full operational capability was declared for all payloads in after successful on-orbit checkout. [

] Primary activities in FY 1981 included the continuation of design and development activities associated with improving the anti-jam capabilities of the Air Force Satellite Communications System payload on the seventh satellite (F-6), the continuation of the multi-year development of a Space Shuttle optimized design on the seventh satellite, reliability improvement efforts, and sustaining engineering support. The production of the fifth (F-5) and sixth (F-5A) satellites, to be launched on Titan/Agena, also continued in FY 81.

2. FY 1982 Program: Efforts for this year include sustaining engineering support, continuing design and development activities to improve the anti-jam capabilities of the Air Force Satellite Communications System payload on the seventh Satellite Data System satellite, and continuing the multi-year development necessary to transition that satellite to the Space Shuttle. Also included are continuing efforts to improve satellite payload reliabilities.] and the production of the sixth satellite continued.

3. FY 1983 Planned Program: Planned efforts include the completion of the development efforts related to the Space Shuttle optimization and the completion of the development of the Air Force Satellite Communications anti-jam improvements. Sustaining engineering support and the System Program Office will also be continued. The decrease in the current year R&D estimate from that of the previous year is the deletion of continued payload technology development. The decrease in procurement funds from last year's estimate reflects [

(U) 4. FY 1984 Planned Program: The FY 1984 plan is to continue sustaining engineering support, the System Program Office, launch support capability and on-orbit support of the SDS satellites.

Program Element: #35158F   Title: Satellite Data System
DoD Mission Area: Strategic Communications, #333   Budget Activity: Strategic Programs, #3

5. Program to Completion: SDS will continue to support the Air Force Satellite Communications System by providing critical [ ] communications coverage [ ] The program will fund the launch support for three additional satellites, sustain engineering support and System Program Office [ ] and provide on-orbit support [ ] for as long as SDS satellites remain operational.

6. Milestones:

Milestones	Date
Program Start	October 1971
System Preliminary Design Review	March 1973
System Critical Design Review	March 1974
Launch First Satellite (F-1)	[
Launch Second Satellite (F-2)	
Full Operational Capability	
Launch Third Satellite (F-3)	]
AFSATCOM System IOC	May 1979
Critical Design Review for Shuttle Optimized (Seventh) Satellite	June 1981

[ ]

* Date presented in Fiscal Year 1982 Descriptive Summaries

** [ ]

EXPLANATION OF MILESTONE CHANGES: [

Budget Activity: Strategic Programs, #3
Program Element: 35158F, Satellite Data System

1. Development Test and Evaluation: The development contractor for the Satellite Data System was Hughes Aircraft Company, El Segundo, California. The first satellite was launched in Initial Operational Capability was established in The first satellite (F-1) was funded entirely within the development program. The second satellite (F-2) was the first vehicle funded under the production program. The development hardware included engineering models of the communication subsystems, a structural model spacecraft (X-1) and a qualification model spacecraft (Y-1). Development tests of the communications subsystems engineering models were completed in November 1973. Structural testing was satisfactorily completed on the X-1 engineering model spacecraft in May 1975. Systems level qualification was completed in October 1975 with all critical performance specifications met or exceeded. System level qualification was designed to demonstrate design integrity and performance to specification via a series of tests including shock, acoustic, modal survey, thermal, electromagnetic interference, solar-thermal vacuum, and integrated system test. The F-1 spacecraft was acceptance tested during the The Y-1 spacecraft was a fully configured spacecraft which has been refurbished and designated as flight vehicle (F-4).

2. (U) Operational Test and Evaluation: A portion of the Satellite Data System is to be part of the Air Force Satellite Communications space segment. Classical separate Initial Operational Test and Evaluation was not conducted on the space segments since all operational objectives and requirements were fully integrated into the Development Test and Evaluation effort and were not broken out separately. Compatibility, operational characteristics, and orbit performance of payloads supporting the Air Force Satellite Communications program are scheduled to be demonstrated during the follow-on test and evaluation which is managed by the Air Force Test and Evaluation Center. Results to date are contained in Development Test and Evaluation reports (see paragraph 1 above).

3. Systems Characteristics:

Characteristics	Objectives	Demonstrated
Data Rate in words per minute		
Message Bit Error Rate per ten thousand bits		
Anti-Jam Protection (decibel watt)		

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63228F
DOD Mission Area: Air Warfare Support, #225

Title: Next Generation Trainer
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	-0-	14,645	52,365	97,860	To Be Determined	To Be Determined

(Individual Project Listing)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A need exists to maintain the Air Force's capability to provide primary flight training in its Undergraduate Pilot Training program. The Next Generation Trainer program is a development effort to modernize or replace the operationally deficient T-37 aircraft to ensure that this capability exists beyond 1986. Forecast increases in USAF pilot training requirements in the mid-1980s, and the fact that the aging T-37 will begin to reach fleet insufficiency around 1986, dictate an Initial Operational Capability for the Next Generation Trainer in 1987. The essential design characteristics include twin engines, side-by-side seating, and pressurization with significant improvements in performance (range, climb capability, sustained "g"), maintainability, and noise pollution.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Five contractors submitted proposals for Full Scale Development on 7 December 1981, and source selection for the Next Generation Trainer has begun. Contract award target date is Spring 1982, and DSARC I/II is scheduled for June 1982. FY 1982 funding of $14.7M will be used to conduct source selection and to begin initial development of the engine and airframe. The fiscal year 1983 funding of $53M is based on development esti

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	-0-	14,714	39,400		To Be Determined	To Be Determined
Procurement (not identified)						

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: # 63228F
DOD Mission Area: Air Warfare Support, #225

Title: Next Generation Trainer Aircraft
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The T-37 aircraft is a twin-jet, side-by-side seating trainer aircraft. It replaced the T-34 aircraft and has been used with great success in the primary phase of Air Force Undergraduate Pilot Training for over 24 years. The Next Generation Trainer program is an acquisition effort to replace the T-37 with a new aircraft to remedy the following deficiencies:

(U) (a) The aircraft, of early 1950's design and technology, is approaching the end of its 15,000 hour certified life. With forecast increases in pilot production in the mid-1980's, the aging T-37 fleet will become numerically insufficient to sustain the required pilot production beyond late 1986. The current acquisition plan will provide an Initial Operational Capability (54 aircraft) by the first quarter of fiscal year 1987.

(U) (b) The fuel consumption of the T-37 turbo-jet engines, relative to current turbo-fan engines, results in high operational costs and an unnecessary drain on our limited fuel supplies. These costs are exacerbated with increases in fuel prices. The Next Generation Trainer will reduce fuel consumption in primary flight training by approximately 50%.

(U) (c) The hydraulic, electrical, and fuel systems are becoming less reliable resulting in high ownership costs. The maintenance manhours per flying hour on a more modern Next Generation Trainer will be approximately 60% of those required on a T-37.

(U) (d) The engine noise levels of the T-37 significantly exceed those permissible under the Federal Aviation Regulation Part 36.

(U) (e) The limited range and endurance restrict training during periods of marginal weather.

(U) (f) The limited performance and lack of pressurization restrict the training envelope to altitudes below 25,000 feet above mean sea level. The airspace at lower altitudes is becoming increasingly congested, more hazardous, and more difficult to dedicate to military training.

(U) (g) The limited weather capability of the T-37 unnecessarily hampers training missions and reduces training potential.

(U) (h) Outdated instrument displays are not consistant with those of modern Air Force operational aircraft.

(U) Acquisition of a new or modernized primary training aircraft will allow the exploitation of technology advancements in aircraft design, engine performance, and avionics design. These factors result in a lower weight, easier to maintain, improved performance, and a more fuel efficient aircraft with a significant life cycle cost savings. A more important factor is that the Next Generation Trainer will permit the Air Force to have a sustained pilot production capability beyond 1986.

Program Element: # 63228F
DOD Mission Area: Air Warfare Support, #225

Title: Next Generation Trainer Aircraft
Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: The US Navy plans to replace the T-2C and TA-4J aircraft with a new jet training system, the VTXTS. The Navy has selected the British Hawk for the VTX and will use it for the advanced, or second, undergraduate pilot training phase. The Next Generation Trainer, however, will be used in the initial, or primary, Air Force training phase. The Hawk is too complex to be used as a primary trainer. The Air Force and Navy have held a number of informal working meetings to discuss the acquisition planning for each services' trainer development programs. Cross participation in VTX and NGT source selection evaluation has also occurred.

(U) WORK PERFORMED BY: The Air Force management of the Next Generation Trainer is accomplished by the Next Generation Trainer System Program Office at the Air Force Systems Command Aeronautical Systems Division, Wright Patterson Air Force Base, Ohio. The five contractors who submitted proposals in Dec 1981 were CESSNA, ENSIGN, FAIRCHILD, GULFSTREAM, and ROCKWELL. One of these five contractors will be selected in the Spring of 1982 to begin Full Scale Development of the Next Generation Trainer.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The System Program Office was established at Wright Patterson Air Force Base following the approval of the Mission Element Need Statement in July 1979. In June 1980, funded Concept Exploration Studies were awarded to five contractors, CESSNA, FAIRCHILD, GENERAL DYNAMICS, ROCKWELL, and VOUGHT. These studies were completed in October 1980 and confirmed that the Next Generation Trainer Program is low risk technically, has a schedule which is realistic, and is relatively low cost. A Congressionally directed study of the T-34C was completed by Air Training Command, and concluded the T-34C was not suitable as a Next Generation Trainer alternative because of its low performance and its additional cost of $3B over a 20 year life cycle.

2. (U) FY 1982 Program: The Request for Proposal for Full Scale Development was released on 7 Oct 1981, and proposals were received from CESSNA, ENSIGN, FAIRCHILD, GULFSTREAM, and ROCKWELL on 7 Dec 1981. The contract for Full Scale Development will be awarded to one contractor in the Spring of 1982. Initial development of the engine and airframe will commence in the Summer of 1982. Information gained from the proposals will be used to refine the funding required to complete the program and the schedule of development necessary to meet an Initial Operational Capability of 1987. A Request for Proposal to modify the existing T-37 simulators or to build new ones will be released in Summer 1982.

3. (U) FY 1983 Planned Program: The development and test activity for the airframe and engine will continue. Tooling and the initiation of the static test article and the first test aircraft will begin. The funding for fiscal year 1983 increased to $53M from $37.4M because of information gained in the Concept Studies. Selection of a contractor for simulator modification/development will be made during 1983.

4. (U) FY 1984 Planned Program: Development and testing for the airframe and engine will continue. Production of the Durability Article, two more test aircraft, and two production aircraft will begin. The engine will have been developed to the point of Initial Flight Release by that time.

5. (U) Program to Completion: Actual flight test activity will begin around February 1985. This testing will determine airframe/engine compatibility, allow for handling qualities to be assessed, verify airplane performance, and provide time to refine the subsystems and avionics interface with the aircraft. A full rate production decision is expected in the Spring of 1985 with the first production aircraft delivered in the Fall of 1986. The production rate of the selected contractor will determine the completion date for the Next Generation Trainer program. The total Research Development Test and Evaluation costs and production costs will be more accurately determined after proposals have been reviewed and a contractor has been selected.

6. (U) Milestones:

			DATE
A.	Mission Element Statement Approval = Milestone 0		June 1979
B.	Milestone I		Spring 1982
C.	Contractor Selection		Spring 1982
D.	Full Scale Development Initiation		Spring 1982
E.	Release of Long Lead Items	*(September 1984)	January 1984
F.	Initial Flight Test	*(February 1984)	February 1985
G.	First Production Item	*(December 1986)	December 1985
H.	Production Decision-DSARC III B	*(May 1985)	April 1986
I.	Initial Operational Capability		October 1987

* Date presented in fiscal year 1982 Descriptive Summaries

EXPLANATION OF MILESTONE CHANGES: Delays have been experienced in the early stages of the program due to the Congressional elemination of funding for fiscal 1981 and the requirement to evaluate the T-34C as a possible alternative to the Next Generation Trainer. The current acquisition strategy will recover this lost time by combining the Milestone I and Milestone II decision points. This deletes the typical demonstration/validation phase, and saves approximately two years of development time. The low technical risk of this program obviates the requirement for a demonstration phase where prototyping normally occurs. Some of the later milestones have moved to earlier dates because of a more defined Next Generation Trainer Generic Master Schedule developed after the Concept Exploration Phase Studies.

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

Budget Activity: Tactical Programs, #4
Program Element: #63228F, Next Generation Trainer Aircraft

Test and Evaluation Data

1. (U) Development Test and Evaluation:

(U) The Next Generation Trainer (NGT) Development Test and Evaluation (DT&E) program is structured into two major divisions: contractor conducted tests and Combined Test Force conducted ground and flight tests. The contractor ground tests are planned, scheduled, directed and conducted by the contractor. These tests include Engineering Development Verification/Pre-Qualification, Qualification/Preflight Integration, and Acceptance. The Combined Test Force will incorporate contractor and Government test requirements into a single integrated plan, using contractor and Air Force flight crews. This program includes Flying Qualities Tests, Structural Tests, Performance, Propulsion and Fuel System Tests, Reliability, Maintainability, Availability and Logistics Supportability Tests, and Technical Order Verification.

(U) The primary objectives of Development Test and Evaluation are: verify the design of the Next Generation Trainer air vehicle and components; verify the performance of the Next Generation Trainer air vehicle and components; evaluate Next Generation Trainer support equipment, maintenance and operating procedures; acquire data to assess and support changes to other components of the Undergraduate Pilot Training System; identify Next Generation Trainer system deficiencies and evaluate changes resulting from tests; acquire data to support the NGT system production process.

(U) The concept exploration phase, consisting of five contractors investigating alternatives to resolving deficiencies in the Mission Element Need Statement, has been completed. Thus far, the extent of DT&E efforts are the contractor initiated tests to investigate design concepts for full-scale development. The NGT Test Planning Working Group will provide guidance for Development Test and Evaluation during Full Scale Development. Development Test and Evaluation flights will begin second quarter, fiscal year 1985.

(U) Three NGT test aircraft will be flight tested at Edwards AFB. Except for the Government furnished Airborne Test Instrumentation System, Development Test and Evaluation, Operational Test and Evaluation. and production aircraft are similarily configured.

(U) The NGT Test Planning Working Group, chaired by the NGT Program Office test manager, will plan, coordinate, evaluate, and document Development Test and Evaluation. Members of the Test Planning Working Group are the NGT Program Office, Air Force Flight Test Center, Air Force Test and Evaluation Center, Air Training Command, Air Force Logistics Command, Arnold Engineering Development Center, and the contractor. The service Program Manager is Lt Col Vic Barnett. The airframe and engine contractors will be selected in the Spring 1982.

(U) Data on Reliability, Maintainability, Availability, and Logistics Supportability will be acquired on near as possible operational equipment during flight tests using the Air Flight Test Center System Effectiveness Data System. During the first half of the Development Test and Evaluation /Initial Operational Test and Evaluation effort, Air Force personnel will perform "over-the-shoulder" and "hands-on" maintenance under the contractors' supervision. In order to make an initial assessment of the Next Generation Trainer maintenance concept, Air Force personnel will perform all maintenance during the second half of Development Test and Evaluation/Initial Operational Test and Evaluation.

Budget Activity: Tactical Programs, #4
Program Element: #63228F, Next Generation Trainer Aircraft

2. (U) Operational Test and Evaluation:

(U) The Air Force Test and Evaluation Center will manage the Operational Test and Evaluation of the T-37 replacement aircraft that will be developed under the Next Generation Trainer (NGT) program. The NGT configuration is unknown at this time as the NGT Program Office will select one concept from a field of approximately five competitors during the second quarter FY 82. Full Scale Development is scheduled to start during the third quarter of FY 82 and the combined Developmental/Initial Operational Test and Evaluation is scheduled to be conducted between the second quarter of FY 85 and the third quarter of FY 86.

(U) Air Force Initial Operational Test and Evaluation planning has identified the following operational evaluation areas:

(U) The NGT operational performance.

(U) The capability of the NGT aircraft, with ancillary support, to effectively serve as a primary trainer in the Undergraduate Pilot Training System.

(U) The operational availability of the NGT (including reliability) to satisfy ATC training requirements.

(U) The operational maintainability and logistics supportability of the NGT.

(U) The Full Scale Development Initial Operational Test and Evaluation test team will consist of personnel from Air Force Test and Evaluation Center, Air Training Command, Air Force Logistics Center, and the Air Force Human Research Laboratory. Test locations will include Edwards AFB California and designated operational training bases. Test aircraft, number to be determined, will be preproduction and production versions of the NGT.

3. (U) Systems Characteristics:

Characteristics	Objectives	Demonstrated
Fuel/Time	Fuel for 1.5 hour formation flight at 15,000 feet, approach, 300 Nautical mile alternate diversion	To be determined
Runway length	5,000 feet runway capability	To be determined
Cruise speed	Minimum cruise 300 knots at 25,000 feet	To be determined

Budget Activity: Tactical Programs, #4
Program Element: #63228F, Next Generation Trainer Aircraft

Characteristics	Objectives	Demonstrated
Landing approach speed	Landing approach 90-110 knots	To be determined
Single engine rate of climb	400 feet per minute engine out rate of climb	To be determined
Climb capacity	2,000 feet per minute rate of climb at 25,000 feet	To be determined
Cruise altitude	Sustained cruise up to 35,000	To be determined

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63230F
DOD Mission Area: Close Air Support & Interdiction, #223

Title: Advanced Tactical Fighter
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	0	27,338	49,577	Continuing	Not Applicable
2472	Advanced Tactical Fighter Program	0	0	8,638	16,977	Continuing	Not Applicable
2878	Joint Fighter Engine	0	0	18,700	32,600	426,900	478,200

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION: The Advanced Tactical Fighter (ATF) program will develop concepts and define required characteristics for the next generation tactical fighter aircraft. This program is intended to maintain the combat advantage of our fighter forces against the continually evolving threat. Because of the long lead times necessary to develop and field new aircraft (traditionally 10-12 years) we must begin now if we are to deploy a new fighter by the mid 1990s. This year's request is intended to initiate the acquisition process by soliciting definition of preferred solution concepts from the aerospace industry for both air-to-air and air-to-surface fighters for the 1990's. The Advanced Tactical Fighter program also includes development of an advanced technology engine beginning in FY 83. This will be a joint AF/Navy development effort to provide a highly mature advanced engine design suitable for both AF and Navy future fighter needs.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The Air Force will initiate concept definition studies with industry leading to a Milestone I decision and start of a competitive concept validation phase. Air Force will also start development of an advanced technology engine. This program is structured to lead to systems selection in 1987 from appropriate air-to-surface and air-to-air options. Cost estimates are based on parametric cost analysis and historical precedent (F-15 pre-full scale development activity).

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	0	10,100	25,000		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63230F | Title: Advanced Tactical Fighter

DOD Mission Area: Close Air Support & Interdiction, #223 | Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Mission Area Analysis centering on the European theater but including worldwide commitments clearly indicates that the Air Force will need to acquire new fighter aircraft in the early to mid-1990s. This conclusion is based on three major factors: (1) evolution of threat capabilities, (2) expansion of mission requirements due to changing global commitments and (3) emerging technological opportunities.

Evolution of threat capabilities will probably negate our current qualitative advantage in the air-to-air arena and may deny the low altitude sanctuary which has become an integral part of our air-to-surface tactics. New Soviet fighter aircraft now being introduced are expected to have energy maneuverability characteristics equivalent to the F-16. Advanced look down/shoot down fire control systems and air-to-air missiles will give the Soviets the capability to detect and engage our attack aircraft at low altitudes. Development of a second generation supersonic cruise aircraft could enable the Soviet air forces to operate continuously in a flight regime where we could not challenge them effectively. Finally, improved Soviet air-to-surface attack capability jeopardizes our basing structure in the NATO environment.

Continuing changes in world wide political alignments cause corresponding changes in the performance needed to meet tactical mission requirements. The increased possibility of operations in areas like Southwest Asia emphasizes the need for greater combat radius, faster deployment capability and reduced logistics support than can be achieved by current fighters.

New technologies are emerging in aerodynamics, propulsion, materials, manufacturing techniques and avionics which can offset threat improvements and provide simpler, more reliable systems at significantly lower operating and acquisition costs. Advanced engine technology, for example, will result in about a 50% reduction in engine parts which will provide greater reliability and durability at reduced weight and cost. Additional cost and weight savings can be achieved with advanced avionics and materials. While some of these technical opportunities can be enjoyed through modification of existing systems, maximum utility can only be realized through integration of the numerous advanced technologies in a new system design.

The most apparent deficiency in our tactical air power capability today is the inability to attack targets at night and in-weather. Because of the immediacy of this need, the bulk of Air Force efforts in the fighter area since the mid-1970s has been oriented towards solving this deficiency. However, the Air Force cannot neglect air-to-air mission requirements in the development of new fighters. While the F-15 and F-16 aircraft are currently superior to threat fighters, the generation of Soviet fighters currently being introduced will be generally equal and in some aspects better than the F-15. These threat improvements will degrade the tactical flexibility of our fighter forces and will increase the advantages which the Soviet forces have traditionally enjoyed from their numerical superiority. Growth of the F-15 and F-16 systems with improved weapons and avionics will help retain their qualitative superiority into the late 1980s. However, improvements to these aircraft will ultimately be limited by the inherent characteristics of the basic design; and they will probably be unable to effectively counter the follow-on generation of Soviet fighter expected in the early 1990s.

Program Element: #63230F
DOD Mission Area: Close Air Support & Interdiction, #223

Title: Advanced Tactical Fighter
Budget Activity: Tactical Programs, #4

The Air Force needs to start now to acquire new tactical aircraft for the 1990s. Normal lead time required to achieve initial operational capability of a new fighter is 10-12 years. This includes necessary front end work to define requirements and develop and refine conceptual solutions. Full scale engineering development and initial production of the selected configuration historically requires six to seven years. This indicates that the systems acquisition decision on a new fighter must be made no later than FY 87 if we are to achieve a significant operational capability by the mid-90s. Current development and technology validation work to support this major systems acquisition decision needs to be pursued during the early 1980s in order to fully understand evolving threat capabilities, mission requirements, and design options. The Air Force development effort in the Advanced Tactical Fighter program is structured to develop both the air-to-air and air-to-surface requirements and technical base so that appropriate options are available when a clearly defined acquisition decision becomes necessary in the mid-1980s.

Development of an advanced engine is being pursued within the Advanced Tactical Fighter program to insure that an adequate propulsion system is available for future fighters. This activity will demonstrate the feasibility of new engine component and material design approaches and will result in a baseline advanced engine design which can be matched to the specific requirements of future fighters. This activity will reduce overall engine development risk.

(U) RELATED ACTIVITIES: The Air Force has developed a structured approach to address current deficiencies in night, adverse and in-weather attack capabilities against mobile targets and to prepare for potential deficiencies in our counter-air capability. Program elements that address the air-to-surface attack deficiencies are the Advanced Tactical Fighter and the Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) programs (PE 64249F). The primary thrust of the Advanced Tactical Fighter program is to develop the next generation tactical fighter aircraft. The aircraft will be characterized by high mission effectiveness, increased survivability, and a quantum improvement in cost effectiveness and affordability, both in acquisition and operating costs. The Advanced Tactical Fighter may address either or both the air-to-air and air-to-surface mission areas. The LANTIRN program will provide a highly effective near to mid-term capability for attack at night and low altitude, under-the-weather conditions. In addition, both the F-15 and F-16 programs are proposing development of derivative models to increase the air-to-surface attack capability of these aircraft. The Advanced Tactical Fighter program is also related to the Advanced Fighter Technology Integration program (PE 63245F) which will develop our technical capability in integrated avionics suites, short take-off and landing capability and aerodynamic refinements to meet the needs of the next generation fighter. This program is currently modifying an F-16 with a highly integrated flight/fire control system to develop greater capability and survivability in unguided weapons delivery and air-to-air combat. This program also plans to start development of an advanced two-dimensional thrust vectoring/reversing engine nozzle and integrated flight and propulsion control to provide the technical capability for an effective short take-off and landing capability on future fighters.

(U) WORK PERFORMED BY: Pre-Milestone O and Concept Definition studies will be managed by the Air Force Systems Command/Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. Contracts for concept definition studies have not yet been awarded. The advanced engine development will be managed by the Air Force Systems Command/Wright Aeronautical Laboratories and Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. Contracts for advanced engine development have not been awarded.

Program Element: #63230F
DOD Mission Area: Close Air Support & Interdiction, #223

Title: Advanced Tactical Fighter
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Conducted mission analyses and technology studies for advanced fighters and developed a Mission Element Need Statement for new fighter aircraft.

2. (U) FY 1982 Planned Program: Completion of preliminary analytic work to define expected threat characteristics and establish goals and thresholds for the design parameters for advanced fighters. Cost difference from FY 1982 Descriptive Summary is due to Congressional action which denied funds to initiate concept definition studies for the Advanced Tactical Fighter in FY 1982.

3. (U) FY 1983 Planned Program: Initiation of concept definition studies with industry leading to a Milestone I decision and initiation of the advanced engine development. Cost difference from FY 82 Descriptive Summary is due to restructuring of program to include development of an advanced technology engine. Cost increase due to engine development effort was partially offset by delay in advanced fighter design development resulting from Congressional action on FY 82 budget request.

4. (U) FY 1984 Plan Program: Completion of concept definition studies and selection of several concepts for further design development and validation. Continue development of an advanced engine design including initial testing of advanced technology components .

5. (U) Program to Completion: Entry into full scale engineering development for an advanced tactical fighter in FY 87 leading to an Initial Operational Capability by the end of FY 93.

6. (U) Milestones:

		Date
a.	MENS submitted to OSD	Sep 1981
b.	Award concept definition studies	Mar 1983
c.	OSD requirements review	Jul 1984
d.	Start Full Scale Engineering Development	Aug 1987

7. (U) RESOURCES: Not Applicable

Project: #2472
Program Element: #63230F
DOD Mission Area: Close Air Support & Interdiction, #223

Title: Advanced Tactical Fighter
Title: Advanced Tactical Fighter
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This project will develop the definition of threat capabilities and mission requirements for fighter aircraft in the 1990's and beyond. The project will also develop design concepts to meet these mission needs and will validate the design approaches and supporting technologies sufficiently to support a source selection for entry into full scale engineering development. Current US fighters represent the world standard in fighter aircraft; however the Soviet Union is responding to the capabilities of these fighters with a new generation of air-to-air and surface-to-air systems that will challenge the Air Force ability to conduct vital air operations. Follow-on systems expected by the mid-1990's will further stress our tactical air power capability. At the same time, mission requirements for fighter forces are continually being expanded due to increases in threat total operating capability in Central Europe (e.g. greater night/adverse weather capability) and changing world wide commitments which involve a variety of operating situations. These changing requirements have left our current fighter forces with deficiencies. These deficiencies will grow as threat capabilities continue to evolve. This project is intended to identify requirements and potential design solutions to meet these deficiencies in both the air-to-air and air-to-surface mission areas for the post 1990 time period. This project will provide the option to rapidly develop and produce a follow-on generation of fighter aircraft in the late 1980's to meet expected threat advances.

(U) RELATED ACTIVITIES: This is the only Air Force activity which will develop design requirements for a follow-on generation of tactical fighter aircraft. Supporting air vehicle technologies are being partially addressed by the Advanced Fighter Technology Integration program which will develop high potential technical concepts in integrated avionics, refined aerodynamics and short take-off and landing capability.

(U) WORK PERFORMED BY: This project is managed by the Air Force Systems Command/Aeronautical Systems Division, Wright-Patterson AFB, OH. Potential contractors are the major U.S. airframe manufacturers including Boeing Aerospace Corp, Seattle, WA; Fairchild-Republic Company, Farmingdale, Long Island, NY; General Dynamics Corp, Fort Worth, TX; Grumman Aircraft Company, Bethpage, NY; Lockheed California Company, Burbank, CA; McDonnell Aircraft Company, St Louis, MO; Northrop Corp, Hawthorne, CA; Rockwell International, Los Angeles, CA; and Vought Corp, Dallas, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Conducted mission analyses and technology studies for advanced fighters and developed a Mission Element Need Statement for new fighter aircraft.

2. (U) FY 1982 Program: Future fighter mission analyses will be continued through 1982 with emphasis on defining potential threat capabilities in the 1990s and establishing goals and thresholds for future fighter design parameters. The threshold will be based on trade-offs between desired capabilities and technical and cost constraints. Cost difference from the FY 1982 Descriptive Summary is due to Congressional action which denied funds to initiate concept definition studies for the Advanced Tactical Fighter in FY 1982.

Project: #2472
Program Element: #63230F
DOD Mission Area: Close Air Support & Interdiction, #223

Title: Advanced Tactical Fighter
Title: Advanced Tactical Fighter
Budget Activity: Tactical Programs, #4

3. (U) FY 1983 Planned Program: Concept definition studies to identify alternative design concepts for advanced fighters will be started in FY 83. These studies will provide a range of design concepts from industry which can meet the mission requirements identified in the FY 82 and prior activity. The FY 83 program will initiate the systems acquisition process which will lead to a full scale development decision in FY 1987 Costs for this project are reduced from FY 1982 the Descriptive Summary due to the delay in the start of concept definition studies from FY 1982 to 1983.

4. (U) FY 1984 Planned Program: Concept definition will be completed and several attractive design concepts will be selected for further development and validation.

5. (U) PROGRAM TO COMPLETION: Design concept validation will be completed and source selection for full scale development will be conducted. Full scale development of a future fighter is planned to be initiated in FY 1987.

6. (U) Milestones: Same as basic program

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	0	0	8,638	16,977	CONTINUING	N/A

8. (U) Comparision with FY 1982 Descriptive Summary:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	0	10,000	25,000		CONTINUING	N/A

Project: #2878
Program Element: #63230F
DOD Mission Area: Close Air Support & Interdiction, #223

Title: Joint Engine Development
Title: Advanced Tactical Fighter
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Advances in propulsion technology have traditionally been a key to achieving significant improvements in the capabilities of combat aircraft. The development process leading to a mature advanced engine that does not sacrifice reliability and durability for increased performance takes at least ten years, and is much longer than the hardware development stage for a new aircraft. Therefore, development of a new engine to meet the needs of the next generation fighter needs to be started now in order to reach design maturity by the early 1990s. Some uncertainty still remains regarding the specific performance needed in future fighters, however, exact aircraft characteristics are not critical to the initial design development of a new engine. Early development work to integrate and validate advanced design features in a baseline design is vital to reducing later development risk. The baseline design can be scaled to match the requirements of a specific aircraft design in full scale development.

This is a new project to validate the performance and durability of critical new engine design concepts and technologies in the size class and with the mission duty profiles of the new fighter engines for both the Air Force and the Navy. The project will include a competitive prototype engine demonstration of a design suitable for transition to FSED. Validation of the critical advanced engine technologies needs to be achieved to support a full scale development initiation in late FY 1987. This is a joint Air Force and Navy development program with Navy funding starting in FY 1984.

(U) RELATED ACTIVITIES: Critical component technologies are being developed in the Aircraft Turbine Engine Gas Generator (PE 63216F) and Aircraft Propulsion Subsystem Integration (PE 63202F) programs. These programs will provide the design features for integrating into an advanced engine design which will have sharply reduced complexity (parts count) and increased reliability, durability and performance. The Engine Model Derivative Program (PE 64218F) will develop improvements to current engines which could be used as a less capable alternative in case the advanced engine does not develop as planned.

(U) WORK PERFORMED BY: This project will be managed by the Air Force Systems Command/Wright Aeronautical Laboratories and Aeronautical Systems Division, Wright Patterson AFB, OH. Contractors have not been selected. It is anticipated that a minimum of two contractors will be funded through the prototype propulsion system program. Potential engine contractors include (but are not necessarily limited to) Pratt and Whitney Aircraft Group of West Palm Beach, Florida, General Electric Comp. of Evendale, Ohio, Detroit Diesel, Allison Division of General Motors in Indianapolis, Ind, The Garret Turbine Engine Company of Phoenix, Arizona, and Teledyne CAE of Toledo, Ohio.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable

2. (U) FY 1982 Program: Not applicable

3. (U) FY 1983 Planned Program: Initiate a program (including a core test program) to validate the critical component design concepts, materials and manufacturing processes required for an Advanced Tactical Fighter Engine. The FY 1983 effort will start design of an advanced engine using newly developed components and materials. This project is a new start in FY 1983. The FY 1982 budget request did not include this activity.

Project: #2878 | Title: Joint Engine Development
Program Element: #63230F | Title: Advanced Tactical Fighter
DOD Mission Area: Close Air Support & Interdiction, #223 | Budget Activity: Tactical Programs, #4

4. (U) FY 1984 Planned Program: Assess critical components designs, technologies and concepts on slave engines and components on test stands. Conduct an engine systems design and an analysis program including a core engine test of an advanced engine design.

5. (U) Program to Completion: Conduct a competitive engine evaluation program including a prototype propulsion system sea level and altitude test of engine performance, operability and durability and a flight clearance test. This program will result in a more mature advanced design that can be scaled to meet advanced fighter requirements and can be transitioned at reduced risk to full scale development in late FY 1987.

6. (U) Milestones: Not applicable

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	0	0	18,700	32,600	426,900	478,200

8. (U) Comparision with FY 1982 Descriptive Summary:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	0	0	0		0	0

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63239F Title: Advanced Tactical Air Reconnaissance System (ATARS)
DOD Mission Area: TIARA for Tactical Air Warfare, #327 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT			4,006	5,710	101,667	111,550

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Advanced Tactical Air Reconnaissance System or ATARS, is an advanced development program to meet the needs of tactical commanders for detection, location and classification of tactical targets with sufficient location accuracy and detail to permit the timely delivery of appropriate air or ground launched weapons. Near term efforts will concentrate on replacing the RF-4C platform with a more survivable and supportable system with future efforts aimed at preplanned product improvements for sensor and associated processing/exploitation systems. The need is based on a Tactical Air Forces Statement of Need for a survivable, penetrating reconnaissance system.

(U) BASIS FOR FY 1983 RDT&E REQUEST: A reconnaissance/surveillance force mix study will be conducted. Contractor studies of platform and sensor alternatives for a podded reconnaissance system will begin. Results will lead to demonstration and a full-scale engineering development decision.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		3,100	4,200		93,900	101,200

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63239F Title: Advanced Tactical Air Reconnaissance System (ATARS)
DOD Mission Area: TIARA for Tactical Air Warfare, #327 Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop a survivable tactical reconnaissance capability which allows commanders to supplement standoff data, if available, to obtain precise target identification and location. Studies have shown the need to replace the only penetrating tactical reconnaissance system, the RF-4C, with a more cost effective and survivable system. Primary efforts will be to develop a deployable, easily supported system with the potential for multi-mission use, to include both reconnaissance and attack capability, depending on the immediate needs of the tactical commander. Work to be accomplished includes tradeoff studies of platform/sensor alternatives, prototype design, and proof of concept prior to initiation of full-scale engineering development.

(U) RELATED ACTIVITIES: The program builds upon the results of a study titled "Advanced Platform for Positioning Reconnaissance Sensors" conducted during 1981. Sensor developments conducted under Program Elements 63208F and 64710F will be considered as potential preplanned product improvements. Coordination will be maintained with Navy reconnaissance developments conducted under Program Element 63261N and any new sensor development programs in support of this initiative will be joint efforts with the Navy.

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson Air Force Base, OH has the overall management responsibility for systems development and conduct of appropriate study efforts. Coordination with Rome Air Development Center, Griffiss Air Force Base, NY is being maintained to ensure consideration of ground processing and exploitation equipment. Contractors have not yet been selected.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Program: Not Applicable

3. (U) FY 1983 Planned Program: Tradeoff studies of platform and sensor alternatives will be conducted. Design of a prototype sensor pod for carriage on a fighter derivative type aircraft will be initiated. A preplanned sensor improvement plan will also be initiated. Funding differences from last year's plan resulted from a zeroing of the planned FY 1982 effort by Congress. The program was restructured to concentrate on near-term, available improvements to the tactical reconnaissance force.

4. (U) FY 1984 Planned Program: Fabrication and testing of a sensor pod will begin and decisions will be made to include final selection of a platform and sensor alternatives. Development and integration of selected advanced sensors will be the subject of separate study efforts.

Program Element: #63239F Title: Advanced Tactical Air Reconnaissance System (ATARS)
DOD Mission Area: TIARA for Tactical Air Warfare, #327 Budget Activity: Tactical Programs, #4

5. (U) Program to Completion: Sensor pod and platform integration work will be transferred to a 64XXX Program Element after the decision is made to enter full scale engineering development. Long lead production funding of platforms and sensor pods will be programmed in a 27XXX Program Element beginning in FY 1986. The first delivery of a multimission capable aircraft equipped with a sensor pod could occur as early as 1988. Work on advanced sensors and pod integration will be continued in this program with the ultimate objective of achieving a near real time, all weather capability.

6. (U) Milestones: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63244F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Aircraft Nonnuclear Survivability
Budget Activity: Tactical Programs #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1,663	1,594	2,011	2,067	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides the resources for the Air Force's participation in the Joint Logistics Commanders' Joint Aircraft Survivability Program. The Naval Materiel Command and the Army Materiel Development and Readiness Command are co-sponsors and contributors to the program. The program develops design guidance and technology for improving the combat survivability of United States aircraft to nonnuclear threat weapons, as well as standard, triservice-approved vulnerability and survivability assessment methodology. Program outputs are used by product divisions, program offices, laboratories and contractors who build aircraft weapons systems.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Based upon analysis of combat experience in Southeast Asia and intelligence gathered from the 1973 Mideast conflict, the Joint Technical Coordinating Group for Aircraft Survivability, in conjunction with the Research and Development organizations of the logistic commanders of the three Services, developed an overall technology plan to provide the knowledge required for the design of combat survivable aircraft and equipment. This is a level of effort program that funds the Air Force portion of this overall plan at a level agreed to by the Joint Logistics Commanders.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	1,290	1,700	1,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63244F
DOD Mission Area: Close Air Support and Interdiction, #223

Title Aircraft Nonnuclear Survivability
Budget Activity Tactical Programs #4

(U) DETAILED BACKGROUND AND DESCRIPTION: In 1971, a Joint Technical Coordinating Group on Aircraft Survivability was established under the Joint Logistics Commanders to acquire and make available technology for designing nonnuclear survivability into new aircraft. The charter of this group is (1) to implement interservice efforts to reduce nonnuclear vulnerability of aircraft; (2) to coordinate research and advanced development in nonnuclear survivability; and (3) to maintain liaison between technology experts and those actually designing new aircraft. In the fall of 1972, the Joint Technical Coordinating Group on Aircraft Survivability formulated a triservice nonnuclear survivability program named Test and Evaluation Aircraft Survivability which was approved by the Under Secretary of Defense for Research and Engineering with $10 million being allocated for the program over a three year period (FY 1973 - FY 1975). As a technology-oriented program, the Test and Evaluation Aircraft Survivability program performed testing to strengthen the data base, evaluated prototype hardware and developed engineering theory and design criteria. In early FY 1975, a decision by the Under Secretary of Defense for Research and Engineering called for further nonnuclear survivability efforts to be budgeted by each of the Services beginning in FY 1976 with interservice coordination to continue under the Joint Technical Coordinating Group on Aircraft Survivability. The objective of this program element is to support the Air Force portion of the overall nonnuclear survivability efforts of the Department of Defense. As such, it will be a level of effort program coordinated with and complementary to Army and Navy programs.

(U) RELATED ACTIVITIES: This program element is related to complementary programs of the Army (PE #63215A) and Navy (PE #63262N) and to Air Force programs to design aircraft with improved survivability in nonnuclear threat environments. The coordination of these efforts is through a central management office of the Joint Technical Coordinating Group on Aircraft Survivability which is manned by an officer for each command represented on the Joint Logistics Commanders Group. Duplication is avoided through joint reviews by that office and the individual service task agencies. Program is also related to survivability efforts in Aerospace Flight Dynamics (PE #62201F), Aerospace Propulsion (PE #62203F) and Materials (PE #62102F).

(U) WORK PERFORMED BY: The Air Force Systems Command, Andrews Air Force Base, MD, has lead responsibility for the Air Force nonnuclear survivability program. Subordinate units performing work are the Air Force Flight Dynamics Laboratory, the Air Force Aero Propulsion Laboratory, the Air Force Avionics Laboratory, and the Aeronautical Systems Division. All of these organizations are at Wright-Patterson Air Force Base, OH. Major contractors are General Electric Company, Cincinnati, OH; The Boeing Company, Seattle, WA; Systems Research Laboratories, Dayton, OH; Booz Allen Applied Research, Bethesda, MD; University of Dayton Research Institute, Dayton, OH; Vought Corporation, Dallas, TX; and COMARCO Incorporated, Ridgecrest, CA.

Program Element: #63244F
DOD Mission Area: Close Air Support and Interdiction, #223

Title Aircraft Nonnuclear Survivability
Budget Activity Tactical Programs #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Defined design requirements for a single broadband, electronically steerable phased array antenna for simultaneous operation of radar and electronic countermeasures functions. Completed optical and electro-optical versions of a standardized visual target detection model. Initiated electronic countermeasures subtasks on the new Tactical Air Command Zinger surface-to-air missile model. Published 57mm high explosive test results. Completed ballistic testing on fire protection technology for wing dry bays. Documented promising concepts to reduce turbine engine infrared and radar cross section signature reduction. Initiated ballistic tests on hybrid composite panels. Developed a model for predicting the performance of a surface-to-air missile warhead. Prior accomplishments include development of design criteria for survivable fuel cells, determination of the minimum effective concentration of inerting gases required to protect F-16 fuel tanks against 23mm high explosive incendiary projectiles, development of analysis methods to predict behavior of structural composite materials to nonnuclear combat damage, demonstration of a compartmentalized lubrication system for vulnerability reduction of the F100 engine, completion of an A-10 combat damage repair time prediction analysis, and development of an improved fire extinguishing agent for use in the high airflow environment of combat damaged engine nacelles.

2. (U) FY 1982 Program: The following tasks will be continued into FY 1982. Armor protection against 57mm high explosive projectiles, chemical powder pack fire protection, infrared signature reduction for turbine engines, development of fragment penetration equations for composites, infrared imaging system protection against lasers, improvement of infrared measurements, multiplexing electronic countermeasures and radar systems, aircraft battle damage repair assessment methodology and data base, laser effects data bases, survivability against laser beam rider missiles, electro-optical countermeasures integration into tradeoff models, and surface-to-air and air combat model updates. Documentation will continue to be provided and advances in survivability disseminated. New tasks being considered are: develop advanced design guide and supporting test data for minimizing radar cross section, threat warhead fragmentation characterization, develop component vulnerability ballistic resistance data base, develop combat damage repair survivability assessment tradeoff methodology, and develop optimum aircraft trajectories for survivability against ground-to-air threats. FY 1982 resources were decreased from $1,700 thousand to $1,600 thousand due to new inflation indices.

3. (U) FY 1983 Planned Program: The following tasks are planned to be continued into 1983. Chemical powder pack fire protection, infrared signature reduction for turbine engines, development of fragment penetration equations for composites, improvement in infrared measurements, aircraft battle damage repair data base, and laser effects data bases, surface-to-air missile model update, advanced radar cross section design guide and test data, threat warhead fragmentation characterization, component vulnerability ballistic resistance data, combat damage repair survivability assessment tradeoff methodology, and optimum survivable aircraft trajectory development. Documentation will continue to be provided and advances in survivability disseminated. New tasks being considered are System verification of 57mm armor protection, evaluate survivable electric power flight control actuation concept, evaluate effectiveness of battle damage repair methods for composite structures, and validation of surface-to-air missile computer model. FY 1983 funds were increased from $1,900 thousand to $2,033 thousand to develop aircraft battle damage repair methodology.

Program Element: #63244F
DOD Mission Area: Close Air Support and Interdiction, #223

Title Aircraft Nonnuclear Survivability
Budget Activity Tactical Programs #4

4. (U) FY 1984 Planned Program: The following tasks are planned for FY 84. Aircraft survivability will be increased by reducing their susceptibility to sophisticated guided missiles and evolving directed energy systems. Advanced composite structural concepts that provide greater damage tolerance than is now provided by conventionally designed composite structures will be developed. Improved survivability modeling techniques against surface-to-air missiles will be developed and documented. A model repository to store and disseminate the various engagement models will be established. Simulation of a real time missile flyout model will be included in the standardized visual target detection model. Expansion of the combat data information center will continue. The model of repair time and skill code data for use in making combat damage repair time estimates on new and existing aircraft will be demonstrated. Design guidelines to minimize the effect of 30mm and 57mm threats will be developed. Component vulnerability to laser and ballistic threats will be developed for use in vulnerability assessments. Evaluations will be performed to establish the capability of various extinguishants for engine compartment fires. Field level battle damage repair techniques that can be used to rapidly prepare the aircraft for another mission will be evaluated. Vulnerability assessments will be performed on the flight control system. Develop necessary technology to design propulsion installations with reduced contributions to aircraft exhaust system infrared and radar cross section signatures. Increase probability of survival in air-to-air engagements through more accurate modeling methodology of weapon system threats.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63249F
DOD Mission Area: Close Air Support/Interdiction, #223

Title: Night Attack Program
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	16,200 1/	6,087 2/	4,491	3,912	0	42,172
2628	Millimeter Wave (MMW) Technology	4,400	3,088	491	0	0	9,061
2882	Target Recognizer Technology for LANTIRN	11,800 3/	2,999 2/	4,000	3,912	0	33,111 4/

1/ Excludes funding for the Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) ($39.985M) now included in Program Element 64249F, Night/Precision Attack and Hypervelocity Missile ($.900M) now included in Program Element 63363.

2/ Includes funding ($2.999M) being reprogrammed from Program Element 64249F. The funding of Target Recognizer technology for LANTIRN in FY 1982, FY 1983, and FY 1984 was transferred from PE 64249F, Night/Precision Attack, to this PE to continue advanced development efforts as directed by Congress.

3/ Performed under LANTIRN Project 2693 Program Element 63249F, in FY 81 and prior years.

4/ Funding for Engineering Development of Target Recognizer to be accomplished under Program Element 64249F (35.8M in FY 85 to completion).

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION: The FY 1983 Night Attack Program includes a feasibility flight test demonstration of a millimeter wave radar. The demonstration consists of evaluating the potential of a 95 GHz millimeter wave radar to provide a high resolution, low cost fire control radar. The radar and displays are being modified to enable low altitude penetration, target acquisition and weapon delivery/gun pointing, compatible with night/in-weather first pass attack. The program will address identified deficiencies present during night and in-weather conditions in the Air Force's air-to-surface interdiction and close air support missions.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The Night Attack funding request will complete radar/avionics modifications, initiate and complete contractor ground tests, and complete feasibility flight testing on a T-39 aircraft. Costs for Millimeter Wave shown are based on contractor cost estimates.

Program Element: #63249F
DOD Mission Area: Close Air Support/Interdiction, #223

Title: Night Attack Program
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,400	3,100	0	0	0	8,600
Procurement				NONE		

(U) OTHER APPROPRIATION FUNDS: None

Program Element: #63249F
DOD Mission Area: Close Air Support/Interdiction, #223

Title: Night Attack Program
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The threat posed by the enemy's formidable armored and air forces, especially that of the Warsaw Pact against the North Atlantic Treaty Organization (NATO), has increased in the past few years and is projected to become stronger in both quantitiative and qualitative terms. Enemy armor, equipped with night vision capability and accurate laser ranging systems, has been combined with new hardware, training and operational doctrine to assure a continued enemy thrust during night and adverse weather conditions. Successful interdiction and close air support missions against this projected threat require accurate target acquisition and weapons delivery. Even though target acquisition, laser designation and attack capability currently exist for day visual conditions, serious deficiencies occur when these tasks are required to be performed during night and adverse weather conditions. This program is primarily dedicated to improving Air Force capability to conduct close air support and interdiction missions at night and in most in-weather conditions. The project's objective is a feasibility flight demonstration of low cost night/in-weather capability. Millimeter Wave Radar Demonstration includes terrain avoidance, blind letdown, short range acquisition, and fire control system for night/in-weather attack. The concept includes a millimeter radar sensor, processor, and a Heads-Up Display (HUD). The millimeter wave sensor provides search and detection of moving and stationary targets at night and in a wide range of in-weather conditions. The radar processor will detect moving targets and select high density target areas for display on the Heads-Up Display. The pilot then selects a target of interest, cues the radar via the hand controller and uses the resulting HUD commands to attack the target. The fire control system will track the designated target and provide gun firing or weapons release command to the pilot. The millimeter wave radar system may also provide a terrain elevation profile interleaved with the target search mode. A terrain profile would provide blind descent through clouds and safe flight at low altitude. This project does not develop a millimeter radar. It adapts an existing millimeter radar to an aircraft fire control system and cockpit display. This project is the only millimeter airborne fire control program which is investigating this technology for use on tactical Air Force aircraft. Target recognizer technology was initiated under this program element for Single Seat night attack using FY 79 and FY 80 funds. At that time, outyear funding for target recognizer development was planned as full-scale develoment efforts. However, the FY 1982 Authorization Conference report directed target recognizer development be continued in advanced development.

(U) RELATED ACTIVITIES: The Army and the Air Force are both considering Millimeter Wave technology for several potential applications. The Army is developing a 35 GHz Millimeter Wave fire control system for their Advanced Attack Helicopter, and the Air Force is developing both 35 GHz and 95 GHz Millimeter Wave seekers for conventional tactical munitions. The Millimeter Wave Radar used in this technology demonstration is Army hardware, developed for the Aquilla mini-Remotely Piloted Vehicle Program. There is also a joint Defense Advanced Research Projects Agency (DARPA)/ Air Force program investigating both X-band and millimeter wave radar. Data from this program will be used for the Millimeter Wave Technology project. The LANTIRN program is devloping a navigation pod and a targeting pod for Single Seat aircraft under PE 64249F. Target recognizer technology will be integrated into the targeting pod to provide a significant increase in expected kills per pass.

(U) WORK PERFORMED BY: All Air Force efforts will be managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The contractor modifying the hardware and conducting the flight test is Norden Systems, Inc, Norwalk, Conn. Target recognizer competing contractors are: Martin Marietta Corp, Orlando, FL, and Hughes Aircraft, Canoga Park, CA.

Program Element: #63249F | DOD Mission Area: Close Air Support/Interdiction, #223
Title: Night Attack Program | Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 Program: The major tasks accomplished in FY 1981 included development of flight test support equipment and continued radar modifications for pod installation.

2. (U) FY 1982 Planned Program: In FY 1982 the radar/pod integration will be completed. The pod will be mounted on a T-39 for the beginning of the feasibility flight test demonstration.

3. (U) FY 1983 Planned Program: The additional MMW funding in FY 83 will complete the Millimeter Wave feasibility flight test demonstration. Target recognizer development will continue in advanced development leading to competitive selection of target recognizer contractor and preparation for full-scale development.

4. (U) FY 1984 Program: Target recognizer technology will enter full-scale develpment as a pre-planned product improvement to the LANTIRN targeting pod under program element 64249F.

5. (U) Program to Completion: Flight test of the target recognizer in a LANTIRN targeting pod is projected to begin FY 198[illegible]. Full scale development of the target recognizer will be funded under PE 64249F.

6. (U) Milestones: Not Applicable

7. (U) Resources ($ in thousands): Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63313F
DOD Mission Area: Counter Air, #221

Title: Advanced Missile Subsystem Demonstration
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3,293	5,878	0	0	Not Applicable	Not Applicable
2697	Ducted Rocket Motor	3,293	5,878	0	0	Not Applicable	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is designed to demonstrate capabilities of advanced air-to-air tactical missile subsystems through flight test. Selected subsystems are integrated with a test missile airframe configuration and flight tested to prove new developments and allow intelligent, low-risk decisions on future tactical missile systems. Emphasis will be placed on selecting those subsystems which can be utilized in current and projected tactical missiles.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The Air Force has decided to terminate flight testing of fixed fuel flow Ducted Rocket Motor. No further request for funds is planned under this Program Element.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	3,300	6,000	7,000		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Project: #2697
Program Element: #63313F
DOD Mission Area: Counter Air, #221

Title: Ducted Rocket Motor
Title: Advanced Missile Subsystem Demonstration
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Development of the Ducted Rocket Motor technology was initiated in 1976 with exploratory work on gas generator fuels. Since that time, exploratory programs have developed additional fuels, flight weight combustors, and insulators. Successful engine performance has been demonstrated in ground, direct connect tests. Based on this successful exploratory effort and the need to fully demonstrate this new techology, a flight test program was initiated in September 1978. At that time, a plan was established for initial funding out of the Aero Propulsion Laboratory, Program Element 63302F, for further ground testing of the Ducted Rocket Motor for the development of flight qualified hardware. This program element (63313F) would fund the flight test effort. Successful flight demonstration of the Ducted Rocket Motor propulsion concept would provide medium range class tactical missiles with higher average speed to target, increased payload capability, longer range, or smaller size than solid rocket propulsion systems. Demonstration and evaluation of engine performance, missile performance limits, propulsion cost, and engine reliability would be an integral part of this program.

(U) RELATED ACTIVITIES: Ducted Rocket Motor ground test and component development, and propulsion test vehicle design and development were initiated in Program Element 63302F, Advanced Missile Propulsion. Successful flight demonstration of the Ducted Rocket Motor would provide an option for an enhanced variant of the Advanced Medium Range Air-to-Air Missile, Program Element 64314F. This Ducted Rocket Motor program is the only effort within the Department of Defense to develop and test this propulsion concept. There are other ramjet technology efforts, such as the Navy Advanced Low Volume Ramjet demonstration motor and the Air Force Advanced Strategic Air Launched Missile demonstration for missiles in the 2000 pound class. Exploratory development of solid fuel ramjet concepts have been initiated by the Services. All efforts are fully coordinated to avoid duplication through the Joint Army, Navy, NASA, Air Force Ramjet Subcommittee.

(U) WORK PERFORMED BY: The Air Force Aero Propulsion Laboratory, Wright-Patterson Air Force Base, Ohio will manage the Ducted Rocket Motor project. Hughes Aircraft Company, Canoga Park, California is the contractor.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Ducted Rocket Motor development work accomplished in Program Element 63302F was expanded and development of a flight test vehicle continued. Fixed fuel flow ducted rocket direct connect testing was completed. Inlet aerodynamic testing, wind tunnel testing of the flight vehicle model, and safe separation tests in the wind tunnel were accomplished.

2. (U) FY 1982 Planned Program: Free jet testing of the ducted rocket engine and development of a nozzleless booster will be completed. The difference from previous FY 1982 planned program is the decision not to fabricate and qualify flight test hardware because of reduced FY 1981/82 funds and an Air Force decision to terminate flight testing.

3. (U) FY 1983 Planned Program: Approval of the FY 1981 request at one-half the requested level resulted in a slowdown of the Ducted Rocket Motor flight test demonstration project. More recently, the Air Force decided to restructure the program to eliminate flight testing and complete required ground testing by the end of FY 1982.

Project: #2697
Program Element: #63313F
DOD Mission Area: Counter Air, #221

Title: Ducted Rocket Motor
Title: Advanced Missile Subsystem Demonstration
Budget Activity: Tactical Programs, #4

4. (U) FY 1984 Planned Program: None.

5. (U) Program to Completion: The fixed fuel flow Ducted Rocket Motor project will be terminated with the completion of free jet testing. Changes from the FY 1982 Descriptive Summary reflect the Air Force decision to terminate flight testing.

6. (U) Milestones: Not Applicable.

7. (U) Resources. Not Applicable.

8. (U) Comparison with FY 1982 Budget Data: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63609F
DoD Mission Area: Close Air Support and Interdiction, #223

Title: Advanced Attack Weapons
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	34,000	55,192	17,999	0 *	Continuing *	Not Applicable *
2369	Wide Area Antiarmor Munitions	34,000	55,192	17,999	0	0	156,091

* Although Project Number 2369 will be completed in FY 1983, this program element may be used for future projects.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops and demonstrates prototype air-to-surface non-nuclear weapons. The total budget in FY 1983 will be used to complete validation of the Wide Area Antiarmor Munitions Wasp missile program. This weapon is designed to meet the Tactical Air Forces' need to destroy multiple enemy tanks in a single aircraft pass under good or adverse weather conditions. The need for this capability against massed armor is documented in the approved Mission Element Need Statement for an Improved Wide Area Antiarmor Capability.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 effort will complete the validation program for Wasp. The validation test of the two competing contractor missile designs will end in the third quarter of FY 1983. At that time, a single contractor will be selected for full scale development under Program Element 64607F. The cost estimates are based on current contractual obligations plus test activity estimates.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

Project Number	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	34,500	56,700	32,500		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Project: #2369 Title: Wide Area Antiarmor Munitions
Program Element: #63609F Title: Advanced Attack Weapons
DoD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The Mission Element Need Statement for an Improved Wide Area Antiarmor Capability details the critical need for the Tactical Air Forces to improve their armor kill capability against massed rear echelon armor. The Wide Area Antiarmor Munitions (WAAM) Program will improve the Tactical Air Forces sortie effectiveness by increasing the number of armor kills per pass.

The need is to develop a weapon that will provide multiple kills per pass, during all hours and weather conditions and from extremely low altitudes or standoff distances. The ability to achieve multiple kills during a single pass will greatly improve the Tactical Air Forces' antiarmor capability while decreasing attrition to enemy defenses. WAAM has been designated a major program and will use multiple contractors to reduce cost/schedule risk in order to achieve an operational capability at the earliest possible time. Three weapon concepts -- the Antiarmor Cluster Munition, the Wasp missile system, and the Extended Range Antiarmor Munition -- will be validated in this program. The Antiarmor Cluster Munition is an unguided improved antiarmor area cluster weapon that may be delivered at minimum altitudes or higher. The Wasp is a minimissile that employs a terminal seeker and a lock-on-after-launch guidance mode. The Wasp is intended for delivery from aircraft-mounted pods for minimum altitude attack. The Extended Range Antiarmor Munition is an air-delivered cluster weapon containing target-activated land mines that provide a standoff kill capability against armor. The target does not have to contact the Extended Range Antiarmor Munition submunition to effect a kill; rather the mine's sensor classifies the target, determines the closest point of approach, and then fires a warhead at the target.

(U) RELATED ACTIVITIES: WAAM technology support is ongoing in Program Element 62602F, Conventional Munitions and Program Element 63601F, Conventional Weapons Technology. Warhead, sensor, seeker, and dispenser technology programs in these program elements provide the basis for the WAAM concepts. Other related Air Force programs will be integrated with WAAM to provide a total wide area antiarmor system capability.

(U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command, Andrews Air Force Base, MD and its subordinate organization, Armament Division, Eglin Air Force Base, FL. Additional contractor support is provided by Boeing Aerospace Company, Seattle, WA; Honeywell Incorporated, Minneapolis, MN; AVCO Corporation, Wilmington MA; and Hughes Aircraft Company, Conoga Park, CA.

(U) PROGRAM ACCOMPLISHMENTS & FUTURE PROGRAMS:

1. (U) FY 1981 & Prior Accomplishments: Project 2369, Wide Area Antiarmor Munitions - Concept Definition studies initiated in FY 1977 were completed by multiple contractors on four WAAM concepts. Two competitive validation contracts for the Antiarmor Cluster Munition were awarded in late FY 1978. Two contracts for the competitive validation of the

Project: #2369 | Title: Wide Area Antiarmor Munitions
Program Element: #63609F | Title: Advanced Attack Weapons
DoD Mission Area: Close Air Support and Interdiction, #223 | Budget Activity: Tactical Programs, #4

Extended Range Antiarmor Munition were awarded in June 1979. The Cyclops concept was eliminated in January 1979 to enable the program to live within funding constraints. Two validation contracts were awarded for the Wasp missile in November 1979 to accomplish system design, component fabrication, and testing of seekers and airframes. The final phase of Antiarmor Cluster Munition validation was successfully completed in FY 1980 with system development and validation tests. Following a favorable Milestone II decision in July, the Antiarmor Cluster Munition advanced into Program Element 64607F, Wide Area Antiarmor Munitions for full scale development. Validation efforts for the other two concepts continued. The Extended Range Antiarmor Munition completed its preliminary design phase and began initial fabrication and testing of the classifier, sensor, and warhead. The Extended Range Antiarmor Munition test program has demonstrated each of the critical subsystems. Testing of the Wasp seekers in FY 1981 has demonstrated a capability to detect, acquire, and track targets in different clutter backgrounds.

2. (U) FY 1982 Planned Program: Validation of both the Wasp and Extended Range Antiarmor Munition will continue. Drop tests, pattern tests, and live warhead tests will complete the Extended Range Antiarmor Munition validation program in the spring of 1982. Higher priority requirements and constrained budgets will prevent the Extended Range Antiarmor Munition from entering full scale development in FY 1983. The testing of the Wasp missile system will continue in FY 1982 with captive carry flights of the seeker. Fabrication of missile hardware for flight test and initial flight test of the two contractor designs will begin in FY 1982.

3. (U) FY 1983 Planned Program: The Wasp missile system will continue contractor flight tests and the validation program will end in the third quarter of FY 1983. The system will be ready to transition into full scale development under Program Element 64607F. An additional $9.5M provided by Congress in FY 1981 accelerated the validation program schedule, resulting in a significant reduction in the FY 1983 requirements and elimination of the FY 1984 requirements. An inflation adjustment was also included.

4. (U) FY 1984 Planned Program: There are no planned FY 1984 efforts for the Wide Area Antiarmor Munitions project under this program element. Depending on validated needs, some continued advanced development of advanced attack weapons may be required.

5. (U) Program to Completion: Not Applicable

6. (U) Milestones:

A. Antiarmor Cluster Munition Validation Contract Award	August 1978
B. Extended Range Antiarmor Munition Validation Contract Award	June 1979
C. Wide Area Antiarmor Munitions Milestone 0	September 1979
D. Wasp Validation Contract Award	November 1979
E. Antiarmor Cluster Munition Milestone II (Full Scale Development Decision) Review	July 1980

Project: #2369
Program Element: #63609F
DoD Mission Area: Close Air Support and Interdiction, #223

Title: Wide Area Antiarmor Munitions
Title: Advanced Attack Weapons
Budget Activity: Tactical Programs, #4

F. Extended Range Antiarmor Munition Validation Complete		April 1982
G. Wasp Validation Complete		May 1983
H. Wasp Milestone II Review	*(May 1983)	FY 1985

* Date presented in FY 1982 Descriptive Summary.

(U) Explanation of Milestone Changes:

H: Change in DoD acquisition policy changes Milestone II dates to coincide with the Critical Design Review activity in full scale development.

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Budget Data: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63714F
DoD Mission Area: Air Warfare Support, #225

Title: DoD Physical Security Equipment-Exterior (Adv Dev)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	7,308	996	3,911	3,838	4,500	51,100

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the development of the Department of Defense Base and Installation Security System, a standardized exterior physical security system, by accomplishing advanced development tasks in three functional areas: detection, command and control, and imaging. A Department of Defense need exists for a family of standardized modular equipment, integrable into system configurations to provide a level of security in consonance with the deployment mode, threat level, and sensitivity of the asset being protected.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds for the continued advanced development of technologies and prototype equipment for the Total Base and Installation Security System capability. The technology base and prototypes developed for this program will be deployed in three modes: permanent, semi-permanent, and mobile. Primary emphasis will be placed on detection and imaging subsystems. Cost estimate based on inputs from various government agencies performing these development efforts.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	7,500	1,000	4,100		8,400	51,900
Procurement (Other)(27596F)	17,590	12,203	39,429		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Other)(27596F)	17,516	10,789	21,820	70,953	Continuing	Not Applicable

Program Element: #63714F
DoD Mission Area: Air Warfare Support, #225

Title: DoD Physical Security Equipment-Exterior (Adv Dev)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This program responds to Secretary of Defense direction contained in Department of Defense Directive 3224.3, 1 December 1976, which designates the Air Force as executive agency for the development of standardized exterior physical security equipment and systems for protection of bases and installations. The Air Force established the Base and Installation Security System program to accomplish the necessary advanced and engineering development tasks in meeting the Department of Defense component requirements. A world-wide increase in the level of terrorist threat and a greater emphasis on security protection for mission-critical resources necessitate the development of a standardized system capability for use by all Defense agencies. Established goals within the Base and Installation Security System program are the Initial Base and Installation Security System and Total Base and Installation Security System with scheduled availability dates of December 1979 and January 1987 respectfully. The completed Inital Base and Installation Security System program provides Type C (production) specifications for equipment providing a medium level of security for small permanent locations and a partial system capability for selected resources deployed in a semipermanent mode. The Total Base and Installation Security System objectives are to provide a capability for high level security, against all threat levels, for resources in three deployment modes: permanent, semipermanent, and mobile. The objectives of this program are to provide a technology base, accomplish advanced development tasks, and develop prototype equipment for full-scale development and integration under Program Element 64715F, Department of Defense Physical Security Equipment-Exterior (Engineering Development). Development of a technology base and prototypes is being carried out in three functional areas: detection, command and control, and imaging. Maximum utilization is being made of technology and prototypes developed by other Services and commercial sources whenever feasible.

(U) RELATED ACTIVITIES: Full-scale development of equipment, subsystem/system integration and test, and type C (production) specification development is accomplished under Program Element 64715F, Department of Defense Physical Security Equipment-Exterior (Engineering Development). Procurement of physical security equipment is accomplished using Other Procurement-Air Force funding under Program Element 27596F. Air Base Defense System. The Base and Installation Security System equipment will be designed for interoperability with the Army interior security system (Facility Intrusion Detection System) and the Army tactical sensor system (Remotely Monitored Battlefield Sensor System). This program also interfaces with an exploratory development program for nuclear site security managed by the Defense Nuclear Agency. Management oversight of the physical security equipment programs is provided by the Department of Defense Physical Security Equipment Action Group with the Chairperson residing in the Office of the Under Secretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: This program is managed by the Physical Security Systems Directorate, Electronic Systems Division, Hanscom Air Force Base, MA. Department of Defense agencies performing development tasks are: Rome Air Development Center, Griffiss Air Force Base, NY; Army Mobility Equipment Research and Development Command and Army Night Vision Laboratory, Fort Belvoir, VA; Army Waterways Experimental Station, Vicksburg, MS; Naval Avionics Center, Indianapolis, IN; Naval Ocean Systems Center, San Diego, CA; and the Naval Coastal Systems Center, Panama City, FL. In addition to these Defense agencies, the Department of Energy/Sandia Laboratories, Albuquerque, NM, performs advanced development tasks and the Analytical Systems Engineering Corporation assists in the system engineering support and integration task.

Program Element #63714F
DoD Mission Area: Air Warfare Support, #225

Title: DoD Physical Security Equipment-Exterior (Adv Dev)
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Although there are many advanced development tasks which have been accomplished, the following are examples of major subsystem components which have completed advanced development: small permanent communications and display segment, open ramp boundary sensor, magnetic/seismic line sensor processor, transducer sensitivity tester, entry control identifier segment, ported coaxial cable sensor, and mobile individual resource protection sensor.

2. (U) FY 1982 PROGRAM: Advanced development continues in the following areas: pyroelectric vidicon imaging sensor, advanced central data control/processing segment, sensor data acquisition, infrared charge coupled device fence sensor, and foliage penetration radar. The foliage penetration radar is expected to complete advanced development in Fiscal Year 1982.

3. (U) FY 1983 PLANNED PROGRAM: The program consists of continued advanced development in support of the Total Base and Installation Security System. Primary emphasis will be placed on the advanced central data control and processing segment, sensor data acquisition, pyroelectric vidicon imaging sensor, and infrared charge coupled device fence sensor. The pyroelectric vidicon and infrared charge coupled device are expected to complete advanced development in Fiscal Year 1983. The decrease in the Fiscal Year 1983 procurement funding level is due to the delay in procurement of the ported coaxial cable sensor.

4. (U) FY 1984 PLANNED PROGRAM: The program consists of continued advanced development in support of the Total Base and Installation Security System. Primary emphasis will be placed on sensor data acquisition and advanced sensor signal processing techniques.

5. (U) PROGRAM TO COMPLETION: This program will provide technology and prototype equipment for engineering development of the Base and Installation Security System. Advanced development tasks will continue at a nominal level subsequent to the availability of the Total Base and Installation Security System capability to keep the system current with the state-of-the-art technology.

6. (U) MILESTONES: Not Applicable

7. (U) RESOURCES: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63718F
DOD Mission Area: Multimission, Technology, & Support, #374

Title: Electronic Warfare Technology
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	14,078	11,756	18,724	21,087	Continuing	Not Applicable
691X	Electronic Warfare Technology	11,013	8,556	9,856	10,768	Continuing	Not Applicable
2432	Warning and Power Management Systems Technology	3,065	3,200	6,641	8,594	Continuing	Not Applicable
2754	C^3 Countermeasures Technology	0	0	2,227	1,725	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides advanced development in the area of electronic warfare where an expanded technology base is needed to solve critical penetration aid problems for all classes of manned and unmanned aircraft. This program also provides for component, technique and subsystem development leading to the reduction of acquisition and life cycle cost of electronic warfare equipment.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Advanced development efforts in FY 1983 will address existing and projected shortfalls in countering Soviet air defenses by demonstrating aircraft radar signature reduction concepts, confusing sophisticated threat radars, and disrupting enemy communication systems. Funding represents a significant increase to accelerate critical technologies for strategic and tactical aircraft protection. The largest new effort will begin development of next generation threat warning system for the 1990's and improvements to existing radar warning receivers. Efforts started in previous years to counter threat missile guidance and investigating improved jamming power management concepts will continue. The cost estimate is based upon the number of different critical development areas, risk of these areas, and previous experience.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	14,400	12,000	22,000		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63718F   Title: Electronic Warfare Technology
DOD Mission Area: Multimission, Technology, & Support, #374   Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Modern air warfare is dominated by the presence of a myriad of electronic devices that locate, monitor, guide and control offensive and defensive elements. Denial of enemy use of these devices while retaining the capability for our own systems, is the function of electronic warfare. The survivability of our aircrews and the number of weapons delivered to the target are directly relateable to the efficiency of our electronic warfare systems. It is axiomatic that an enemy faced with a strong electronic warfare capability will attempt to enhance his capability through changes in tactics and improved equipment. To gain and maintain an advantage requires a strong electronic warfare technology program to provide demonstrated alternatives that counter any initiatives made by the enemy defense.

(U) The program consists of three projects. Project 2432 funds development of warning receivers used to alert aircrews of impending attack and also automatically set jammers against highest priority threats. In addition, an integrated receiver/jamming power management system is being developed to demonstrate jammer concepts against sophisticated threat environments. Project 691X funds development of radar, and radar guided missile countermeasures. This includes both active jamming techniques (onboard or expendable) and passive techniques such as radar signature reduction, electronic intelligence receivers, and dispensed radar reflecting clouds called chaff used to confuse enemy radars. Project 2754 funds development of countermeasures to enemy communication and navigation systems. Included are methods to identify critical enemy communication links, integrate this information into the signals intelligence network and display the enemy battlefield communication scenario.

RELATED ACTIVITIES: The efforts in this program are closely coordinated with Program Element (PE) 63743F, Electro-Optical Warfare, and other electro-optical and electronic warfare programs as well as advanced development work in similar activities by the Army and the Navy through joint reviews conducted by the Joint Technical Coordinating Group and memoranda of agreement. Exploratory development efforts are phased into this program from PE 62204F, Aerospace Avionics. Completed electronic warfare efforts are transitioned into the engineering development programs; PE 64220F, EW Counter Response; PE 64710F, Reconnaissance Equipment; PE 64724F, Tactical C^3 Countermeasures; PE 64738F, Protective Systems; PE 64737F Airborne Self Protection Jammer; and PE 64739F, Tactical Protective Systems. Tri-Service efforts are in radar warning receivers and jamming systems and radar countermeasures. Joint Air Force/Navy efforts are in an Advanced Transmitter applicable to the ALQ-99 installed in the EF-111A and EA-6B, expendable countermeasure decoys, and the New Threat Warning System. Project 2754 is new in FY 1983. It continues efforts previously funded in Project 691X and initiates new efforts, all developing C^3 countermeasures technology.

WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, manages the program along with Rome Air Development Center, Griffiss AFB, NY. The major contractors are: Calspan Corporation Buffalo, NY - study and analysis; Kuras-Alterman Corporation, Fairfield, NJ - jammer control and modulation technique; SEDCO Corporation Farmingdale, NY - antenna techniques; GTE Sylvania Corporation, Mountain View, CA - communications jammers; Georgia Institute of Technology, Atlanta, GA - electronic warfare technique analysis; Norden, Norwalk, CT - jammer techniques; Motorola, Phoenix, AZ - radar signal receivers and early warning radar ECM; Raytheon, Goleta, CA - jamming; Northrop, Chicago, IL - common transmitter chains; Sperry, Clearwater, FL - radio frequency sources, Westinghouse Baltimore, MD - radar signal processors; IBM, Owego, NY - signal processing software; and General Electric, UTICA, NY - radar absorbing material.

Program Element: #63718F — Title: Electronic Warfare Technology

DOD Mission Area: Multimission, Technology & Support, #374 — Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Recent accomplishments include demonstration and transition of: [ ] jammer program, a high probability of intercept receiver to the [ ] aircraft; [ ] radar countermeasures to engineering development; new receiver technology to be used to update operational radar warning receivers; an improved chaff cartridge now under joint US/Dutch engineering development (RR-180); an improved jamming amplifier for the ALQ-131, and signal processing used in the Advanced Self Protection Jammer and ALQ-131.

2. FY 1982 Program: Efforts in 1982 address completion of several major efforts as well a new starts to demonstrate technology for survivability needs. Scheduled for completion are the high power jamming transmitter to increase the frequency coverage and effectiveness of the EF-111A in protecting penetrating aircraft from threat radars, and the [ ] radar countermeasure. Also to be completed are the tri-service [ ] transmitter and radar warning development. New starts include a system to dud or predetonate threat missile fuzes; radar signature reduction using special radome designs; [ ] chaff decoys to counter [ ] and pulse doppler threat radars; [ ] jammers to complement stand-off jammers like COMPASS CALL; a higher power, broadband [ ] jamming transmitter; radar signal processors and jamming power management techniques to improve effectiveness of tactical and strategic jamming systems. The largest new effort is initial development of the next generation threat warning system and technology improvements to existing radar receivers to allow unambiguous warning in dense, exotic threat signal environments.

3. FY 1983 Planned Program: The FY 1983 funds represent a significant increase to accelerate previously initiated efforts and new starts. Continued efforts include missile guidance countermeasures, radar signature reduction, both active and passive [ ] radar countermeasures, advanced threat signal recognizers and processors to handle dense sophisticated threat environments and to aid in warning and jamming response, and the next generation threat warning system and technology insertion development. New starts will address integration of electronic warfare assets (warning receivers, jammers, decoys) to reduce size and cost and improve survivability; smaller lower cost jamming transmitters, a [ ] to improve the effectiveness of the EF-111 in screening USAF aircraft, testing and evaluation of advanced jamming power management system and subsystem and advanced countermeasures to the Soviet AWACS system. Because of the growth in importance, C^3 Countermeasures efforts have been consolidated into a new project. Included in this project is development of jamming packages for drone borne or pod borne applications to complement COMPASS CALL in disrupting coordination and fire control of enemy defensive systems, countermeasures to [ ] real time [ ] of enemy air interceptor control, development of processing/display capabilities for real time enemy C^3 target recognition and decision aides for C^3CM and battle decisions. Funding was reduced in FY 82 to fund higher priority Air Force requirements.

Program Element: #63718F Title: Electronic Warfare Technology
DOD Mission Area: Multimission, Technology & Support, #374 Budget Activity: Tactical Programs, #4

4. FY 1984 Planned Program: The FY 1984 program will continue development of key technology areas addressing capability shortfalls. These areas include radar signature reduction to reduce aircraft detection range, passive and active countermeasures to[ ]threat radars, and missile seekers, counters to missile and guidance and fuzing systems, improved jamming transmitter and antennas, a[ ]transmitter to increase the effectiveness of stand-off jamming platforms, threat radar warning receivers and signal processing technologies to cope with expected threat signal environments, countermeasures to enemy communication, command, and control systems and advanced countermeasures techniques to improve penetrativity of manned bombers.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

Project: #691X | Title: Electronic Warfare Technology
Program Element: #63718F | Title: Electronic Warfare Technology
DOD Mission Area: Multimission, Technology & Support, #374 | Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The enemy air defense network is characterized by both airborne and land based radar and communication systems that locate, monitor, guide, and control offensive and defensive elements. The enemy continues to improve these elements against our forces and our operational countermeasures. This requires a strong technology base to provide demonstrated counters to these improvements and avoid technological surprises by new enemy threat systems.

(U) Project 691X was established to provide advanced development of new countermeasure techniques and hardware for both existing and new electronic warfare systems. The project includes the following areas: (1) a supporting simulation effort that guides the allocation of funding through the evaluation of new concepts and techniques: (2) radar signature reduction to delay and impair acquisition and tracking of our aircraft by enemy radar; (3) on-board jamming systems, components, and techniques needed to jam enemy radar; (4) offboard or expendable systems to confuse enemy radars and dilute enemy defenses; (5) electronic collection systems to inform the field commander of changes in the electronic environment; and (6) the development of standardized and low cost components and systems to enable the Department of Defense to better afford the increasing amount and sophistication of electronic countermeasures equipment required on modern aircraft.

RELATED ACTIVITIES: The efforts in this program are closely coordinated with Program Element 63743F, Electro-Optical Warfare, and other electro-optical and Electronic Warfare (EW) programs as well as advanced development work in similar areas conducted by the Army and the Navy. Exploratory development efforts are phased into this program from PE 62204F, Aerospace Avionics. Completed EW efforts are transitioned into the engineering development programs; PE 64220F, EW Counter Response; PE 64710F, Reconnaissance Equipment; PE 64724F, Tactical C^3 Countermeasures; PE 64738F, Protective Systems; PE 64737F, Advanced Self Protection Jammer; and PE 64739F, Tactical Protective Systems. Tri-Service efforts are in [ ] radar warning receivers and jamming systems and [ ] countermeasures. Joint Air Force/Navy efforts are in an Advanced Transmitter applicable to the ALQ-99 installed in the EF-111A and EA-6B, expendable countermeasures decoy and the New Threat Warning System. C^3 Countermeasure efforts previously funded in Project 691X transfer to Project 2754 in FY 1983.

(U) WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, manages the program. The major contractors are: Calspan Corporation, Buffalo, NY - study and analysis; SEDCO Corporation, Farmingdale, NY - antenna techniques; Georgia Institute of Technology Atlanta, GA - electronic warfare technique analysis; Norden, Norwalk, CT - jammer techniques; Motorola, Phoenix, AZ - radar signal receivers and early warning radar ECM; Raytheon, Goleta, CA - millimeter wave jamming; Northrop, Chicago, IL - common transmitter chains; and General Electric, Utica, NY - radar absorbing material.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Recent accomplishments include demonstration and transition of: [ ], program, [ ], radar

countermeasures to engineering development, new receiver technology to be used to update operational radar warning receivers, an improved chaff cartridge now under joint US/Dutch engineering development (RR-180), and improved jamming amplifier for the ALQ-131, and signal processing in the Advanced Self Protection Jammer.

2. FY 1982 Program: Efforts in 1982 address completion of several major efforts as well a new starts to demonstrate technology to critical survivability needs. Scheduled for completion are the effectiveness of the EF-111A in protecting penetrating aircraft of terminal threat radars, and the radar countermeasure. Also to be completed are the tri-service transmitter and radar warning development. New starts include a system to dud or predetonate threat missile fuzes; radar signature reduction using special radome designs; chaff decoys to counter and pulse doppler threat radars; jammers to complement stand-off jammers like COMPASS CALL; a higher power, broadband jamming transmitter.

3. FY 1983 Planned Program: The FY 1983 funds represent a significant increase to accelerate previous initiated efforts and new starts in critical areas. Continued efforts include missile guidance countermeasures, radar signature reduction, both active and passive radar countermeasures. New starts will address integration of electronic warfare assets (warning receivers, jammers, decoys) to reduce size and cost and improve survivability of smaller lower cost jamming transmitters, a transmitter to improve the effectiveness of the EF-111 in screening USAF aircraft, and advanced countermeasures to the Soviet AWACS system. Because of the growth in importance, communication, command and control countermeasures (C^3CM) efforts have been consolidated into a new project. Included in this project is development of jamming packages for drone borne or pod borne applications to complement COMPASS CALL in disrupting coordination and fire control of enemy defensive systems, countermeasures to real time of enemy air interceptor control, development of processing/display capabilities for real time enemy C^3 target recognition and decision aides for C^3CM and battle decisions.

4. FY 1984 Planned Program: The FY 1984 program will continue development of key technology areas addressing critical capability shortfalls. These areas include radar signature reduction to reduce aircraft detection range, passive and active countermeasures to threat radars, and missile seekers, counters to missile guidance and fuzing systems, improved jamming transmitter and antennas, a to increase the effectiveness of stand-off jamming platforms, threat radar warning receivers and signal processing technologies to cope with expected threat signal environments, countermeasures to enemy C^3 systems and advanced countermeasures techniques to improve penetrativity of manned bombers.

5. (U) Program to Completion: This is a continuing program.

Project: #691X
Program Element: #63718F
DOD Mission Area: Multimission, Technology & Support, #374

Title: Electronic Warfare Technology
Title: Electronic Warfare Technology
Budget Activity: Tactical Programs, #4

6. (U) Milestones: Not Applicable

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	11,013	8,556	9,856	10,768	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
RDT&E	11,000	9,000	15,000		Continuing	Not Applicable

(U) FY 1983: Funding in FY 1983 represents a $5,144 thousand decrease due to transfer of $2,400 thousand into Project 2754 and a reduction of $2,700 thousand to fund higher priority Air Force requirements.

Project: #2432 | Title: Warning & Power Management Systems Technology
Program Element: #63718F | Title: Electronic Warfare Technology
DOD Mission Area: Multimission, Technology & Support, #374 | Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The enemy air defense network relies on radar systems to search, acquire, target, and guide missiles and anti aircraft fire. Because of this proliferation of different radar systems in large numbers, and over a large portion of the microwave frequencies, sophisticated systems are required to analyze the threat environment and either warn aircrews of potential threats or initiate an automatic jamming response. Literally, millions of radar pulses will impinge on the aircraft and require extensive sorting to determine the lethality of the threat environment and determine an optimum use of the limited onboard jamming resources or power management.

(U) Project 2432 was established to develop warning and power management technologies to cope with the projected threat environments both for strategic and tactical aircraft. The project includes the following areas: 1) advanced power management systems to develop and evaluate optimum system configurations, 2) high speed, flexible jamming signal generators, 3) radar signal receiver technologies that are smaller, can handle dense signal environments, and are able to detect exotic threat signal modulations, 4) high speed signal processors that can sort through data and determine optimum jamming response, 5) receiver and transmit antennas which can provide precise threat direction and optimize jamming radiation, and 6) threat warning systems to integrate radar warning, infrared, laser sensor input and provide clear, unambiguous warning to aircrews.

(U) RELATED ACTIVITIES: The efforts in this project are closely coordinated with Program Element 63743F, Electro-Optical Warfare, other electro-optical and electronic warfare programs as well as advanced development work in similar areas conducted by the Army and Navy. Exploratory efforts are phased into this program from PE 62204F, Aerospace Avionics. Completed development are transitioned into engineering development programs, PE 64220F, EW Counter Response, PE 64738F, Protective Systems, PE 64739F, Tactical Protective Systems, PE 64737, Advanced Self Protection Jammer, and PE 64226F, Long Range Combat Aircraft. Portions of the New Threat Warning System are being worked as a cooperative Air Force/Navy effort.

(U) WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson AFB, OH manages the program. Major contractors are Kuras Alterman, Fairfield NJ - power management systems; IBM, Owego NY - signal processing; Sperry, Clearwater, FL - jamming signal generators; TRW, Los Angeles CA - threat warning systems; and Applied Technology, Sunnyval CA - threat warning systems.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: This project was established in FY 1976. Recent accomplishments include demonstration of a state-of-the-art jamming power management system capable of [ ] in a dense, exotic signal environment. The processing technology in this system is being incorporated is an [ ] defensive system. Receiver technologies developed in this project are being incorporated into the ALR-74 radar warning receiver. A synthesized signal generator developed is being incorporated into threat radar simulators in the Air Force and Navy. A high probability of intercept receiver is being incorporated into the [ ] intelligence collection aircraft. Initial concept studies of a next generation threat warning system were completed.

Project: #2432
Program Element: #63718F
DOD Mission Area: Multimission, Technology & Support, #374

Title: Warning & Power Management Systems Technology
Title: Electronic Warfare Technology
Budget Activity: Tactical Programs, #4

2. FY 1982 Program: In FY 82 the Advanced Power Management System will complete final evaluation of the baseline system. The baseline system will serve as a tool for evaluating new improved subsystem capabilities such as the digital frequency synthesizer for more rapid, accurate set-on jamming, [ ] jamming techniques, high speed multi-computer processors, new microwave integrated curcuit receiver technologies, and acusto-optical receivers. New starts are planned in processors which can predict the characterictics of random signal threat radars, receive/transmit antennas which minimize size to lower aircraft modification costs, and a preliminary study for the New Threat Warning System which will investigate aircraft integration and software support issues for a next generation warning system.

3. (U) FY 1983 Planned Program: The FY 1983 program will continue evaluation of high pay-off subsystem technologies in The Advanced Power Management System. Previous starts in new signal processors, array antenna concepts and designs for small size and low radar cross-section, and New Threat Warning System integration and software issues. New starts will include a digital storage device to more precisely replicate threat radar signals thereby increasing jamming effectiveness, and acusto-optical signal processors to sort through dense radar signal environments. Phase I of the New Threat Warning System which will evaluate critical high risk technologies in the next generation will begin. This will lead to a brass board demonstration of competing technoligies prior to beginning engineering development designs. Examples of high risk areas include Very High Speed Integrated Circuits in electronic warfare applications and broad band highly sensitive, high probability of intercept receivers.

4. (U) FY 1984 Planned Program: In FY 1984, evaluation of the modified Advanced Power Management System with new subsystems will continue, along with development of new threat signal processors and storage devices and electronic warfare antenna designs. The New Threat Warning System will continue demonstrating critical warning technology subsystems. Development will begin on a miniaturized jamming signal generator which can substantially reduce the size and cost of signal generators installed in tactical aircraft jamming systems such as the Advanced Self Protection Jammer.

5. (U) Programs to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Complete	Total Estimated Costs
RDT&E	3,065	3,200	6,641	8,594	Continuing	Not Applicable

8. (U) Comparision with FY 1982 Descriptive Summary:

RDT&E	3,400	3,000	7,000		Continuing	Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63726F
DOD Mission Area: Air Warfare Support #225

Title: Fiber Optics Development
Budget Activity: Tactical Programs, #4

(U) RESOURCES: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT (RDT&E)	--	--	2,864	1,660	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force Fiber Optics Development Program provides for the development of fiber optic systems needed to meet Air Force operational requirements for lightweight, low cost, broadband transmission systems. Also included is the development of standards to provide interoperability between Air Force systems and the systems of the other Services and to prevent the proliferation of non-standard equipments.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Program begins with the development of firer optics standards, transmission systems, and continuation of the 26-pair cable replacement program (which will begin in FY 82 using Army funds with Memo of Agreement with the Army). Development of connector and fiber related standards and systems needed for the tactical Air Forces will also be completed.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: This is a new start in FY 1983.

(U) OTHER APPROPRIATION FUNDS:	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Other) (PE 27586F - 'FIBER OPTICS')	--	--	3,000	3,000	Continuing	Not Applicable

FY 1983 RDT&F DESCRIPTIVE SUMMARY

Program Element: # 63726F
DOD Mission Area: Air Warfare Support #225

Title: Fiber Optics Development
Budget Activity: Tactical Programs, #4

(U) RESOURCES: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT (RDT&E)	--	--	2,864	1,660	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force Fiber Optics Development Program provides for the development of fiber optic systems needed to meet Air Force operational requirements for lightweight, low cost, broadband transmission systems. Also included is the development of standards to provide interoperability between Air Force systems and the systems of the other Services and to prevent the proliferation of non-standard equipments.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Program begins with the development of fiber optics standards, transmission systems, and continuation of the 26-pair cable replacement program (which will begin in FY 82 using Army funds with Memo of Agreement with the Army). Development of connector and fiber related standards and systems needed for the tactical Air Forces will also be completed.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: This is a new start in FY 1983.

(U) OTHER APPROPRIATION FUNDS:	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Other) (PE 27586F - 'FIBER OPTICS')	--	--	3,000	3,000	Continuing	Not Applicable

Program Element: #63726F
DOD Mission Area: Electronics and Physical Sciences #551

TITLE: Fiber Optics Development
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force Fiber Optics program provides for the development of fiber optics systems needed to meet Air Force operational requirements for lightweight, low cost, broadband transmission systems. Also included is the development of standards to provide interoperability between Air Force systems and between Air Force systems and the systems of the other services to prevent the proliferation of non-standard equipments. A large portion of the progra is for procurement of off-the-shelf commercial products for installation in the Tactical Air Control System and other ground facilities. These installations will result in a tremendous cost, weight, and volume savings and large increases in transmission length and information carrying capacity along with immunity to electromagnetic interference --- The FY 83 program begins the development of fiber optics standards and transmission systems, acquisition of off-the-shelf components/ systems for remoting of RF emitters and elimination of circuit noise, and installation of command, control, and communications links in the Tactical Air Control System.

(U) RELATED ACTIVITIES: The Air Force Fiber Optics program is funded by two program elements (63726F for RDT&E dollars for Advanced Developmental efforts, and 27586F for procurement dollars for follow-on acquisition and near term acquisition. 27586F also contains required manpower for this program).

(U) WORK PERFORMED BY: The Air Force Systems Command manages the Advanced Developmental Activities under this program with Support from the Air Force Logistics Command and Air Force Communications Command. The Air Force Logistics Command Manages the follow-on acquisition and rapid reaction acquisition with support from Air Force Communications Command. Finally, Air Force Communications Command manages base cable installation activities with support from Air Force Logistics Command.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: N/A - This program is an FY 83 new start.

2. (U) FY 1982 Program: The 26-pair communications cable replacement program begins using Army funding through a Memo of Agreement (approx $400K). Other planning efforts begin in preparation for the FY 83 program.

3. (U) FY 1983 Planned Program: The program begins with the development of fiber optics standards, transmission systems, development of connector and fiber related standards, continuation of the 26-pair cable replacement program, and other systems needed for the tactical Air Forces. Also included is the near term acquisition of commercial standard systems by procurement of off-the-shelf equipment.

Program Element: #63726F
DOD Mission Area: Electronics and Physical Sciences #551

TITLE: Fiber Optics Development
Budget Activity: Advanced Technology Development, #2

4. (U) FY 1984 Planned Program: Includes continuation of Advanced Development Activities which began in the FY 83 program.

5. (U) Program to Completion: Includes continuation of Advanced Development activities, and beginning of follow-on procurement (using procurement dollars under the related program element, 27586F).

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63727F
DoD Mission Area: Tactical Communications, #345

Title: Advanced Communication Technology
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2087	5,280	6,106	5,243	Continuing	Not Applicable
2345	Airborne Imagery Transmission	0	3,487	3,645	3,301	Continuing	Not Applicable
2746	Low Probability of Intercept Communication	0	498	689	874	Continuing	Not Applicable
2747	Communication Vulnerability Analysis	0	498	886	874	Continuing	Not Applicable
2748	Advanced High Frequency Technology	0	797	886	194	Continuing	Not Applicable

(BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Modern military systems and weapons derive much of their value from the communication systems which provide the primary means of force coordination and battle management. [

] This program provides continuing research and development of new communication technologies to offset this threat evolution and to insure viable communications during the 1980s and 1990s. Specific emphasis is being placed on the development of a jam resistant reconnaissance data link, low probability of intercept tactical communications, the analysis of the vulnerability of command, control and communication (C^3) systems and advanced high frequency communication technology.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Complete design and begin fabrication of an advanced narrow band high frequency communication system, continue design of an airborne imagery transmission system. Begin assessment of employing millimeter wave technology to reduce intercept and antiradiation weapon threats to this data link. Continue concept design of a low probability of intercept voice and data communication system for tactical aircraft. Continue the assessment of the vulnerability of current communication systems to intercept and destruction threats. Begin development of an automated data base for the analysis of threats to our C^3 systems. Continue development of C^3 vulnerability simulations. Begin the enhancement of the data link vulnerability analysis (DVAL) methodologies developed by the DVAL Joint Task Force.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	0	5,400	6,400		Continuing	Not Applicable

Program Element: #63727F Title: Advanced Communication Technology
DoD Mission Area: Tactical Communications, #345 Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Modern military systems and weapons derive much of their value from communication systems, which provide the primary means of force coordination and battle management. [

] This program provides continuing research and development of new electronic counter countermeasures (ECCM) communication technologies to offset this threat evolution. Various Air Force ECCM programs have established "Red Teams" to analyze possible design vulnerability and assist with test program definition. The Air Force needs to consolidate this expertise and develop a comprehensive methodology for vulnerabilities analysis and testing. [ ] At the same time, the US is developing and deploying many new reconnaissance platforms and weapons requiring data links. This program will develop a new advanced jam resistant reconnaissance data link. The Air Force must continue to address intercept analysis and physical survivability. Low probability of intercept (LPI) communications are required to reduce the vulnerability of C^3I systems to antiradiation weapons and communication location analysis. The Air Force requires improved high frequency communications as an alternative to satellite communication systems to improved survivability and world wide connectivity.

(U) The Airborne Imagery Transmission project is developing and applying technologies to protect future data links from jamming; this project is part of the Joint Service Weapon Data Link (JSWDL) program; and as such this advanced technology will be available for use by other Services. The Low Probability of Intercept project will develop and apply LPI technologies to increase the survivability of tactical C^3 systems. The Communication Vulnerability project will develop and apply technologies and methodologies to analyze and test jam resistant and LPI communication systems.

(U) These programs support Tactical Air Command (TAC) Required Operational capability (ROC) 1-72, Multimission drones for Tactical Forces; Strategic Air Command (SAC) ROC 8-72, Reconnaissance Data; TAC ROC 324-75 Tactical Reconnaissance data link system; SAC ROC 1-75, Low Level Modular Reconnaissance Drone; TAC ROC 321-75, Jam Resistant Secure Voice Communication; SAC ROC 5-77, Adaptive High Frequency/Very High Frequency Communications; Military Airlift Command (MAC) General Operational Requirement (GOR) 3-77, Adaptive High Frequency Communications; TAC ROC 310-73, Improved Electronic Counter Countermeasures for the Tactical Air Forces (TAF); Joint Chiefs of Staff Memorandum 353-78, Requirement for Survivable and Endurant Strategic Communications; and TAF ROC 407-77, Improved Communications Package for the Tactical Air Control System.

Project Number:

2345 Airborne Imagery Transmission: This program will provide the advanced data link technology required to counter the Soviet threat during the late 1980s and after. [ ]

Program Element: #63727F — Title: Advanced Communication Technology
DoD Mission Area: Tactical Communications, #345 — Budget Activity: Tactical Programs, #4

program emphasis will be placed on antenna nulling and beam forming, information preprocessors, information compression, wide band and extremely wide band spread spectrum modems. An advanced technology data link will be developed and demonstrated to provide a jam-resistant, wide band, covert, tactical reconnaissance data link.

2746 (U) Low Probability of Intercept (LPI) Communication: In conjunction with Air Force Exploratory Development, will analyze, define and scope the susceptibility of tactical command, control, communication and intelligence to intercept analysis and antiradiation weapons in the 1990s time frame. Develop and demonstrate jam-resistant, LPI communication technology.

2747 (U) Communication Vulnerability Analysis: The overall objective of this advanced development initiative is to consolidate the technical efforts and expertise that exist in communications vulnerability analysis and to develop vulnerability testing methodologies. Test and evaluate a comprehensive methodology and special test equipment for assessing the vulnerability of development C^2 communications technology, equipments, and systems. To achieve this overall objective the following specific objectives will be met. Establish requirements for and access to hostile environment (threat) data bases to support the communications vulnerability assessment (CVA) process. Develop analyses and measurement techniques to determine the susceptibilities and interceptibilities of developmental communications components, elements, links, switching systems, protocols and system control systems. Identify existing C^2 communications simulations/emulations so they can be used to support test planning and to analyze the impact of communications system susceptibilities on the effectiveness of command and control. Conduct analysis of emerging C^3 ECCM technologies to (A) evaluate the CVA methodology developed under this program and (B) evaluate areas of vulnerability so that decisions relative to ECCM capabilities can be made early in the system development cycle. Develop the capability to insure that adequate threat signal simulators and test and evaluation requirements are available to support the test and evaluation at each phase of C^3 system developments.

2748 (U) Advanced High Frequency (HF) Technology: This project will develop advanced capability HF radio systems. Required capabilities include: Antijam voice and data communication, improved communication security, and reliable data communication over dispersive and nuclearly perturbed propagation channel conditions. The approach is to develop two systems: a narrow band, 3-10 KHZ signal band width mode not requiring new, currently unavailable, channel allocations and a wideband, up to 1 MHZ signal band width mode which will provide increased data rates. These efforts will exploit the technologies of voice source encoding, spread spectrum signal processing, adaptive channel equalization, adaptive (null steering) antenna technology, automatic frequency sounding (scanning), channel quality assessment and channel selection, and low

Program Element: #63727F Title: Advanced Communication Technology
DoD Mission Area: Tactical Communications, #345 Budget Activity: Tactical Programs, #4

probability of intercept (LPI) waveforms and power management.

(U) RELATED ACTIVITIES: This program is part of a coordinated effort to improve communication capabilities. As such it is related to Command, Control and Communications, PE 62702F; Command, Control and Communication Advanced Development, PE 63789F; and Advanced Communication Systems; PE 27423F. Advanced data link technology efforts will develop an advanced, wide band jam-resistant data link for real and near-real time reconnaissance efforts in Electronic and Physical Sciences, PE 63208F; and Tactical Surveillance, Reconnaissance, and Target Acquisition, PE 64710F. Data link development tasks are coordinated with the Army Modular Integrated Communication, Navigation System, PE 64748A.

(U) WORK PERFORMED BY: Air Force Systems Command (AFSC), Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright-Patterson AFB, OH. Contractors include: TRW Defense and Space, Redondo, CA; General Dynamics Electronic Division, San Diego, CA; ITT Avionics Division, Nutley, NJ; GTE Sylvania, Needham, MA; Electromagnetic Compatibility Analysis Center, Annapolis, MD; General Electric Company, Utica, NY; Motorola Inc., Scottsdale, AZ; RCA Corporation, Camden, NJ; and AEL Inc., Lansdale, PA. Federal Contract Research Center support is being provided by MIT Lincoln Laboratories, Lexington, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable.

2. (U) FY 1982 Program: The conceptual design of a highly jam resistant reconnaissance data link was begun. The design of a multi-beam, adaptive antenna system for this data link was started. These activities are based on promising technologies developed under exploratory development programs. A conceptual design and analysis study will begin to define a low probability of intercept tactical communication system. An analysis of existing jam resistant tactical communications to intercept, exploitation and physical destruction was begun. Evaluation of existing methodologies used to identify vulnerabilities in command, control and communication (C^3) systems was begun. To support the analysis C^3 system vulnerabilities an automated threat data base will be developed. The conceptual design of an advanced jam resistant, low probability of intercept high frequency communication system for Strategic Emergency Action Messages will begin.

3. (U) FY 1983 Planned Program. Design of the Airborne Imagery Transmission System will continue. Air and ground terminal equipment designs will start. Assessment of a millimeter wave technology preplanned improvement to this data link will reduce the threat of intercept and physical destruction. Conceptual design of a low probability of intercept communication system will continue. Laboratory and range testing of jam resistant communication systems will continue. The development of a C^3 vulnerability simulator will continue. Design of a C^3 test bed will be started. Vulnerability testing methodologies developed by the Data Link Vulnerability (DVAL) Joint Task Force (JTF) will be enhanced and applied to our C^3 systems. The design of a jam resistant high frequency system will be completed and fabrication of validation equipment will be started.

Program Element: #63727F
DoD Mission Area: Tactical Communications, #345

Title: Advanced Communication Technology
Budget Activity: Tactical Programs, #4

4. (U) FY 1984 Planned Program: Design of Airborne Imagery Transmission System and multi-beam adaptive antenna system will be completed. Fabrication of validation equipment will be started. Assessment of a millimeter wave technology for this data link will be continued. The conceptual design of a low probability of intercept communication system will be completed and fabrication of validation equipment will be started. Laboratory and range testing of current systems will be completed. Evaluation of a C^3 vulnerability test bed will begin. Enhancements for the DVAL JTF test methodologies will be completed. Fabrication of narrow band, jam resistant high frequency communication equipment will continue.

5. (U) Program to Completion: Fabrication and testing of the Airborne Imagery Transmission System validation to PE 64710F, Tactical Surveillance, Reconnaissance, and Target Acquisition. Development, fabrication and testing of a low probability of intercept tactical communication system will be completed and transitioned to PE 27423F, Advanced Communication Systems for full scale development. The analysis of C^3 vulnerabilities will continue. Fabrication and testing of a narrow band, jam resistant high frequency communication system will be completed and transitioned to PE 33126F, Long Haul Communications.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63742F
DOD Mission Area: Tactical Command and Control, #344

Title: Combat Identification Technology
Budget Activity: Tactical Programs, # 4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2,750	14,744	17,486	19,664	Continuing	Not Applicable
1177	Noncooperative Identification Techniques	2,750	3,800	5,500	2,900	Continuing	Not Applicable
2599	Cooperative Identification Technology		10,944	11,986	16,764	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of this program element is to accomplish advanced development of technology that can be used to provide reliable long range identification of airborne targets in both all-weather and hostile electromagnetic countermeasure environments. This program is necessary because the numerical superiority of the projected threat demands that we be capable of engaging the enemy at long ranges with our beyond visual range weapons. The long range identification that is a prerequisite for such engagements[

]

BASIS FOR FY 1983 RDT&E REQUEST: Includes funds for fabrication of advanced development models of a cooperative (question and answer) identification system to replace the aging Mark XII identification system. Also includes funding to begin development of new identification techniques based on the results of FY 1982 airborne sensor studies, to conduct]and to expand the ongoing engineering simulation of hardware and software necessary to integrate and correlate identification data. Complementary technological approaches for obtaining identification information (i.e. cooperative, noncooperative and the integration of the two) are necessary to assure a high confidence identification capability over the wide range of conditions existing in tactical warfare situations. Costing of these activities was based on parametric estimates performed by the Combat Identification System Program Office at the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH as of 17 November 1981.

Program Element: #63742F

DOD Mission Area: Tactical Command and Control, #344

Title: Combat Identification Technology

Budget Activity: Tactical Program, #4

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	2,750	14,800	To Be Determined		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63742F | Title: Combat Identification Technology
DOD Mission Area: Tactical Command and Control, #344 | Budget Activity: Tactical Program, #4

DETAILED BACKGROUND AND DESCRIPTION: Beyond visual range identification of airborne targets is [ ] In March 1978, North Atlantic Treaty Organization (NATO) Long Term Defense Program Task Force Five on Air Defense [ ] Similarly, the need for improved identification capability has been documented by Tactical Air Forces Statements of Need 304-79 and 305-79 and more recently in a Joint Mission Element Need Statement approved by the Secretary of Defense on 30 October 1980. [ ] This program element will fund advanced development of cooperative and noncooperative identification techniques that can be applied to the problem. Both types of identification technology must be developed [ ] Project 1177, Noncooperative Identification Techniques is developing noncooperative sensor techniques that will permit autonomous identification of hostile and friendly aircraft. Included in these techniques is the [ ] identification technique which identifies the target aircraft by [ ] Radio Frequency Emissions Identification, another technique under development, will use radio frequency emissions from target aircraft to perform long-range, adverse-weather air-to-air identification passively. Project 1177 is also developing the capability to integrate and correlate identification information from multiple sources onboard the weapon system to raise the confidence level and better manage the overall identification process. Project 2599, Cooperative Identification Technology is developing technology for a replacement system for the Mark XII Identification, Friend or Foe (IFF) System. Efforts will focus on advanced development of a NATO interoperable, secure and jam-resistant cooperative (question and answer) system for positive identification of friendly forces. Near term work is emphasizing the definition of United States requirements and the exploration of alternative solutions. This work is also the basis for developing the United States position in efforts to reach agreement with the other NATO nations on the signals-in-space and other interoperability characteristics of the next generation question and answer system(s). This work, provides a balanced United States approach to the [ ]

(U) RELATED ACTIVITIES: Work accomplished under this program element is part of an integrated Tri-Service effort to improve United States identification capabilities worldwide. Related activities include: Program Element (PE) 63267N, NATO Future Identification System; PE 63515N, Advanced Identification Techniques; PE 63706A, IFF Developments; PE 64211N, AIMS/ATCRBS/Mark XII; PE 64709A, IFF Equipment; and PE 64725F, Combat Identification Systems. Coordination and integration of the various activities under these program elements is accomplished through the Combat Identification System Program for which the Air Force is lead service.

(U) WORK PERFORMED BY: The overall program is managed by the Combat Identification System Program Office at the Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson Air Force Base, OH. The Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright-Patterson Air Force Base, OH is managing Project 1177 for the Combat Identification System Program Office. Contractors supporting Project 1177 are: Westinghouse Corp., Baltimore, MD; Hughes Aircraft Co., Culver City, CA; McDonnell Douglas Aircraft Corp., St. Louis, MO; Hazeltine Corp., Greenlawn, NY; and General Dynamics Corp., Fort Worth, TX. Contractors providing support to Project 2599 include: Dynamics Research Corp., Wilmington, MA; Bendix Corp., Baltimore, MD; E-Systems, St. Petersburg, FL; and Hazeltine Corp., Greenlawn, NY. Support is also provided by the Massachusetts Institute of Technology Lincoln Laboratory, Lexington, MA and the Electromagnetic Compatibility Analysis Center, Annapolis, MD.

Program Element: #63742F
DOD Mission Area: Tactical Command and Control, #344

Title: Combat Identification Technology
Budget Activity: Tactical Program, #4

) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (FY 1981 and Prior Accomplishments: Day and day/night electro-optical identification devices have been developed and tested under this program element. Additionally, the technology base for Dual Mode Recognition (DMR), was developed, tested and transitioned to the F-15 and F-16 program offices for engineering development. Preliminary design concepts for performing passive identification based on the target aircraft radio frequency emissions was completed. Non-real time simulations of algorithms and display concepts to integrate identification information from multiple sources was demonstrated. Also, with the help of reprogrammed Army and Navy funding, concept definition contracts for the NATO interoperable, cooperative (question and answer) identification system were awarded to industry, various supporting contractual activities were initiated and multiple technology studies were conducted.

2. (U) FY 1982 Program: Engineering simulation of hardware and software necessary to integrate and correlate identification data inputs from both cooperative and noncooperative identification techniques will be initiated. The concept definition contracts for alternative design approaches to a cooperative (question and answer) identification system will be completed and preparations for fabrication of advanced development models of a NATO interoperable, cooperative (question and answer) identification system will begin. Engineering simulation of various identification algorithms will continue. Additionally, the feasibility of using a radio frequency sensor to perform noncooperative, air-to-air identificaton passively will be demonstrated.

3. FY 1983 Planned Program: Engineering simulation of radio frequency emitter, passive identification algorithms will be completed. Noncooperative target identification techniques using will be refined and design simulations of new active/passive identification sensors will be initiated. Also, identification data integration software and display for tactical aircraft (e.g., F-15) will transition to engineering development via man-in-the-loop simulation/demonstration. In addition, fabrication of the advanced development models of the NATO interoperable, cooperative (question and answer) identification system will continue and subsystem/component level testing conducted.

4. (U) FY 1984 Planned Program: Various development and engineering simulation of noncooperative identification techniques will continue. A development decision on incorporating passive radio frequency identification techniques in new threat warning receivers and/or as modifications to existing receivers will be made. Design studies on the practical implementation of an integrated air-to-air identification system will be conducted. Also, competitive fabrication of advanced development models of the NATO interoperable, cooperative (question and answer) identification system will be completed and demonstration and validation testing will be conducted.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

Project: #1177 | Title: Noncooperative Identification Techniques
Program Element: #63742F | Title: Combat Identification Technology
DOD Mission Area: Tactical Command and Control, #344 | Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Beyond visual range identification of airborne targets is

In March 1978, North Atlantic Treaty Organization (NATO) Long Term Defense Program Task Force Five on Air Defense

Similarly, the need for improved identification capability has been documented by Tactical Air Forces Statements of Need 304-79 and 305-79 and more recently in a Joint Mission Element Need Statement approved by the Secretary of Defense on 30 October 1980.

Because of

several complementary cooperative and noncooperative identification techniques, as well as their integration are being developed under the Air Force led, Tri-Service Combat Identification System Program. This project accomplishes the advanced development of techniques for performing noncooperative target identification. Included in these techniques is the Radar Warning Receiver/Fire Control Interface Software (RFIS) effort to demonstrate the feasibility of using radar warning receiver information to establish accurate multiple target tracks and identifications for beyond visual range air-to-air missile fire control. Another technique in development, entitled: Advanced Identification Multi-Sensor Integration Development/Demonstration, will demonstrate the feasibility and utility of integrating cooperative, noncooperative, active and passive, direct and indirect identification information onboard the aircraft to provide high confidence identification of air-to-air targets beyond visual range. Building on previous Navy work, this project is also developing radar signal processing techniques for application to Air Force fighter radars which would perform aircraft identification by

(U) RELATED ACTIVITIES: The Noncooperative Identification Techniques Project will be implemented in close coordination with all efforts under the Combat Identification System (CIS) Program. These efforts include the following program elements: Program Element (PE) 64725F, Combat Identification Systems; PE 63706A, Identification Friend or Foe; PE 64709A, Identification Friend or Foe; PE 63515N, Advanced Identification Technology; PE 63267N, NATO Identification System; and PE 64211N, AIMS/ATCRBS/MK XII. The work under Project 1177 will transition to PE 64725F, Project 2597 for engineering development.

(U) WORK PERFORMED BY: The Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Air Force Systems Command (AFSC), Wright-Patterson Air Force Base, OH manages this project. The following contractors provide support for this project: McDonnell Douglas Aircraft Corp., St. Louis, MO; Hughes Aircraft Co., Culver City, CA; and other contractors to be determined.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Day and day/night electro-optical identification devices have been developed and tested under this program element. These included the Laser Augmented Target Acquisition/Recognition System, the latest Electro-Optical System and the Eagle Eye III electro-optical identification sensor. Additionally, the technology base for Dual Mode Recognition (DMR),

Project: #1177
Program Element: #63742F
DOD Mission Area: Tactical Command and Control, #344

Title: Noncooperative Identification Techniques
Title: Combat Identification Technology
Budget Activity: Tactical Programs, #4

was developed, tested, and transitioned to the F-15 and F-16 program offices. In addition, performance requirements and preliminary design concepts for passive identification using a target aircraft's radio frequency emissions and the host aircraft's radar warning receiver were completed and used as a baseline for initial engineering simulations of the implementing algorithms. Also, three non-real time simulations of algorithms and display concepts to integrate identification information from multiple sensors were demonstrated. One of the algorithms was selected for implementation in identification tactics/technology simulations for possible near-term application to the F-15 aircraft.

2. (U) FY 1982 Program: An engineering simulation, using simulated radar warning receiver outputs, will be constructed to evaluate the performance of passive radio frequency techniques for air-to-air tracking and identification. This engineering simulation will also help develop specifications for use on the next generation threat warning receiver as well as identify opportunities for near-term modifications of existing equipment. In addition, man-in-the-loop simulation of identification tactics and technology will be initiated along with supporting analysis to evaluate the operational utility of fighter identification sensors, sources and display concepts. Additionally, work will continue on advanced algorithms to integrate identification data, concentrating on statistical data combination techniques to define next generation avionics and fighter implementation concepts. Work will also continue on identifying and investigating promising new or novel identification techniques and, with the Navy, on acquiring correlated multi-source data (i.e., radar, electro-optical, electronic support measures, and cooperative identification) to support the long term development and evaluation of algorithms for integrating identification information.

3. FY 1983 Planned Program: Engineering simulation of passive radio frequency identification using radar warning receiver technology will be completed. Man-in-the-loop simulation of identification tactics and technology to evaluate the operational utility of various fighter sensors, sources and display concepts will be completed along with an initial implementing algorithm and transition to engineering development in fiscal year 1984 under Program Element 64725F. Also, work will begin on the development of a radar signal processing algorithm to

Using results of the fiscal year 1982 studies and simulations, development work will begin on new identification techniques/sensors. Additionally, the ongoing work addressing identification data sources and integration concepts will be expanded to include the Joint Tactical Information Distribution System (JTIDS) and passive sensors.

4. FY 1984 Planned Program: Various development and engineering simulation work will continue. A decision will be made on whether to begin a follow-on integration and demonstration program for the passive radio frequency identification technique using available near-term hardware (e.g., ALR-69 radar warning receiver) versus becoming part of the final design for the New Threat Warning Receiver. In addition, development work will continue on

s will the expanded simulation work addressing the integration of multi-source identification information to include the Joint Information Distribution System (JTIDS) and passive sensors. Also, sensor contributor design studies, which examine potential sensor improvements relating to the practical implementation of an integrated air-to-air identification system, will be conducted.

Project: #1177 Title: Noncooperative Identification Techniques
Program Element: #63742F Title: Combat Identification Technology
DOD Mission Area: Tactical Command and Control, #344 Budget Activity: Tactical Programs, #4

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

7. (U) Resources:

Project Number	Title	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
1177	Noncooperative Identification Techniques		3,800	5,500	2,900	Continuing	Not Applicable

8. (U) Comparison with FY 1982 DESCRIPTIVE SUMMARY:

Project Number	Title	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
1177	Noncooperative Identification Techniques	2,750	3,300	3,600		Continuing	Not Applicable

The $1.9 million increase in FY 1983 takes advantage of the extensive simulation capability put together for the Advanced Medium Range Air-to-Air Missile (AMRAAM) operational utility evaluation. This will allow an extensive simulation of identification tactics and technology so that the operational utility of fighter identification sensors, sources and display concepts can be evaluated at substantially less cost than would otherwise be possible.

Project: #2599 Title: Cooperative Identification Technology
Program Element: #63742F Title: Combat Identification Technology
DOD Mission Area: Tactical Command and Control, #344 Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The principal method now used for target identification is a question and answer system which is the Mark X or Mark XII. The Mark XII system is a Mark X system with an added cryptographic computer to encypher the question and answer. This equipment is capable of identifying friends similarly equipped. The Mark X system is not secure (i.e., it can be read and spoofed) and is used by foes, friends and neutrals alike for air traffic control purposes. In 1955 the International Civil Aviation Organization provided a Mark X system to the Warsaw Pact for air traffic control standardization. As a result, the United States developed the Mark XII in 1958 to provide a secure identification capability. The Mark XII system, [

] Also, the enemy[

] Thus, pilots, for example, are faced with the serious dilemma of turning on their Mark XII equipment and permitting enemy exploitation or turning it off and being declared a foe by friendly air defense forces. Because of this uncertainty, combat rules of engagement frequently require a positive visual identification to be made before an engagement. This puts a severe restriction on our modern weapons which are capable of being launched far beyond visual identification range as well as placing the delivering weapon system in unnecessary danger. The need for improved identification capabilities is well documented. In March 1978 the North Atlantic Treaty Organization's Long Term Defense Program Task Force Five on Air Defense [

] Similarly, the need for improved identification capability has been documented by Tactical Air Forces Statements of Need 304-79 and 305-79 and more recently in a Joint Mission Element Need Statement approved by the Secretary of Defense on 30 October 1980. This project is part of a Tri-Service (Air Force led) effort, under the Combat Identification System (CIS) Program, to evolve comprehensive and balanced improvements to United States (U.S.) identification capabilities worldwide. For these improvements to have maximum effectiveness they must be interoperable with the identification capabilities of U.S. allies. To this end the U.S. is cooperating with the other North Atlantic Treaty Organization (NATO) nations to reach agreement on the basic operating characteristics (e.g., signals-in-space) of future identification equipment. The work in this project addresses direct, cooperative techniques of identification (e.g., use of cryptographically secure questions and answers). This work is complemented by direct, noncooperative and indirect identification techniques being pursued by other projects within this and other program elements. The thrust of the near term effort will be the selection of design approaches for which advanced development models will be competively built and tested. The results of such tests will be the basis for defining the role and contribution of direct, cooperative identification in improving overall U.S. identification capabilities considering other complementary identification techniques (e.g., direct, noncooperative and indirect). The testing will also provide the basis for obtaining interoperability agreement with the other NATO nations.

(U) RELATED ACTIVITIES: The Cooperative Identification Technology Project will be implemented in close coordination with all efforts under the Combat Identification System (CIS) Program. These efforts include the following program elements: Program Element (PE) 64725F, Combat Identification Systems; PE 63706A, Identification Friend or Foe; PE 64709A, Identification Friend or Foe; PE 63515N, Advanced Identification Technology; PE 6326/N, NATO Identification System; and PE 64211N, AIMS/ATCRBS/MK XII. The work under Project 2599 will transition to PE 64725F, Project 2598 for engineering development.

Project: #2599 | Title: Cooperative Identification Technology

Program Element: #63742F | Title: Combat Identification Technology

DOD Mission Area: Tactical Command and Control, #344 | Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: The Aeronautical Systems Division, Air Force Systems Command (AFSC), Wright-Patterson Air Force Base, OH manages this project. Additionally, project support is provided by Rome Air Development Center, AFSC, Griffis's Air Force Base, NY. The following contractors provide support for this project: Bendix Corp., Baltimore MD; Dynamics Research Corp., Wilmington MA; E-Systems, St. Petersburg, FL; Harris Corp., Melbourne, FL; Hazeltine Corp., Greenlawn, NY; Harris Corp., Melbourne, FL; Martin-Marietta Corp., Orlando, FL; Raytheon Co., Sudbury, MA; Texas Instruments Corp., Dallas, TX; and Veda Corp., Arlington, VA. Major support is also provided by Massachusetts Institute of Technology Lincoln Laboratory, Lexington, MA and the Electromagnetic Compatibility Analysis Center, Annapolis, MD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: This project was initiated in fiscal year 1979 with several studies of technology that could be applied in the design of a cooperative identification system. During fiscal year 1980 limited engineering design studies were conducted and high technology components that could support a specific design implementation of a cooperative, question and answer identification system were fabricated and tested by Lincoln Laboratories. The information developed from these activities helped to define the preliminary technical specifications for the United States requirements in this area. In fiscal year 1981, with the help of reprogrammed Army and Navy funds, concept definition contracts were awarded to three U.S. industry teams and various supporting contractual activities were initiated. These contracts investigated various alternative approaches to achieving a new direct, cooperative (question and answer) identification system, the technology development required, the costeffectiveness of the various approaches, frequency allocation issues, electromagnetic compatibility considerations and the weapon system impact(s) of trying to integrate such a system.

2. (U) FY 1982 Program: The concept definition contracts will be completed. The results of these contracts and supporting contractual activities along with various government studies and analyses will be reviewed and integrated by the Combat Identification System Program Office. Based upon this review the design approach(es) for which advanced development models are to be competitively built and tested will be selected. Preparations for fabrication of these advanced development models will be initiated.

3. (U) FY 1983 Planned Program: Development of the cooperative (question and answer) identification system will continue. Fabrication of advanced development models will continue and engineering simulation/testing at the subsystem/component level will be conducted. Technology application and supporting studies will be conducted to determine the most cost effective level of performance to build into a question and answer system.

4. (U) FY 1984 Planned Program: Fabrication of the advanced development models of the cooperative (question and answer) identification system will be completed and demonstration and validation testing will be conducted. Various cost effectiveness and supporting studies will be completed in preparation for a decision to transition to engineering development.

Project: #2599
Program Element: #63742F
DoD Mission Area: Tactical Command and Control, #344

Title: Cooperative Identification Technology
Title: Combat Identification Technology
Budget Activity: Tactical Programs, #4

5. (U) Program to Completion: The cooperative (question and answer) identification will transition to engineering development under Program Element 64725F with a production decision expected to occur in fiscal year 1987. Technology base efforts for other cooperative identification techniques will be initiated. This is a continuing program.

6. (U) Milestones:

		Date
A.	Tactical Air Forces Statements of Operational Need 304-79 and 305-79	1979
B.	Joint Mission Element Need Statement	1980
C.	DSARC I	1982
D.	Ratification of NATO Standardization Agreement (STANAG)	1985
E.	DSARC II	1985
F.	DSARC III	1987

7. (U) Resources:

Project Number	Title	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
2599	Cooperative Identification Technology	0	10,944	11,986	16,764	Continuing	Not Applicable

8. (U) Comparison with FY 1982 DESCRIPTIVE SUMMARY:

Project Number	Title	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
2599	Cooperative Identification Technology	0	11,500	To Be Determined		To Be Determined	To Be Determined

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63745F
DOD Mission Area: Defense Chemical and Biological Systems #275
Title: Chemical Warfare Defense
Budget Activity: Tactical Program #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT		3,985	4,877	4,687	Continuing	Not Applicable
2722	Biomedical Chemical Warfare Defense		3,985	4,877	4,687	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is designed to alleviate basic Air Force operational and medical problems associated with chemical warfare operations. The program will demonstrate improved technology solutions to enhance Air Force capabilities to sustain mission essential operations and handle casualties in a chemical warfare environment. This includes advanced development of equipment and operational procedures for crew protection, with emphasis on tactical air operations, personal decontamination, and casualty handling. The program will be performed by the Aerospace Medical Division, Brooks AFB TX, which includes the United States Air Force School of Aerospace Medicine, Brooks AFB TX, and the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB OH.

(U) BASIS FOR FY 1983 RDT&E REQUEST: With increased indications that the Warsaw Pact countries would use chemical weapons in a conventional conflict, the United States must step up their efforts to protect against chemical warfare attack. The most serious near-term aspect of the United States posture is the state of our defensive capability and ability for our forces to continue to operate in a chemical warfare environment. In coordination with the Army, the Department of Defense lead agency for overall chemical warfare defense, this advanced development program was initiated in FY 1982. The FY 1983 planned program will address these development efforts: advanced chemical defense aircrew respirator; aeromedical vital signs monitor; air transportable shelter; thermal control system to reduce protective ensemble thermal stress; skin decontamination system; aeromedical casualty treatment and transportation equipment; and, detection techniques for aircraft cockpits.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY ($ in thousands):

FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	4,000	5,100			

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Project: #2722 — Title: Biomedical Chemical Warfare Defense

Program Element: #63745F — Title: Chemical Warfare Defense

DOD Mission Area: Defense Chemical and Biological Systems #276 — Budget Activity: Tactical Program #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Chemical Warfare Defense, in context with Aerospace Biotechnology, is the application of both existing and new biotechnology programs for the solution of Air Force unique chemical defense problems. Chemical defense biotechnology has been divided into five key areas: personal protective equipment; airbase operations; medical operations and equipment; crew performance; and, field demonstrations. In the solution of these problems, we intend to develop improved aircrew filter systems and protective equipment compatible with current aircraft design; develop service life indicators of cockpit air filters and crew member protective clothing; develop specific medical and air evacuation support equipment such as vital signs indicators, multichannel respiratory support equipment, and decontamination apparatus. Absolute efficiency will be necessary to transport, decontaminate, and stabilize even the moderately injured or chemically intoxicated. We intend to develop a complete and highly mobile aeromedical echelon system, including integrated transportation, decontamination and treatment equipment, and a supportive technology for medical care and casualty flow in a chemical warfare environment.

(U) RELATED ACTIVITES: The Air Force Chemical Warfare Defense program is formally coordinated with the other Services. The Army is recognized as the Department of Defense lead agency for overall chemical warfare defense. Only efforts that have specific Air Force relevance or can be accomplished more economically by the Air Force's technical expertise, will be addressed in this program. Areas that have multiservice interest and are not unique to the Air Force are identified to the Army for inclusion in their overall chemical warfare defense research program. This program is also coordinated on an international basis through the Air Standardization Coordinating Committee. In addition, bilateral efforts have been established between the Aerospace Medical Division and the United Kingdom's Institutes of Aviation Medicine, and Chemical Defense Establishment. Liaison is maintained with Air Force operational commands.

(U) WORK PERFORMED BY: The Chemical Warfare Defense research and development program is conducted by the Aerospace Medical Division through its two laboratories, the United States Air Force School of Aerospace Medicine, Brooks AFB TX, and the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB OH. The contract portions of the program are complemented by in-house efforts. The in-house portion of the program is centered on unique, complex, man-rated experimental facilities which are generally not available in the aerospace industry or academic institutions.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A project was established in PE 62202F, Aerospace Biotechnology, to provide chemical defense exploratory development technology to feed into this program.

2. (U) FY 1982 Program: Project 2722 under PE 63745F was initiated in FY 82 to provide advanced development for chemical defense technology. The major efforts/products in FY 82 are in development of an aeromedical vital signs monitor for chemical warfare casualty care, personal liquid-cooled garments for aircrews, an under-the-hood aircrew respirator, advanced point and area detection and warning systems, and next generation hand and feet protection for air and ground crews.

Project: #2722 | Title: Biomedical Chemical Warfare Defense

Program Element: #63745F | Title: Chemical Warfare Defense

DOD Mission Area: Defense Chemical and Biological Systems #276 | Budget Activity: Tactical Program #4

3. (U) FY 1983 Planned Program: The FY 83 program will continue development efforts initiated in FY 82. New efforts will be started that will address an oxygen supply system for the USAF aeromedical casualty care, a multiman casualty ventilator and provide design specifications for a casualty transportation system. The development of a personal chemical agent dosimeter and patient decontamination system will be started.

4. (U) FY 1984 Planned Program: Efforts started in FY 83 will continue. New starts include a filtration system for use in aircraft cockpits, shelters, and walk-around personal breathing equipment. Chemical warfare protection and operational capability improvements for the USAF Military Airlift Command's aeromedical evacuation mission will be emphasized. Miniature aircraft cockpit detectors will be completed and transitioned to engineering development.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63747F
DoD Mission Area: TIARA for Tactical Land Warfare, #372

Title: PAVE MOVER
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	15,060	5,180	2,003	4,202	7,072	63,894

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A critical need exists for an effective new capability to attack numerically superior Warsaw Pact second echelon armored mobile ground forces. To fill this need, the Department of Defense has undertaken the Assault Breaker, a cooperative standoff antiarmor concept, as a high priority initiative. PAVE MOVER is the Assault Breaker radar sensor and control subsystem. The airborne PAVE MOVER will detect and track second echelon enemy forces and guide accurate attacks against them via standoff missiles and direct attack aircraft.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Full Scale Engineering Development of the PAVE MOVER radar/fire control system along with necessary weapon and command and control interfaces is being conducted via Program Element 64616F, PAVE MOVER Engagement System. Program Element 63747F provides concurrent advanced development of improved electronic counter countermeasures and target discrimination capabilities along with selected risk reduction efforts for transition into the Full Scale Engineering Development Program. Cost estimates are program office assessments, based upon experience with related development efforts, of the costs including contracts activities, to complete needed technology investigation.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	13,100	5,300	2,100		8,200	58,190

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63747F   Title: PAVE MOVER

DoD Mission Area: TIARA for Tactical Land Warfare, #322   Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The PAVE MOVER Program (formerly the Low Visibility Moving Target Acquisition Strike/Target Acquisition Weapon Delivery System Program) was established to develop advanced techniques and equipment for detection, location and attack of moving ground vehicles from standoff ranges. In 1978, the PAVE MOVER advanced development work was restructured as a jointly funded Air Force/Defense Advanced Research Projects Agency effort supporting the Assault Breaker concept. The primary objectives were to develop a hybrid Moving Target Indicator/Fixed Target Indicator radar suitable for fixed wing aircraft applications, and to demonstrate that a system using the data from one or more such radars could locate stopped or moving ground targets with sufficient accuracy and timeliness to guide effective tactical attack.

(U) More specifically, the PAVE MOVER radar/fire control system is intended to: (1) provide continuous wide area detection location and track of enemy second echelon ground targets; (2) operate in real-time, day, or night in all weather; (3) provide the ability to translate second echelon enemy movements into battle planning and strike targeting activities; (4) provide the capability to guide standoff air and ground launched missiles at high rates of fire; (5) measurably enhance the mission success probability of penetrating low altitude strike aircraft by cooperatively providing standoff derived real-time cue-vectoring to penetrating aircraft during their ingress/egress; and (6) measurably increase penetrating aircraft survivability by enhancing the ability of these forces to remain in mask and by reducing their exposure time to hostile surface-to-air defenses.

(U) The above objectives are being demonstrated as part of the FY 1981-1982 Assault Breaker End-to-End Technology Demonstration along with detailed investigation and demonstration of radar performance, system accuracy, processor capability and electronic counter countermeasure features.

(U) Continued efforts in this program element are centered upon advanced development of improved electronic counter countermeasure techniques and target discrimination techniques. These improvements will be developed concurrent with, and transitioned to, the Full Scale Engineering Development Program for the PAVE MOVER Engagement System conducted in Program Element 64616F.

RELATED ACTIVITIES: There is no other system planned to provide closed loop target detection and tracking as well as real-time aircraft cue-vectoring and/or standoff missile guidance against second echelon armor. Currently, this mission is performed PAVE MOVER Full Scale Engineering Development, to include weapon interfaces and command and control element interfaces, is conducted under Program Element 64616F, PAVE MOVER Engagement System.

(U) The Assault Breaker Air Launched Missile, pursued as a project within Program Element 64616F in FY 1982, has transitioned to Full Scale Engineering Development as the Conventional Standoff Weapon. Via Program Element 64606F, the Conventional Standoff Weapon will be developed for employment from both tactical and strategic aircraft against a variety of key targets. Equipped with appropriate antiarmor submunitions, the Conventional Standoff Weapon will provide the standoff missile element of the Assault Breaker concept for application with the PAVE MOVER Engagement System.

Program Element: #63747F
DoD Mission Area: TTARA for Tactical Land Warfare, #322

Title: PAVE MOVER
Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: This advanced development program is managed by the Air Force Systems Command at the Rome Air Development Center, Electronic Systems Division, Griffiss AFB, NY. Two advanced development model airborne PAVE MOVER radars have been developed and are participating in FY 1982 in the Assault Breaker End-to-End Technology Demonstration at White Sands Missile Range. Contractors for these two advanced development model radars are Hughes Aircraft, El Segundo, CA, and Grumman Aircraft, Beth Page, NY teamed with Norden Systems, Norwalk, CT.

(U) Lincoln Laboratory, Lexington, MA, assists the Rome Air Development Center in evaluating/documenting the performance of the advanced development model PAVE MOVER radars with particular emphasis upon their electronic counter countermeasures and low probability of intercept performance.

(U) The Responsible Test Organization for the PAVE MOVER advanced development radar participation in the Assault Breaker demonstration is the Armament Division, 3246th Test Wing, Eglin AFB, FL.

(U) The Full Scale Engineering Development Program for the PAVE MOVER Engagement System conducted within Program Element 64616F is managed by the Air Force Systems Command at the Electronic Systems Division, Hanscom AFB, MA. MITRE Corporation, Bedford, MA, assists the Electronic Systems Division program office in overall concept studies, test planning and evaluation of demonstration results, preparation of Full Scale Engineering Development technical specifications and technical advice and analyses.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The Multiple Antenna Surveillance Radar (MASR), developed and flight demonstrated by Lincoln Laboratory through FY 1979, was the brassboard predecessor of the PAVE MOVER program. It employed a Displaced Phase Center Array antenna for [ ] and a coherent radar system featuring adaptive digital processing to provide a capability to detect [ ] ground targets from a single platform. A proof-of-concept brassboard test model was fabricated and demonstrated on a Twin Otter aircraft. As a part of this development activity, Lincoln Laboratory conducted an extensive investigation of the electronic counter countermeasures vulnerability of the MASR. A number of recommendations surfaced which have been incorporated into the PAVE MOVER development.

MASR development included [ ] Final MASR demonstrations, concluded in FY 1979, included highly accurate, automatic moving target indicator radar detection, [ ] The MASR also demonstrated algorithms for [ ] Having demonstrated the basic concept over limited ranges and system capabilities, the MASR program was phased out in FY 1979, transitioning to the advanced development of a radar with operationally expanded capability, the PAVE MOVER.

Program Element: #63747F
DoD Mission Area: TIARA for Tactical Land Warfare, #322

Title: PAVE MOVER
Budget Activity: Tactical Programs, #4

A dual contract was awarded for the competitive procurement of the PAVE MOVER advanced development model radar as a joint Air Force/Defense Advanced Research Projects Agency program in support of Assault Breaker. Contract awards were made in the fourth quarter, FY 1978, to two competing contractors (Hughes Aircraft and Grumman/Norden). These advanced development PAVE MOVER radars, employed on a fixed wing aircraft, are to be capable of detecting and tracking to ground vehicles to ranges of the aircraft. Advance development models also include a small area spot image radar mode having a PAVE MOVER efforts to preclude enemy exploitation and interference include advanced development of low probability of intercept techniques to enable the radar signal to remain undetected by enemy receivers and electronic counter countermeasures techniques to counter enemy attempts to jam the radar.

To provide a high probability of target destruction, weapon guidance/aircraft strike cueing uses the PAVE MOVER radar's inherent ability to accurately determine the relative position/velocity of a target with respect to a weapon to Total system strike accuracy (including target location, weapon location and guidance and control errors) using the PAVE MOVER

(U) Ground checkout of the complete PAVE MOVER advanced development model radar systems was completed in early FY 1981 along with Class II modification packages to install the two advanced development model radars into F-111 aircraft. The F-111 was selected for test/demonstration purposes only with ground processing of radar information. The installation of the radars was completed in FY 1981 and overall system checkout was initiated at White Sands Missile Range preparatory to participation of the PAVE MOVER radars in the Assault Breaker Technology Demonstration.

2. (U) FY 1982 Program: The advanced development model PAVE MOVER radars are participating in the Assault Breaker End-to-End Technology Demonstration which is planned for completion in FY 1982. The demonstration is broken into two phases: (1) baseline PAVE MOVER demonstrations; and (2) Assault Breaker End-to-End demonstrations. The baseline PAVE MOVER radar demonstrations include: (1) radar and related subsystem checkout and accuracy verification experiments; and (2) demonstration of PAVE MOVER low probability of intercept and electronic counter countermeasures features, to include red team evaluation.

(U) The Assault Breaker Demonstration will involve PAVE MOVER for: (1) the detection and tracking of moving targets; (2) the providing of accurate guidance updates to standoff missiles; and (3) the cue-vectoring of a low-altitude, penetrating attack aircraft for the effective delivery of antiarmor munitions against moving tank targets.

Program Element: #63747F DoD Mission Area: TIARA for Tactical Land Warfare, #322

Title: PAVE MOVER Budget Activity: Tactical Programs, #4

3. (U) FY 1983 Planned Program: In support of the Full Scale Engineering Development program for the PAVE MOVER Engagement System, this program will provide concurrent advanced development of improved electronics counter countermeasures techniques and of target discrimination techniques. Based upon the results of FY 1982 testing, selected risk reduction efforts will be undertaken in support of the Full Scale Engineering Development program. In addition, as warranted by the interface and integration requirements of the Full Scale Engineering Development program, advanced development will be conducted on man-machine inter-relationships with emphasis on development of automatic aids in the areas of weapon control and assignment, target recognition and designation, and sensor management.

4. (U) FY 1984 Planned Program: Advanced development of improved electronic counter countermeasures techniques and target discrimination techniques will continue to include hardware/software brassboarding and ground evaluation. As warranted, related advanced development of man-machine inter-relationships will be continued to assist the command and control tasks associated with the Full Scale Engineering Development of the PAVE MOVER Engagement System.

5. (U) Program to Completion: Improved techniques for electronic counter countermeasures and target discrimination will be evaluated and transitioned to Program Element 64616F for inclusion in the PAVE MOVER Engagement System Full Scale Engineering Development program. Additional funding estimated beyond that included in the FY 1982 Descriptive Summary increases and extends the Advanced Development efforts in improved electronic counter countermeasure and target discrimination techniques.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E Descriptive Summary

Program Element: #64201F   Title: Aircraft Avionics Equipment Development
DOD Mission Area: Interdiction/Naval Strike, #223   Budget Activity: Tactical Program, #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Complete	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	23,910	13,051	21,237	26,563	Continuing	N/A
2257	Standard Avionics	1,905	2,000	3,841	4,900	Continuing	N/A
2259	Terrain Following Radar	100	0	0	0	0	3,550
2297	Software and Computer Standardization	3,237	1,300	1,100	2,100	Continuing	N/A
2519	[illegible]ar Programmable Signal Processor	8,173	7,151	10,446	12,413	Continuing	N/A
2560	[illegible]ial Language Control Facility	800	700	900	1,200	Continuing	N/A
2590	Standard Fuel Savings Advisory System	2,695	100	0	0	0	5,595
2771	Standard Central Air Data Computer	0	1,800	3,000	2,500	900	6,377
2649	Advanced Medium Range Air-To-Air Missile (AMRAAM) Beyond Visual Range Operational Utility Evaluation	7,000	0	0	0	0	8,999
2658	Integrated Digital Avionics	0	0	1,950	3,450	Continuing	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The high cost of operating and maintaining our forces is reducing operational capability and readiness. This program element develops standard architecture and airborne electronic equipment that will reduce support costs and allow technology evolution to provide overall operational force improvement. Typical products include a joint US Air Force/Navy air data computer development, radar software applicable to tactical and strategic forces, and fuel savings systems to conserve at least 3% of trip fuel in the C-5, C-141 and C-135 aircraft.

(U) BASIS FOR FY 1983 REQUEST: Planning and acquisition of standard avionics equipment and software for all Air Force aircraft will continue. Application of generic radar signal processor capability to the F-16, F-15, B-1B, and other aircraft will be accomplished in project 2519 to provide improved air-to-air and air-to-surface capability. Engineering development of a standard air data computer for the USAF and Navy will continue. Costs are based upon a combination of negotiated contracts and engineering estimates.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Complete	Total Estimated Costs
RDT&E	23,910	13,100	20,000		Continuing	N/A

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #64201F

DOD Mission Area: Interdiction/Naval Strike, #223

Title: Aircraft Avionics Equipment Development

Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This program has been established to permit engineering development of avionics equipment that are candidates for standardized equipment for future aircraft or modifications to existing aircraft. No other program element provides the specific application engineering necessary to translate the results of advanced development programs to actual form, fit, and function standard equipment for navigation, radar processing and other avionics needs. For example, the Standard Precision Navigator was transitioned from an advanced development program, Advanced Avionics for Aircraft (63203F) where feasibility was demonstrated, to Program Element 64201F where an engineering development model was purchased for broad application to Air Force aircraft. The fuel savings advisory system program is an example where this program element is adapting commercially developed equipment to a variety of Air Force applications. Standard avionics multiplex bus control equipment, compatible processor hardware, software, and advanced displays will be developed through this program element. The project for standardization and improvement of airborne radars is directed at the existing and evolving Warsaw Pact threat which is increasing in numbers, capability, and electronic countermeasures performance. Without this specific program, separate, costly development programs for individual aircraft application would be conducted.

(U) RELATED ACTIVITIES: This program is closely coordinated with the Army and Navy to maximize joint developments where feasible. A tri-service memorandum of agreement has been established to promote interservice standardization. Currently a joint effort with the Navy's Program Element 64203N, Avionics Components and Subsystems, is underway to develop a standard air data computer. There is a close relationship between the products of this program and the technological building blocks developed in advanced and exploratory development programs such as PE 63203F, Advanced Avionics for Aircraft; and PE 62204F, Aerospace Avionics. Techniques, components and subsystems showing a high payoff potential can be progressively transitioned through the development process until a specific weapon system application is identified and an engineering development task established. The radar programmable signal processor project investigates the generic radar improvements possible with initial application in the F-15, F-16 and B-1B. Electronic Counter-Countermeasures test data obtained from PE 63750F will aid in developing software for the project.

(U) WORK PERFORMED BY: Program management will be provided by elements of the Air Force Systems Command with all projects under the direction of the Aeronautical Systems Division, Wright-Patterson AFB, OH. Major contracts of Project 2257 are with The Analytic Services Corporation, Redding, Massachusetts and Aeronautical Radio Inc., Annapolis, MD. Project 2519 is contracted with Hughes Aircraft Corporation, Culver City, California through McDonnell Douglas for the F-15 and with Westinghouse Electric Corporation, Baltimore, Maryland for F-16 and B-1B application. The Project 2560 contractor is SOFTEC Inc., Waltham, Massachusetts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The Common Strategic Doppler and the Standard Medium Accuracy Navigator completed development and were adopted as Air Force standards. An Air Force/Army/Navy agreement was established to provide for joint standard equipment development with a standard air data computer initiated as the first system. An Avionics Master Plan and Avionics Planning Guide were completed to guide Air Force avionics development and acquisition. Testing of the Radar Programmable Signal Processor (PSP) software began flight test in an F-15 test bed incorporating added capabilities such as Noncooperative Target Recognition and improved ECCM. Transition

Program Element: #64201F
DOD Mission Area: Interdiction/Naval Strike, #223

Title: Aircraft Avionics Equipment Development
Budget Activity: Tactical Program, #4

of these capabilities to the F-16 was initiated. Flight testing of fuel savings hardware on KC-135, C-141 and B-52 aircraft was completed verifying conservation of at least 3% of trip fuel, and development of software and support equipment was begun.

2. (U) FY 1982 PROGRAM: Project 2257 will continue to plan avionics acquisition and identify candidates for standardization. A tri-service standard digital intercom system will be investigated. The standard air data computer initiated in project 2257 will continue as new project 2771 where specific contractor development will be accomplished. In project 2519 development for the F-16 will be conducted to incorporate transferable radar modes developed for the F-15 and added air-to-ground modes needed for the F-16. Project 2297 will provide enhancement, configuration management and maintenance of Jovial Compilers and MIL-STD-1750A support software for the F-16, LANTIRN, MATE and B-1B. Operation of the Jovial Language Control Facility in project 2560 will continue at Aeronautical Systems Division to control the J-73 Higher Order Language (HOL).

3. (U) FY 1983 PROGRAM: Avionics planning and design studies of standardization candidates will continue in project 2257. The logistics data base will be integrated into the consolidated avionics data base and a specification for a small (fighter type) crash survivable flight data recorder will be developed. Radar software portability will be developed in project 2519 to increase transfer of radar capability among weapon systems. Project 2297 will support development of an ADA compiler targeted to the MIL-STD-1750A instruction set architecture. Project 2560, Jovial Language Control Facility, will continue with specific efforts on compiler validation, language extension and expansion, trouble reports and document maintenance. Development of the Air Force/Navy standard Central Air Data Computer for the USAF F-4, KC-135, F-111, C-5, C-141 and Navy A-7, A-6, E-2 aircraft will continue. Project 2658, Integrated Digital Avionics will continue to develop MIL-STD-1750A validation software and initiate development of MIL-STD-1760 interface certification tools (hardware testers and software). MIL-STD-1553B implementation in F-16 Multinational Staged Improvement Program (MSIP), LANTIRN, and KC-135 Fuel Savings Advisory System will be certified. Changes in funding between the FY 1982 and FY 1983 Descriptive Summaries are due to transfer of PE 64219F, Integrated Digital Avionics (IDA) effort, into this program element as project 2658.

4. (U) FY 1984 PLANNED PROGRAM: Project 2257 will continue to control Air Force avionics developments and identify candidates for standardization to reduce proliferation and improve supportability. In project 2519, modes developed for the B-1B (e.g. terrain following and high resolution mapping) will begin transfer to updates of fighter aircraft (e.g. F-16 and/or F-15). Project 2297 will incorporate F-16 MSIP developed support software into an Air Force support software package. The Jovial Language Control Facility (Project 2560) will continue to centrally maintain the JOVIAL language for Air Force programs. Evolution of tools for validating compliance with avionics interface standards will continue in project 2658. Development of the standard central air data computer in project 2771 will progress into the testing phase.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES: Not applicable.

Project: #2519 | Title: Radar Programmable Signal Processor

Program Element: #64201F | Title: Aircraft Avionics Equipment Development

DoD Mission Area: Interdiction, #422 | Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Warsaw Pact employment of large scale operations produces a significant air-to-air targeting problem. They also display the capability for around-the-clock armor attack in all weather operations. Significant improvements in the number and sophistication of the threat requires penetrators to fly at the lowest possible altitude. Radar electronic counter countermeasures (ECCM) are needed to make fighter and bomber aircraft less susceptible to air-to-air and air-to-ground electronic countermeasures. All weather beyond-visual-range identification, track while scan, ECCM protection and raid assessment are needed to help pilots make optimum missile launch decisions. Also, Terrain Following/Terrain Avoidance, high resolution ground map, and ground moving target capability are needed in both tactical and strategic operations. The generic radar programmable signal processor program will develop radar capability which provides these improved modes. F-15 and F-16 test bed aircraft will be used to test the software developed initially under this program. The project will perform a coordinated series of efforts which will develop radar processor capabilities for many aircraft. The F-15 and F-16 radars and Multi-Role Radar for the B-1B will specifically take advantage of the technological opportunity provided by this project.

(U) RELATED ACTIVITIES: F-15 Radar programmable signal processor hardware was developed by PE 27130F for the F-15 APG-63 radar. Non-cooperative identification techniques and equipment are provided by PE 63742F/1177. Efforts are carefully reviewed to ensure that they are not duplicative. F-16 radar programmable signal processor hardware development is being accomplished under PE 27133F. The efforts from project 2519 will be used to support F-15 and F-16 aircraft for selected improvements, the B-1B, and other USAF aircraft where appropriate.

(U) WORKED PERFORMED BY: The Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson AFB, OH manages this project. The project receives support from the Air Force Avionics Laboratory, Wright-Patterson AFB, OH. The project contractors are McDonnell Douglas Aircraft Company, St Louis, MO, and the Hughes Aircraft Corporation, Culver City, CA for the F-15. F-16 and B-1B related work will be accomplished by Westinghouse Corporation, Baltimore, MD and General Dynamics Corporation, Ft Worth, TX.

Project: #2519
Program Element: #64201F
DOD Mission Area: Interdiction, #422

Title: Radar Programmable Signal Processor
Title: Aircraft Avionics Equipment Development
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS: Software development of air-to-air modes including passive ranging, long range search enhancement, and noncooperative target recognition were completed. Flight testing in an F-15 test bed were conducted. Studies of application of generic radar programmable signal processor architecture to the F-15, F-16 and B-1B were conducted.

2. (U) FY 1982 PROGRAM: Noncooperative target recognition and passive ranging modes initiated in the F-15 will be incorporated into the F-16. Development of air-to-ground modes for the F-16 and B-1B (ground moving target indication and track, hard target track, improved ground map resolution and electronic counter countermeasures) will begin. Development of MIL-STD-1750A and J-73 higher order language capability in the F-15 will be initiated to increase transfer of capability among the F-15, F-16 and B-1B.

3. (U) FY 1983 PLANNED PROGRAM: Ground and flight testing of the new air-to-ground modes will be conducted. Development of MIL-STD-1750A computer and J-73 software capability for the F-15 will continue. Design of architectural changes in the F-15, F-16, and B-1B will be initiated to improve supportability and to facilitate technology insertion in these as well as future weapons systems.

4. (U) FY 1984 PLANNED PROGRAM: Development of MIL-STD-1750A and J-73 capability for the F-15 will be completed. Transfer of modes developed in the B-1B program (e.g., terrain following and high resolution mapping) to F-16/F-15 will be initiated.

5. (U) PROGRAM TO COMPLETION: Testing of the initial programmable signal processor modes providing advanced tactical and strategic mission capabilities will be completed in FY 1985. Continuing radar programmable signal processor and architectural work will provide advanced tactical/strategic software/hardware radar updates to improve operational usefulness, reduce life cycle costs and standardize radar technology to the extent possible.

6. (U) MILESTONES: Not Applicable.

7. (U) RESOURCES:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	8,173	7,151	10,446	12,413	Continuing	N/A

8. (U) COMPARISON WITH FY 1982 Descriptive Summary: Changes in funding between the FY 1982 and FY 1983 Descriptive Summaries are due to redefinition of the FY 1983 task.

RDT&E	8,400	7,700	10,300		Continuing	N/A

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64212F   Title: Aircraft Equipment Development
DOD Mission Area: Close Air Support and Interdiction #223   Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4,056	2,192	1,864	17,614	Continuing	Not Applicable
1926	Aircraft Windshield Development	1,360	1,392	1,483	2,345	Continuing	Not Applicable
2098	Landing Gear Development	215	200	185	2,605	Continuing	Not Applicable
2228	Standard Cryogenic Cooler	5					2,135
2377	Airdrop Systems Support	100	100	96	444	Continuing	Not Applicable
2709	Generic Turbine Engine Monitoring System				9,582	46,600	56,300
2713	Aircraft Instruments and Displays	100				Continuing	Not Applicable
4366	Integrated Attack Avionics	276	500	100	2,638	Continuing	Not Applicable
2525	F100 Engine Diagnostic System	2,000					18,800

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Due to changing threat scenarios, equipment obsolescence and technological advancements, a need exists to update and modernize the aircraft force. A need also exists to correct deficiencies that exist in operational aircraft in the areas of safety and improved systems effectiveness. This program element represents a collection of different but related projects which develop, test, and evaluate a variety of aircraft subsystem equipment in response to these operational needs. Technological advancements in aircraft equipment are exploited and/or translated into operational hardware. This is the only engineering development program element which utilizes advanced state-of-the-art technology to develop windshield systems offering improved hazard resistance and reduced cost-of-ownership.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds for projects that range in size and complexity from safety certification of equipment to be airdropped from Air Force cargo aircraft to development of a bird impact resistant windshield for T-38 aircraft. All of the FY 1983 projects are continuing efforts that apply latest and advanced technology in correcting operational aircraft deficiencies in the areas of windshields, landing gear, instruments and displays, avionics, and airdrop systems. The cost estimates are derived based on past experience with similar efforts.

Program Element: #64212F
DOD Mission Area: Close Air Support and Interdiction #223

Title: Aircraft Equipment Development
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

Project Number	Title	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4,100	2,200	9,900		Continuing	Not Applicable
1926	Aircraft Windshield Development	1,200	1,400	1,800		Continuing	Not Applicable
2098	Landing Gear Development	200	100	1,000		Continuing	Not Applicable
2145	Laser Acquisition Device						1,725
2228	Standard Cryogenic Cooler	5					2,135
2377	Airdrop Systems Support	100	100	300		Continuing	Not Applicable
2713	Aircraft Instruments and Displays	100	100	1,500		Continuing	Not Applicable
4366	Integrated Attack Avionics	495	500	500		Continuing	Not Applicable
5551	PAVE LOW III						[illegible],900
2525	F100 Engine Diagnostic System	2,000					18,800
2709	Generic Turbine Engine Monitoring System			4,800		49,100	53,900

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) DETAILED BACKGROUND AND DESCRIPTION: Deficiencies in operational force aircraft due to changing threat scenarios, equipment obsolescence and advancements in technology are documented by command required operational capability documents. Various requirements addressed by this program element are as follows: Improved F-111 Transparency Windshield; Post-Attack Launch Recovery; Aircraft Ground Mobility System; Cockpit Television Sensor; and Engineering for Transportability. The objective of this program element is to develop, test and evaluate a wide variety of aircraft subsystem equipments in response to these operational needs. The equipments involved are characterized by their installation on or within the aircraft. Project 1926, Aircraft Windshield Development, applies the latest technology to achieve bird impact resistance while maintaining high optical quality and light weight. F-111 bird impact resistant windshields have been developed in this project and effort will now be concentrated on the F-16 and T-38 aircraft. Project 2098, Landing Gear Development, applies landing gear technological improvements in the areas of high temperature wheels and brakes and carbon disc brakes in an effort to improve performance, decrease acquisition costs, and reduce operation and support costs. Project 2377, Airdrop Systems Support, provides the method by which the United States Air Force carries out its responsibilities as executive agent (designated by the Joint Technical Airdrop Group) for development and testing of on-board airdrop systems. Project 2713, Aircraft Instruments and Displays, maintains cognizance of new technologies in this area and exploits these advancements to improve/solve operational deficiencies of currently operational controls and displays systems. Project 4366, Integrated Attack Avionics, integrates and tests the latest developments in the avionics/weapons areas to develop interface techniques which will assure optimum weapon delivery in high performance aircraft.

Program Element: #64212F

DOD Mission Area: Close Air Support and Interdiction #223

Title: Aircraft Equipment Development

Budget Activity: Tactical Programs #4

(U) RELATED ACTIVITIES: Program Elements 62201F, Aerospace Flight Dynamics; 63211F, Aerospace Structural Materials; 63246F, Aircraft Subsystems Technology; and 63203F, Advanced Avionics for Aircraft, are related to this program element in that this element provides a means for completing the Engineering Development required to introduce equipment into the operational inventory. Program Element 64201F, Aircraft Avionics Equipment, is a related and closely coordinated effort that accomplishes the bulk of the engineering development of avionics systems.

(U) WORK PERFORMED BY: Program management is provided by the Air Force Aeronautical Systems Division and Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH. In-house test facilities involved in projects under this program element include the Wright Aeronautical Laboratories (Flight Dynamics, Materials, Structure, and Avionics Laboratories) at Wright-Patterson Air Force Base, OH; the Air Force Flight Test Center, Edwards Air Force Base, CA; Arnold Engineering and Development Center, Tullahoma, TN; Tactical Fighter Weapons Center, Nellis Air Force Base, NV; and the Armament Development and Test Center, Eglin Air Force Base, FL. Contractors include McDonnell Douglas Corporation, Long Beach, CA, and St. Louis, MO; General Dynamics, Fort Worth, TX; Hughes Aircraft Company, Culver City, CA; B. F. Goodrich, Akron, OH; Sierracin Corporation, Sylmar, CA; Pittsburgh Plate Glass Company, Pittsburgh, PA; Honeywell Incorporated, Minneapolis, MN; Bendix Corporation, South Bend, IN, Goodyear Aerospace Corporation, Akron, OH; and Dunlop Limited, Coventry, England.

1. (U) FY 1981 and Prior Accomplishments: The following are examples of prior accomplishments under this program element. A second source/alternate design (lightweight) bird impact resistant windshield has been qualified and procured and retrofitted into F-111 series aircraft. A decision was made to procure a new F-16 canopy with improved bird impact resistance. Test and evaluation of titanium wheel/carbon brake assemblies was completed as was service testing of carbon disc brakes supplied by multiple vendors. Development of the Helmet Mounted Laser Acquisition Device and the Standard Cryogenic Cooler was completed. Development and testing of PA LOW III, the night/adverse weather/all terrain search and rescue modification of the HH-53 helicopter have been completed. Aircraft retrofit is now complete. An airdrop systems support project designed to insure safety certification of all equipment to be air dropped from Air Force cargo aircraft was initiated. The competitive preproduction development of a charge coupled device gun camera (Cockpit Television Sensor) to replace film type gun cameras in tactical aircraft was completed. Production of this unit has been initiated. Procurement was initiated for a newly modified tow plate for installation in C-130 aircraft equipped with the Low Altitude Parachute Extraction System. The F-100 Engine Diagnostic System flight evaluation phase was completed.

2. (U) FY 1982 Program: Operational Test and Evaluation/Durability Program of a new F-16 canopy will be continued. Project 2226 Standard Cryogenic Cooler was terminated in FY 81 due to a lack of requirement for production units. Development of a split screen capability for the Cockpit Television Sensor will be initiated. The F-100 Engine Diagnostic System flight evaluation phase and detailed data analysis results are being rolled forward into the Generic Turbine Engine Monitoring System planned for FY 84. The F-100 Engine Diagnostic System project has been discontinued and is now a part of Project 2709.

3. (U) FY 1983 Planned Program: Development of a stronger bird impact resistant windshield for the T-38 aircraft will be continued. Windshield development efforts will also include evaluation of coatings and the effects of rain

Program Element: #64212F
DOD Mission Area: Close Air Support and Interdiction #223

Title: Aircraft Equipment Development
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

erosion and in-service wear on impact resistance. Landing gear systems projects will continue to investigate materials and manufacturing techniques to improve gear component service life while reducing acquisition costs and operation and support costs. Development of a split screen capability for the Cockpit Television Sensor will be continued. Capability for color video recording and a compact Airborne Video Tape Recorder will be initiated. Development improvements on a C-130 Airdrop Tow Plate will be initiated. Fiscal Year 1983 funding reductions from the FY 1982 Descriptive Summary have delayed start of the Generic Turbine Engine Monitoring System project until Fiscal Year 1984 and reduced the scope of other level of effort projects to a minimum sustaining level. The reductions were due to the funding of other higher priority efforts.

4. (U) FY 1984 Planned Program: During this period windshield development efforts will continue evaluating coatings and the effect of in-service wear on impact resistance. Design and development of an isolated hydraulic fluid system for landing gear mechanism will be initiated. Landing gear improvement efforts will concentrate on material and manufacturing techniques investigations which improve service life and reduce costs. The Generic Turbine Engine Monitoring System project will be initiated based on the results of the F-100 Engine Diagnostic System project and the A-10 Turbine Engine Monitoring System project.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64218F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Engine Model Derivative Program (EMDP)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	73,654	38,510	10,254	20,511	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Engine Model Derivative Program (EMDP) is aimed at filling a void which existed in the engine management and acquisition process for ten years. This program will conduct efforts to provide improvements in the specification characteristics (i.e., performance, durability/life, reliability/maintainability, and reduced risk of development) of in-service engines or those engines which have passed the equivalent of a military qualification test. This capability, when combined with new engine developments, will ensure that the Air Force has propulsion alternatives for near term and far term needs. The only other means today to provide this capability is through full scale weapon system development. The EMDP will conduct the early engineering development leading to a prototype engine. Full scale development will continue in a weapon system development program after validation of the requirement for increased capability.

(U) BASIS FOR FY 1983 REQUEST: Accelerated Mission Testing (AMT) of the F100 EMDP engine in the final design configuration will begin. The purpose of this test, to be completed in 1984, will be to prove durability at an upgraded operating temperature that could provide a thrust level nominally 15 per cent greater than the F100 (3) Component Improvement Program (CIP) which includes a double-pass advanced combustor, single crystal turbine airfoils, and a full life compressor. In addition to these core components, the engine will incorporate an Advanced Augmentor Fuel Management (AFM) system designed to eliminate stall/stagnation, the Digital Electronics Engine Control (DEEC), a prime reliable Main Fuel Pump (MFP) and an increased flow fan.

(U) Sea level development testing at Pratt & Whitney will be conducted and altitude development testing at Arnold Engineering Development Center (AEDC) will be resumed in 1983 to finalize the engine control logic prior to flight certification. A new effort on the TF33 engine will start in FY 83. Since most of the year will be consumed in program initiation, more concentrated efforts are planned for FY 84. The derivative TF33 program will provide an eight to ten percent improvement in specific fuel consumption for C-141 and B-52H aircraft with an annual fuel savings potential of 52 million gallons.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	73,905	25,100	TBD		Continuing	N/A

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #64218F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Engine Model Derivative Program (EMDP)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Engine Model Derivative Program (EMDP) fills a void which existed in the engine development process for ten years by permitting the demonstration of growth potential for current operational engines. This function had been accomplished under the Component Improvement Program until 1968 when Congress directed that the Air Force discontinue the practice. Aircraft have historically increased in gross weight at the rate of two percent per year following their development. This historical factor, resulting from changes in roles and missions, increased threat, and the incorporation of more on-board equipment, demands that higher engine performance be available to maintain the system thrust to weight necessary to maintain weapon system performance. Until 1979, the only method to accomplish this growth engine performance was through a full scale development program. Under the current concept, promising advanced component and engine technologies proven under Air Force advanced development programs will be transitioned to the EMDP and applied to practice. Early engineering development will be accomplished through prototype engine demonstration. Full scale development will continue under the specific weapon system program after the requirement for increased performance has been validated. This process will greatly enhance the Air Force ability to respond quickly to changing system needs. Propulsion has always been a pacing factor in aircraft system development. EMDP will permit the Air Force to selectively pursue derivative engine demonstrations early in the development process. Component technologies chosen for demonstrating desired increased capability will focus on improved durability and life, reduced cost, and improved performance. The EMDP will perform the engineering development of the upgraded components, integrate it into the derivative engine, and conduct the proof test. The program will demonstrate prototype engines to a point that prototype new concepts and designs can be incorporated into a follow-on full scale weapon system development. The overall objective of this effort is to maximize long range benefits in cost and system requirements. It will provide for the major design changes in Air Force engines to achieve performance improvements for future programs including F-16, F-15, B-1, C-130 and C-141 aircraft.

(U) RELATED ACTIVITIES: For the requisite technology, this program draws gas generator "core" engine technology (high pressure compressor, combustor, and high pressure turbine) from Program Element (PE) 63216F, Advanced Turbine Engine Gas Generator. Fan, low pressure turbine, and limited engine test data are provided by PE 63202F, Aircraft Propulsion Subsystems Integration (APSI). Advanced component technology is also obtained from PE 62203F, Aerospace Propulsion. Other principle inputs including materials processing and component fabrication demonstration come from PE 78011F, Manufacturing Technology Program. Activities conducted by the Navy, National Aeronautics and Space Administration, Army, and the propulsion industry in-house programs also constitute significant sources of technology. The Air Force and the Navy have a broad Memorandum of Understanding for joint cooperative propulsion programs in areas of common interest Component Improvement Program efforts directed toward engine flight safety problems, service revealed difficulties and the achievement of durability goals also complement the long term EMDP development process.

(U) WORK PERFORMED BY: The program is managed by the Aeronautical Systems Division, Deputy for Propulsion, Wright-Patterson AFB, OH. The T56 program is being performed by Detroit Diesel Allison Division, Indianapolis, IN. The growth F100 engine program is run by Pratt and Whitney Aircraft, Government Products Division, West Palm Beach, FL. General Electric Company, Evendale, OH is a potential contractor for future effort.

Program Element: #64218F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Engine Model Derivative Program (EMDP)
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Efforts were initiated to significantly enhance the performance of the T56 engine for the C-130 aircraft. New engine components providing a 20-25 percent improvement in the hot day take-off power of the engine and a 10 percent reduction in the cruise specific fuel consumption of the engine were designed and tested. Design improvements include new compressor aerodynamics, improved turbine materials and an improved combustor fuel injection design. The limited development program for the Alternate Fighter Engine/F101X was initiated following Congressional direction to transfer funds previously authorized and appropriated for reengining the Navy F-14 aircraft to a joint Air Force/Navy engine development effort. The program was a limited development program which took the F101 Derivative Fighter Engine (DFE) engine through a flight cleared engine demonstration and subsequent limited flight tests in an F-16 and F-14 aircraft. Initial efforts were directed toward fabrication of the new low pressure spool hardware (i.e., fan and fan turbine); fabrication of a new augmentor; and refurbishment of three engine cores from the B-1/F101 engine program. A fan stress test was completed to verify the design of that component. The F101 DFE successfully completed a 2000 equivalent mission hour test in May 1981. Flight testing in the F-16 started in December 1980 and was completed in May 1981. Eleven pilots accomplished 58 flights for 75 flight hours. Test objectives accomplished were installation, operability, system performance and usage evaluation. The initial F-14 flight test program started in July and went through October. Subsequently, the Navy decided to have the air vehicle modified for high stress flight and will conduct additional flight testing which is scheduled for January through March 1982. A major revision to the F100 Engine Model Derivative Program (EMDP) was made in 1981 when the program was enlarged to address durability and operability improvements. A higher airflow fan and low volume A/B fuel system are additional revisions to the design.

2. (U) FY 1982 Planned Program: Two major engine efforts will be in their critical stages. A complete engine test for the T56 engine will be conducted. Power section tests of the T56 derivative engine will be completed to verify the performance improvements predicted from the results of the component rig testing and to verify the durability of the T56 EMDP power section design. Program revisions since the FY 83 planned flight test was deleted include an extensive durability evaluation of 600-700 test hours simulating approximately 1500 hours of service use. The Navy has purchased long lead hardware for a Navy version of the USAF's XT56-100 and also has signed a contract with Detroit Diesel Allison (DDA) to develop a marinized version of the XT56-100 to serve as an electrical power generator engine on Spruance class destroyers. Our 1982/1983 program will interact with these programs. The F101 DFE effort has transitioned to the Alternate Fighter Engine (AFE) program element (64223) and a full scale development on that program is programmed in 1983 and 1984. F100 growth engine efforts will be continued with the conduct of extensive integrated engine ground tests. The new augmentor and fuel control components will be installed on a flight engine, and comprehensive mission oriented cyclic testing will be conducted. A flight test of the interim configuration F100 EMDP is planned for late summer FY 82. The FY 82 F100 EMDP program is being expanded to include the Congressional add of $17.5 million to demonstrate a higher thrust F100. An engine core test at higher operating temperature will be initiated to verify performance. Accelerated mission tests will also be initiated to demonstrate 4000 cycle durability characteristics at the higher thrust levels.

Program Element: #64218F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Engine Model Derivative Program (EMDP)
Budget Activity: Tactical Programs, #4

3. (U) FY 1983 Planned Program: Efforts will continue on the derivative F100 engine and the TF33 engine derivative will be initiated. The improved core components will be incorporated into the F100 EMDP design and extensive durability testing will be started on the final EMDP design. A 4000 cycle durability test of the final design will be conducted. Hardware procurement and design support to integrate hot section component improvements and the advanced fuel management system into the F100 EMDP configuration will be accomplished. Arnold Engineering Development Center planning and facility preparation will be conducted to support altitude testing in early FY 84. Initial design of a derivative of the TF33 engine, offering a savings in specific fuel consumption of eight to ten percent with an annual potential fuel savings of 52 million gallons, will begin in FY 83. Life cycle cost trade studies will be initiated. Thermal mapping of the TF33 turbine package will be completed.

4. (U) FY 1984 Planned Program: The efforts previously initiated on the F100 and the TF33 will be continued. Durability testing will be conducted. Altitude testing of the F100 EMDP design will be resumed in support of planned flight tests in the F-15 and F-16 in FY 84. TF33 EMDP activity in 1984 will concentrate on design completion and EMDP unique part procurement. A preliminary Airframe Integration Study, Steady State Engine Performance Computer Program, and an updated Life Cycle Cost Analysis will be completed. EMDP engine part detail drawings will be finished and available for the Critical Design Review which would be held early in FY 85. Development testing will also start in FY 84 with receipt and test preparation of the performance demonstration engine. Test objectives will include mechanical integration and performance verification.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64220F
DOD Mission Area: Escort, Stand-Off & Counter C^3, #372

Title: EW Counter Response
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981* Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5,507	9,165	27,335	22,217	12,866	231,583
2066	EF-111A Development	5,407	3,065	2,735	2,517	8,066	176,283
2687	Operational Flight Trainer	100	6,100	24,600	19,700	4,800	55,300

* FY 81 funds contained in PE 27252F

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the Research, Development, Test, and Evaluation and integration of the ALQ-99E jamming subsystem into F-111A aircraft converting them into EF-111A Tactical Jamming System aircraft. The EF-111A is being developed to provide world-wide defense suppression jamming in support of United States and Allied Tactical Strike Force operations. Procurement is for 42 modification kits and two Operational Flight Trainers.

BASIS FOR FY 1983 RDT&E REQUEST: Funding is required for basic updates to aircraft electronic countermeasures subsystems to incorporate minor hardware and software development efforts to [ ] Includes funds for the development of an Operational Flight Trainer. Development cost estimates are derived from prior year System Program Office estimates using the RCA price model.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,400	14,500	19,200		25,200	219,100
Procurement (Aircraft PE #27252F)*	272,500	264,300	202,700		0	1,046,600

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Procurement (Aircraft)*	262,800	270,600	206,400		37,900	1,081,400
(Quantities)	(12)	(12)	(9)			
Military Construction		2,390	9,150			11,540
Operation and Maintenance (Mod Install)	17,300	30,300	54,000	69,000		182,900

* Includes Initial Spares and simulator

Program Element: #64220F
DOD Mission Area: Escort, Stand-off & Counter C^3, #372

Title: EW Counter Response
Budget Activity: Tactical Programs #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Aircraft of the tactical forces are unable to counter the entire radar threat spectrum with on-board electronic countermeasures (ECM) subsystems due to space, weight, and power limitations. On-board tactical ECM subsystems are primarily directed against the enemy's terminal weapon control radars. The mission of degrading surveillance, acquisition, and ground control intercept radars must be accomplished by tactical support jamming forces. Studies by the Department of Defense and United States Air Force have concluded that the most effective means of providing the required jamming would be through integration of the ALQ-99 jamming subsystem with the F-111A aircraft. This combination meets the requirements without recourse to expensive and time consuming development of a new weapon system. This program also takes full advantage of experience gained with the existing Navy EA-6B system, incorporating improvements where they will be most effective.

(U) The purpose of this program was to develop, test and evaluate the EF-111A Tactical Jamming System to demonstrate the system's operational performance prior to a production decision and to maintain operational effectiveness throughout the system's service life. One inventory F-111A aircraft was modified to incorporate updated ALQ-99E ECM subsystems including receivers, computers and ten high-power transmitters with directional/steerable antennas. Modified ALR-62 Terminal Threat Warning and ALQ-137 Self Protection Subsystems were also incorporated. Receiver antennas were isolated from the transmitter antennas by locating them in a new vertical fin. A second inventory F-111A was modified to the EF-111A form factor and was used for the airworthiness certification and to certify the tail fin design. The Defense Systems Acquisition Review Council III Memorandum directed a phased production program tied to demonstration of operational suitability with deficiency corrections incorporated. The Secretary of Defense approval of full rate production was based on excellent test results where the EF-111A surpassed all thresholds and goals set for the test. Efforts to update system effectiveness are planned to counter continuing technical advances in existing and new hostile command and control radars and surface-to-air missile acquisition radars.

Between 1974, the design point of the EF-111A, and 1995, [

The EF-111A also will provide the [ ] The capability of this jamming to counter the threat must be maintained to ensure the effectivness of this defense suppression system.

Program Element: #64220F
DOD Mission Area: Escort, Stand-Off & Counter C^3, #372

Title: EW Counter Response
Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: The United States Navy developed the ALQ-99 electronic countermeasures (ECM) subsystem under Program Element (PE) 25674N, EA-6B, for installation in the EA-6B aircraft. Warning and Self Protection Equipment from PE 64738F, Protective Systems, are being used. The development and production of a second generation receiver/processor is intended to be a joint Air Force/Navy effort. The EF-111A System Program Office is reviewing existing receiver/processor development efforts to determine their suitability for use in the EF-111A

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson AFB, OH is responsible for management of the EF-111A program. The program was competitive. The winning bidder was Grumman Aerospace Corporation, Bethpage, NY (airframe and electronics). Prime subcontractors are: Airborne Instruments Laboratory, Deer Park, Long Island, NY (ALQ-99 receiver); Raytheon Company, Goleta, CA (ALQ-99 Band 4-9 transmitters and exciters for all bands); Astronautics Corporation of America, Milwaukee, WI (displays); American Electronics Laboratories, Colmar, PA (ALQ-99 Band 1 and 2 transmitters); International Business Machines, Oswego, NY (Computer); Sanders Associates Inc, Nashua, NH (Self-Protection Subsystems); and Dalmo Victor, Belmont, CA (Threat Warning Subsystems).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The EF-111A program was first funded in late FY 1973 for proposal solicitation, evaluation, award of dual design definition, and brassboard equipment demonstrations. Dual design definition/risk reduction study contracts with the Grumman Aerospace Corporation and General Dynamics were completed in September 1974. Grumman's proposal was selected. A Joint Operational and Technical Review and a Defense Systems Acquisition Review Council (DSARC) II review were conducted in 1975. Contractor Development, Test and Evaluation, and Initial Operational Test and Evaluation was completed in April 1978. DSARC III met in December 1978 and, in February 1979, directed a phased production program with production of the first six aircraft tied to successful accomplishment of milestones associated with a suitability demonstration. The EF-111A surpassed all directed goals and thresholds, and the Office of the Secretary of Defense approved full rate production on 26 March 1980 Twelve modification kits were purchased in FY 81 bringing the cumulative total to 21. Four aircraft were input for modification in FY 81; seven aircraft are in various stages of conversion. The requirement for two Operational Flight Trainers was validated and funded.

2. FY 1982 Planned Program: The production program will continue in FY 1982 with procurement of 12 additional modification kits. RDT&E funding is required to continue software updates, to develop an Operational Flight Trainer, and to initiate development studies necessary to ensure continued capability and effectiveness against Soviet threat system advances. Efforts are underway to evaluate the effectiveness of expanded coverage where expansion is feasible, cost effective and will provide a significant increase in defense suppression effectiveness without specifically duplicating other efforts. This effort is a joint program with the Navy to expand and increase ALQ-99E jamming capabilities to cover additional enemy radars. This joint effort will develop a new receiver/processor/jammer system that will allow the rapid detection and identification of the[

Program Element: #64220F
DOD Mission Area: Escort, Stand-Off & Counter C^3, #372

Title: EW Counter Response
Budget Activity: Tactical Programs, #4

3. (U) FY 1983 Planned Program: The final nine modification kits will be procured. Nine aircraft will be delivered. Software updates and receiver/processor/jammer studies will continue. Eight million in FY 83 RDT&E funds is added to develop the Operational Flight Trainer.

4. (U) FY 1984 Planned Program: Thirteen aircraft will be input for modification, and thirteen aircraft will be delivered to TAC. Initial Operational Capability will be achieved in November 1983. Software updates will continue. Receiver/processor/jammer development will begin. Development of the Operational Flight Trainer will continue.

5. (U) Program to Completion: The final twelve aircraft will be input and the 42nd aircraft will be delivered to TAC by November 1985. Two Operational Flight Trainers will be procured. Mountain Home AFB, ID will receive its Operational Flight Trainer by November 1985. Upper Heyford, England will receive its Operational Flight Trainer by November 1986. Updates and receiver/processor/jammer development will continue and lead to production and installation in 1988. This is a continuing program.

6. (U) Milestones: Not Applicable.

Project: #2066 Title: EF-111A Development
Program Element: #64220F Title: EW Counter Response
DOD Mission Area: Escort, Stand-off & Counter C^3, #372 Budget Activity: Tactical Programs #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Aircraft of the tactical forces are unable to counter the entire radar threat spectrum with on-board electronic countermeasures (ECM) subsystems due to space, weight, and power limitations. On-board tactical ECM subsystems are primarily directed against the enemy's terminal weapon control radars. The mission of degrading surveillance, acquisition, and ground control intercept radars must be accomplished by tactical support jamming forces. Studies by the Department of Defense and United States Air Force have concluded that the most effective means of providing the required jamming would be through integration of the ALQ-99 jamming subsystem with the F-111A aircraft. This combination meets the requirements without recourse to expensive and time consuming development of a new weapon system. This program also takes full advantage of experience gained with the existing Navy EA-6B system, incorporating improvements where they will be most effective.

(U) The purpose of this program was to develop, test and evaluate the EF-111A Tactical Jamming System to demonstrate the system's operational performance prior to a production decision and to maintain operational effectiveness throughout the system's service life. One inventory F-111A aircraft was modified to incorporate updated ALQ-99E ECM subsystems including receivers, computers and ten high-power transmitters with directional/steerable antennas. Modified ALR-62 Terminal Threat Warning and ALQ-137 Self Protection Subsystems were also incorporated. Receiver antennas were isolated from the transmitter antennas by locating them in a new vertical fin. The existing F-111A Environmental Control System was replaced by the larger version from the F-111D to handle increased cooling requirements. Larger capacity F-14 electrical generators have also been added. A second inventory F-111A was modified to the EF-111A form factor and was used for the airworthiness certification and to certify the tail fin design. The Defense Systems Acquisition Review Council III Memorandum directed a phased production program tied to demonstration of operational suitability with deficiency corrections incorporated. The Secretary of Defense approval of full rate production was based on excellent test results where the EF-111A surpassed all thresholds and goals set for the test. Efforts to update to enhance system effectiveness are planned to counter continuing technical advances in existing and new hostile command and control radars and surface-to-air acquisition radars.

Between 1974, the design point of the EF-111A, and 1995,

The EF-111A will also provide the . The capability of this jamming to counter the threat must be maintained to ensure the effectiveness of this defense suppression system.

Project: #2066 | Title: EF-111A Development
Program Element: #64220F | Title: EW Counter Response
DOD Mission Area: Escort, Stand-Off & Counter C^3, #372 | Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: The United States Navy developed the ALQ-99 electronic countermeasures (ECM) subsystem under Program Element (PE) 25674N, EA-6B, for installation in the EA-6B aircraft. Warning and Self-Protection Equipment from PE 64738F, Protective Systems, are being used. The development and production of a second generation receiver/processor is intended to be a joint Air Force/Navy effort. The EF-111A System Program Office is reviewing existing receiver/processor development efforts to determine their suitability for use in the EF-111A.

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson AFB, OH is responsible for management of the EF-111A program. The program was competitive. The winning bidder, was Grumman Aerospace Corporation, Bethpage, NY (airframe and electronics). Prime subcontractors are: Airborne Instruments Laboratory, Deer Park, Long Island, NY (ALQ-99 receiver); Raytheon Company, Goleta, CA (ALQ-99 Band 4-9 transmitters and exciters for all bands); Astronautics Corporation of America, Milwaukee, WI (displays); American Electronics Laboratories, Colmar, PA (ALQ-99 Band 1 and 2 transmitters); International Business Machines, Oswego, NY (Computer); Sanders Associates Inc, Nashua, NH (Self-Protection Subsystems); and Dalmo Victor, Belmont, CA (Threat Warning Subsystems).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The EF-111A program was first funded in late FY 1973 proposal solicitation, evaluation, award of dual design definition, and brassboard equipment demonstrations. Dual design definition/risk reduction study contracts with the Grumman Aerospace Corporation and General Dynamics were completed in September 1974. Proposals for the two prototype development programs were evaluated and Grumman's proposal was selected. A Joint Operational and Technical Review and a Defense Systems Acquisition Review Council (DSARC) review were conducted in 1975. Contractor Development, Test and Evaluation, and Initial Operational Test and Evaluation was completed in April 1978. DSARC III met in December 1978 and, in February 1979, directed a phased production program with production of the first six aircraft tied to successful accomplishment of milestones associated with a suitability demonstration. The EF-111A surpassed all directed goals and thresholds, and in the Office of the Secretary of Defense approved full rate production on 26 March 1980. Twelve modification kits were purchased in FY 81 bringing the cumulative total to 21 Four aircraft were input for modification in FY 81; seven aircraft and in various stages of conversion.

2. FY 1982 Planned Program: The production program will continue in FY 1982 with procurement of 12 additional modification kits. RDT&E funding is required to continue software updates and to initiate development efforts necessary to ensure continued capability and effectiveness against Soviet threat system advances. Efforts are underway to evaluate the effectiveness of expanded coverage where expansion is feasible, cost effective and will provide a significant increase in defense suppression effectiveness without specifically duplicating other efforts. This effort is a joint program with the Navy to expand and increase ALQ-99E jamming capabilities to cover additional enemy radars. This joint effort will develop a new receiver/processor/jammer system that will allow the rapid detection and identification of the[

Project: #2066 | Title: EF-111A Development
Program Element: #64220F | Title: EW Counter Response
DOD Mission Area: Escort, Stand-Off & Counter C^3, #372 | Budget Activity: Tactical Programs, #4

3. (U) FY 1983 Planned Program: The final nine modification kits will be procured. Nine aircraft will be delivered. Minor software updates minimal and receiver/processor/jammer study efforts will be conducted with the programmed $2.7M R&D funds.

4. (U) FY 1984 Planned Program: Thirteen aircraft will be input for modification, and thirteen aircraft will be delivered to TAC. Initial Operational Capability will be achieved in November 1983. Threat responsive software updates will continue with the $2.7 R&D funding. Receiver/processor/jammer development will begin.

5. (U) Program to Completion: The final twelve aircraft will be input and the 42nd aircraft will be delivered to TAC by November 1985. Updates and receiver/processor/jammer development will continue and lead to production and installation in 1988. This is a continuing program.

6. (U) Milestones:

Milestones		Date
A. Phase IB Contract Award		Jan 1975
B. Preliminary Design Completed		Nov 1975
C. Final Design Completed		Aug 1976
D. Avionics Equipment Development Completed		Oct 1976
E. Aircraft #1 (Less Tactical Jamming Systems avionics)		Feb 1977
F. Fabrication of Avionics Set Completed		Feb 1977
G. Aircraft #1 (Less TJS avionics) First Flight		Mar 1977
H. Bench Avionics Integration Completed		May 1977
I. Simulator Testing Completed		Jun 1977
J. First Full-up Airborne Avionics Performance Test Completed		Jun 1977
K. Flight Test Evaluation Completed		Apr 1978
L. Defense System Acquisition Review Council (DSARC) III Completed		Dec 1978
M. DSARC III Memorandum		Feb 1979
N. Initiation of Phased Production/Suitability Evaluation		Mar 1980
O. Final Milestone/Full Production Decision		Mar 1980
P. Completion of Support Equipment Development		Jun 1981
Q. Deliver First Aircraft	*(Jul 81)	Nov 1981
R. Initial OperationalCapability (IOC) (18th Aircraft)		Nov 1983
S. Full Operational Capability		Nov 1985

* Date presented in FY 82 Descriptive Summary

Project: #2066
Program Element: #64220F
DOD Mission Area: Escort, Stand-Off & Counter C^3, #372

Title: EF-111A Development
Title: EW Counter Response
Budget Activity: Tactical Programs, #4

(U) EXPLANATION OF MILESTONE CHANGE

Delivery of first production aircraft was delayed for additional testing at Rome Air Development Test Range at the request of Aeronautical Systems Division, System Program Office.

7. (U) Resources:

	FY 81 Actual	FY 82 Estimate	FY 83 Estimate	FY 84 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,407	3,065	2,735	2,517	8,066	176,283
Procurement	262,800	270,600	206,400			1,043,500

8. (U) Comparison with FY 1981 Descriptive Summary:

RDT&E	5,500	16,500	19,200 1/		25,200	219,100
Procurement	272,300	264,300	202,700			1,046,600 1/

1/ The FY 83 estimate changed from $19,200 thousand to $2,643 thousand due to a breakout in FY 83 of the Operational Flight Trainer (OFT) as a separate project within PE 64220F. The overall increase in the program element funding from $19,200 thousand to $27,243 thousand resulted from an increase in development costs for the OFT. Total RDT&E funding for the program element increased from $219,100 thousand to $231,838 thousand as a result of the increased OFT development costs. Total procurement funding for the program element decreased from $1,046,600 thousand to $1,043,858 thousand as a result of repricing project 2066.

Project: #2687, Program Element: #64220F DOD Mission Area: Escort, Stand-Off & Counter C^3, #372

Title: Operational Flight Trainer
Title: EW Counter Response
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Tactical Air Force requires development of an Operational Flight Trainer to facilitate training of both pilot and electronic warfare officers in a new and unique mission. Requirement for this equipment is supported by absence of available training ranges in the free world, transfer of duties required in varying mission profiles and restrictions on peacetime flight which preclude realistic operation of electronic warfare equipment.

(U) The Operational Flight Trainer will be a two place simulator which will be capable of simulating Central European radar environment and all flight profiles of the EF-111A.

(U) RELATED ACTIVITIES: Not Applicable

(U) WORK PERFORMED BY: Not Applicable

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A request for proposal was released in FY 81.

2. (U) FY 1982 Program: Contract will be awarded and development will begin.

3. (U) FY 1983 Planned Program: Operational Flight Trainer development will continue; $24.6 million in FY 84 RDT&E funds is for continued development of the Operational Flight Trainer.

4. (U) FY 1984 Planned Program: Operational Flight Trainer development will continue; $19.7 million in FY 84 RDT&E funds will be used to continue development of the Operational Flight Trainer.

5. (U) Program to Completion: Complete development of the first Operational Flight Trainer and deliver it to Mountain Home AFB, ID in Nov 1985. Begin procurement of a second Operational Flight Trainer in FY 1985 with delivery to Upper Heyford, England in Nov 1986.

6. (U) Milestones:

Milestones	Date
TAC ROC No. 315-73	30 Apr 73
Aircrew Training Device Amendment	29 Jul 77
Validate OFT Requirement	31 Jan 78
Contract Award	Apr 82

Project: #2687,
Program Element: #64220F
DOD Mission Area: Escort, Stand-Off & Counter C^3, #372

Title: Operational Flight Trainer
Title: EW Counter Response
Budget Activity: Tactical Programs, #4

Preliminary Design Review (PDR)	Sep 82
Critical Design Review (CDR)	2 Qtr FY 84
Fabrication	4 Qtr FY 83 - 3 Qtr FY 84
In-plant Test	3 Qtr FY 84 - 3 Qtr FY 85
Exercise Production Option	Nov 85
Teardown, Pack, Ship, Install, Test	3 Qtr FY 85
First Trainer Ready for Training	1 Qtr FY 86
Second Trainer Ready for Training	1 Qtr FY 87

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Complete	Total Estimated Costs
RDT&E	100	6,100	24,600	19,700	4,800	55,300
Procurement (PE 27252F)					37,900	37,900

8. (U) Comparision with FY 1982 Descriptive Summary: Not Applicable

Budget Activity: Tactical Program, #4
Program Element: #27253F/64220F, EF-111A

Test and Evaluation Data

1. (U) Development, Test and Evaluation: The ground test portion of the EF-111A Tactical Jamming System Development, Test and Evaluation began at Grumman Aerospace Corporation, Bethpage, New York, in March 1975. The goal was system integration and acceptable performance for those development efforts directed by Defense System Acquisition Review Council II prior to flight test to ensure that new or modified subsystems met contractural specifications. Tests conducted at contractor facilities under laboratory or mockup conditions included evaluations of the environmental control system, modified electrical power system, antennas and radomes associated with new equipment, reliability, airframe vibration and retained F-111A avionics systems. Air Force software support and fully developed support equipment were not available for this phase due to Defense System Acquisition Review Council II direction. This was based on the cost associated with support equipment development and the need to verify EF-111A effectiveness prior to obligating funds associated with these areas. Peculiar ALQ-99E intermediate level maintenance and software support was provided by the contractor during Development, Test and Evaluation. This affected the quality of information available for the production decision and resulted in continued testing after Defense System Acquisition Review Council III. Specific test and evaluation capabilities built exclusively for the support of EF-111A Development, Test and Evaluation include a System Integration Test Station for software testing and total system integration, a crew station mockup for human factors evaluation of cockpit control and display adequacy, and operator procedures. Government owned facilities used include the National Aeronautics and Space Administration wind tunnels (for aerodynamic loads and flutter tests), the Department of Defense Anechoic Chamber (for electromagnetic interference and compatibility investigation), the Electronic Warfare Ground Simulators (for antenna pattern testing/optimization), the Rome Air Development Center EF-111A antenna pedestal (for antenna pattern testing/optimization), the Air Force Eglin Test Range and the Western Test Range (for ALQ-99E receiver and transmitter performance evaluation). The Grumman Electronic Warfare Test Range was used to obtain broad-based engineering data. Government test facilities and ranges used during Development, Test and Evaluation did not differ significantly from those used during Initial Operational Test and Evaluation. Airborne testing utilized two EF-111A prototype aircraft. Overall air vehicle Development, Test and Evaluation testing was performed from 10 March to 22 June 1977 using an EF-111A prototype modified to the propose structural configuration but without peculiar EF-111A avionics. This testing concluded that a tail fin redesign was necessary. The second EF-111A prototype vehicle was used for contractor avionic system and subsystem Development, Test and Evaluation between 17 May and 30 September 1977. This vehicle differed from the airworthiness vehicle in that all avionics subsystems were installed. System and subsystem components were identical to those intended for use in the production EF-111A except for the ALR-23 Infrared Warning Receiver which was deleted in the production configuration. The configuration of other systems evaluated during Development, Test and Evaluation have been altered slightly from the original configuration as a result of corrections to deficiencies identified during this and other phases of the flight test. Specific components added to the modified F-111A airframe included the ALQ-99E Jammer Subsystem, the ALR-62 Terminal Threat Warning System, the ALQ-137 Self Protection System, a new Environmental Cooling System, revised right seat aircrew station, and updated generators from the F-14 aircraft.

Budget Activity: Tacticial Programs, #4
Program Element: 64220F - Tactical Jamming System -

2. Operational Test and Evaluation: The Initial Operational Test and Evaluation of the EF-111A Tactical Jamming System was conducted October 1977 - April 1978 by the Air Force Test and Evaluation Center. The EF-111A Initial Operational Test and Evaluation Final Report was published in August 1978. The aircraft was flight-tested in the barrier/standoff and penetration/escort mission roles. The close air support and battlefield interdiction mission roles were evaluated at the Air Force Electronic Warfare Evaluation Simulator. The following is a summary of the Initial Operational Test and Evaluation results and conclusions. The EF-111A's performance in the standoff/barrier role was determined to be excellent. The EF-111A's performance in the penetration/escort role supporting deep strikes was determined to be satisfactory to excellent. When supporting battlefield interdiction missions at the Air Force Electronic Warfare Evaluation Simulator the EF-111A's performance was satisfactory. In addition to the EF-111A's jamming effectiveness, the Initial Operational Test and Evaluation included evaluation of the ALR-62, ALQ-137, human factors, aircraft performance, internal Electromagnetic Interference/Electromagnetic Compatibility, external Electromagnetic Interference/Electromagnetic Compatibility, and software. Results in each of these areas are: [ ] the ALQ-137 performance was satisfactory; the single Electronic Warfare Officer concept was validated. The displays, controls, and cockpit configuration were determined to be satisfactory; however, some man/machine interface software improvements were recommended. Aircraft performance was satisfactory. Internal Electromagnetic Interference/Electromagnetic Compatibility was undetermined due to the ALR-62 not being in a configuration for testing. External Electromagnetic Interference/Electromagnetic Compatibility was minimal and determined to be satisfactory. The ALQ-99E and ALQ-137 software performance was satisfactory. Reliability was evaluated in two areas: Mission Completion Success Probability and hardware reliability. Mission Completion Success Probability was satisfactory. Peculiar subsystem reliability was satisfactory [ ] No significant degradation occurred in the systems common to the F-111A. Maintainability was evaluated in terms of Maintenance Man Hours per Flying Hour values measured in a sterile test environment, using contractor support, were satisfactory; [ ] The Logistics Composite Model was used to estimate maintenance manpower requirements for the current and a mature system. They were satisfactory. Software supportability was determined to be deficient, but correctable to satisfactory. Due to the number and possible impact of deficiencies identified in Initial Operational Test and Evaluation, the Office of the Secretary of Defense directed the Air Force to complete a suitability demonstration to provide additional decision data. The additional operational testing of the EF-111A Tactical Jamming System was conducted as a Follow-on Test and Evaluation managed by Air Force Test and Evaluation Center. The primary purpose of the Follow-on Test and Evaluation, as directed in a 10 February 1979 Office of the Secretary of Defense memo to the Secretary of the Air Force, was to evaluate system reliability and maintainability using Air Force maintenance personnel. Flight testing was initiated at Mountain Home Air Force Base during April 1979 and was planned to end in October 1979. Reliability data was collected during the entire test. Maintainability data was gathered from 1 June through 31 October 1979, as the period 16 April through 31 May 1979 was used for training Air Force maintenance personnel. Although the test was primarily designed as a suitability assessment, some effectiveness testing was conducted. Laboratory testing to compare the effectiveness of the ALQ-99E and the ALQ-137 in performing the self-protection role was conducted at the Air Force Electronic Warfare Evaluation Simulator. Similar testing with the ALQ-99E and ALQ-137 installed in the prototype

Budget Activity: Tactical Programs, #4
Program Element: 64220F - Tactical Jamming System -

EF-111A test aircraft was also conducted against radar simulators on the Nellis ranges. Flight testing was also conducted to evaluate the performance of the ALR-62 in an internal (ALQ-99E/ ALQ-137) and external (F-4 aircraft with ALQ-119 self protection electronic countermeasures pods) electronic countermeasures environment. Flight testing was completed on 14 November 1979. The Air Force Electronic Warfare Evaluation Simulator tests incurred delays due to test system problems, and testing was completed 9 May 1980. The Defense Systems Acquisition Review Council III memorandum established a flight test goal of 150 flight test hours for the collection of Reliability and Maintainability data. Final flight test results were: 85 missions flown out of 89 scheduled; 261.4 flight test hours accumulated for reliability data; 197.6 flight test hours accumulated for maintainability data; a 5.0 hour Mean Flying Hours Between Failure was demonstration for the ALQ-99E (The threshold was 3.0 hours.); Mean Time To Repair for the ALQ-99E was measured at 3.1 hours. However, due to to the high skill level of the test team maintenance personnel, a projection for a normal operational unit with some personnel in a training status was made. The projection indicated the ALQ-99E Mean Time To Repair could be 4.4 hours (The Follon-on Test Evaluation threshold was 6.0 hors). The ALQ-137, which experienced two failures in 121 flying hours for an Mean Flying Hours Between Failure of 60.5 hours, was evaluated as satisfactory even though no Follow-on Test and Evaluation threshold has been established. False removal rate of line replaceable units resulting from built-in-test/built-in-test equipment was 19.2 percent (The Follow-on Test and Evaluation threshold was 25 percent.). The measured Maintenance Man Hours per Flying Hour was 22.6. Since these results were obtained in a sterile test environment, a projection was made to estimate the Maintenance Man Hours per Flying Hour for a mature system. This estimate was close to the current Maintenance Man Hours per Flying Hour of the F-111A and was determined to be satisfactory. Improvements to correct ALQ-99E software deficiencies discovered during Initial Operational Test and Evaluation were evaluated and determined to be satisfactory. Corrections to the deficiencies discovered during Initial Operational Test and Evaluation, such as ALQ-99E internal Electromagnetic Interference, ALQ-99E Band 4 transmitter reliability and ALQ-99E power interrupt, were evaluated and determined to be satisfactory. The ALR-62 flight testing showed system operation to be considerably improved when compared to the system's performance during Initial Operational Test and Evaluation. The system experienced[

]was evaluated as satisfactory even though no Follow-on Operational Test and Evaluation threshold was established. The test report was published in February 1980. Because all of the data from the Air Force Electronic Warfare Evaluation Center testing was not available at the time of publication, some of the Air Force Electronic Warfare Evaluation Center test results were published as an addendum to the final report in August 1980. The completion of Phase I Follow-on Test and Evaluation using production aircraft is planned to be accomplished by Air Force Test and Evaluation Center between December 1981 and August 1982. This testing will be accomplished to confirm that deficiency corrections have been installed in production aircraft and to further assess the operational suitability of the aircraft. Emphasis will be placed on evaluating equipment which had not previously been available for testing, such as the intermediate level automatic test equipment. For the EF-111A Operational Flight Trainer, initial testing will be accomplished under a combined Development, Test and Evaluation/Initial Operational Test and Evaluation Concept.

Budget Activity: Tactical Programs, #4
Program Element: 64220F - Tactical Jamming System

Air Force Test and Evaluation Center will conduct the operational testing. Testing will consist of a combined Development Test and Evaluation/Initial Operational Test and Evaluation at the contractor's facility and a dedicated Initial Operational Test and Evaluation at the on-site location (Mountain Home Air Force Base, Idaho). The Initial Operational Test and Evaluation will consist of evaluations in the following areas: training capability of the Operational Flight Trainer for all tasks assigned to it within the training program; instructional capability of the Operational Flight Trainer instructor-operator station; software effectiveness to include the adequacy of computer resources for developing mission scenarios, usability and maintainability; availability for training tactical jamming, navigational and aeronautical tasks; the capability to accomplish scheduled missions and the impact of reliability, maintainability and logistics supportability on availability for training. The on-site test will be conducted in a realistic operational environment (i.e., use of Operational Flight Trainer to train operational crews using typical training missions in the operational facility). Testing will be conducted with contractor provided maintenance and support equipment while Air Force observes "over-the-shoulder". The Air Force will use computer resources to generate the mission scenarios used to train aircrews in the Operational Flight Trainer.

3. (U) System Characteristics: Significant EF-111A performance parameters with Decision Coordinating Paper threshold values shown below:

A. (U) Characteristics	DCP Threshold	Achieved Values	Testing Accomplished During	By
Maximum sustained air speed at Sea level (Mach Number)	.91	1.07	Final Operational Test and Evaluation	Air Force Test and Evaluation Command
			Final Operational Test and Evaluation	Air Force Test and Evaluation Command
Unrefueled mission radius strike mission Mach 0.84 (Nautical Miles)	765	770	Final Operational Test and Evaluation	Air Force Test and Evaluation Command
B. ALQ-99E Jammer Subsystem				
			Final Operational Test and Evaluation	Air Force Test and Evaluation Command
			Final Operational Test and Evaluation	Air Force Test and Evaluation Command

Budget Activity: Tactical Programs, #4
Program Element: 64220F - Tactical Jamming System

			Final Operational Test and Evaluation	Air Force Test and Evaluation Command
			Final Operational Test and Evaluation	Air Force Test and Evaluation Command
Reliability				
Mean Flying Hour Between Failure (hours)	3.0	12.5	Final Operational Test and Evaluation	Air Force Test and Evaluation Command
Maintainability				
Mean Time To Repair, organizational level (hours)	6.0	1.6	Final Operational Test and Evaluation	Air Force Test and Evaluation Command

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64222F
DOD Mission Area: Theater Wide Nuclear Warfare, #242

Title: Nuclear Weapon Support
Budget Activity: Tactical Program, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands);

PROJECT NUMBER	TITLE	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
5708	NUCLEAR WEAPON SUPPORT	2,240	1,694	2,298	2,059	CONTINUING	N/A
TOTAL FOR PROGRAM ELEMENT		2,240	1,694	2,298	2,059	CONTINUING	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides technical guidance to the Department of Energy, and direction to the North Atlantic Treaty Organization and Canadian Armed Forces to fulfill United States Air Force responsibilities related to the development and support of nuclear weapon systems. Supports Strategic Air Command required Operational Capability 16-71 (MX), 12-76 (Air Launched Cruise Missile), 6-76 (B61 Tactical Bomb), 6-69 (B83 Modern Strategic Bomb), and Tactical Air Force Statement of Need 304-77 (Ground Launched Cruise Missile).

(U) BASIS FOR FY 1983 RDT&E REQUESTS: Provides funds for salaries of the Air Force Weapons Laboratory cadre of civilian nuclear weapon specialists. Includes funds to perform Air Force gravity nuclear weapon development. Funds other nuclear weapon support activities managed by the Air Force Weapons Laboratory's Nuclear Engineering System Division. Cost estimates are developed by the Air Force Weapons Laboratory.

(U) COMPARISON WITH FY 82 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Cost
RDT&E	1,580	1,700	2,100		CONTINUING	N/A

OTHER APPROPRIATION FUNDS:

Procurement *
B83 Modern Strategic Bomb
B61 Tactical Bomb
Operations and Maintenance *
B83 Modern Strategic Bomb
B61 Tactical Bomb

*Department of Energy Funded

Project: #5708
Program Element: #64222F
DOD Mission Area: Theater Wide Nuclear Warfare, #242

Title: Nuclear Weapon Support
Budget Activity: Tactical Program, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Programs were initiated to develop nuclear warheads for cruise missiles (W80, W84), gravity bombs (B83, B61), and intercontinental ballistic missiles (MX, MMIII). Nuclear certification/compatibility support efforts for the F-16, B-52 Offensive Avionics System, and North Atlantic Treaty Organization trilateral aircraft, the Tornado, were initiated. On-going efforts supporting all stockpiled Air Force nuclear weapons continued. Nuclear weapon stockpile improvement efforts for the B28 and B61 warheads were initiated. Engineering development of upgraded aircraft monitor and control (AMAC) units for the FB-111 and B-52G,H forces was initiated.

2. (U) FY 1982 Program: Continues nuclear weapon development support. The M-X DOD/DOE weapon design and cost report was completed and published, and efforts are being initiated to begin engineering development for the MX warhead; upgraded W78 warhead was deployed on MM III missiles at Grand Forks AFB, ND, and Minot AFB, ND. B61-3/4 tactical bombs were deployed.

3. (U) FY83 Planned Program: All nuclear weapon development support continues. B-52/cruise missile/short range attack missile nuclear certification support efforts will be completed. B61 3/4 deployment continues. Upgraded AMACs are deployed with the B-52 and FB-111 forces. B83 development testing is completed. First full squadron of B-52 aircraft equipped with the Air Launched Cruise Missile becomes operational at Griffiss AFB, NY. Ground Launched Cruise Missile first war reserve production occurs.

4. (U) FY 1984 Planned Program: All nuclear weapon support activities continue.

5. (U) Program to Completion: Not Applicable

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

Project: # 5708
Program Element: # 64222F
DOD Mission Area: Theater Wide Nuclear Warfare, #242

Title: Nuclear Weapon Support
Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Nuclear weapon development, modification, and life cycle support is a joint Department of Defense and Department of Energy program. Air Force activities which support this dual agency program and those which fulfill unique Air Force nuclear weapon responsibilities are performed in this program element.

(U) Nuclear weapons development responsibilities include acting as the Air Force technical manager during the development and modification of nuclear weapon assets, and in the case of gravity bombs, acting as the system program office during weapons development (B83, B61-3/4) and major modification (B61, B28).

(U) Nuclear weapon carrier/compatibility and equipment support programs include performing the system related technical safety evaluations required to nuclear certify new/modified Air Force weapon systems. Systems presently under study include the B-52 Offensive Avionics System/Air Launched Cruise Missile System, the F-16 fighter, and the North Atlantic Treaty Organization trilateral aircraft. Design responsibility for Air Force nuclear weapons loading and handling shapes, and for flight and load crew electronic simulators resides in this program element. Presently under development are the B83 loading and handling trainers, and the F-16 nuclear weapon store simulator. Nuclear weapon cargo tiedown testing in support of the Military Airlift Command for logistic nuclear weapon movements is also performed.

(U) Nuclear loading, delivery, and transport technical orders for all Air Force and North Atlantic Treaty Organization air delivered nuclear weapons are written, published, and maintained in this program element. Funds are provided by the Air Force Logistics Command and Foreign Military Sales funds, on a cost reimbursable basis.

(U) RELATED ACTIVITIES: Activities which are related to the warhead development in this program element (PE) include PE 64312F (MX), PE 64361F (Air Launched Cruise Missile), PE 64362F (Ground Launched Cruise Missile), PE 63319F (Advanced Cruise Missile Technology). Activities related to nuclear weapon carrier modification/update include PE 11113F (B-52 Offensive Avionics System), PE 11115F (FB-111B/C), PE 11118F (Short Range Attack Missile), PE 11213F (Minuteman Squadrons) PE 11212F(TITAN Squadrons), PE 64226F (B-1B), and PE 11126F (B-1B).

(U) WORK PERFORMED BY: Work is managed and primarily performed by the Air Force Weapons Laboratory, Kirtland AFB, N.M. Flight testing in conjunction with the B83 and B61 programs is performed at the Air Force Flight Test Center, Edwards Laboratory AFB, CA, employing both Air Force Systems Command and Strategic Air Command aircraft assets. An Air Force Weapons operating location at Ramstein Air Base, Federal Republic of Germany, monitors all work on the trilateral Tornado aircraft.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64223F — Title: Alternate Fighter Engine

DOD Mission Area: Close Air Support and Interdiction, #223 — Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT		34,869	94,125	83,125	TBD	212,119

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides funds to extend the previous, highly successful efforts on the F101 Derivative Fighter Engine (DFE) under PE 64218F, Engine Model Derivative Program (EMDP), to exercise the option of full scale development and qualify the Digital Electronic Engine Control for the F100 Engine.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Provides initiation of full scale engineering development (FSED) of the F101 DFE. The FY 83 portion of the program will be heavily hardware oriented. By the end of the FY 82 effort (transition phase), the common engine design effort will be completed and the redesigned hardware to support the FY 83-84 FSED will be on order. Also, testing will have been completed for ingestion capability and operability/reliability improvements brought about by minor controls and augmentor changes. During the latter part of FY 83 this hardware, enough to build/convert and support five engines, will be delivered. In addition, new rotors will be procured for all test engines. A sixth test engine will be procured in FY 83 and delivered in early FY 84. This engine will serve as the engine official qualification vehicle. Full scale development of the Digital Electronic Engine Control (DEEC) for the F100 engine will also be initiated to provide enhanced operability and reduced support costs. FY 83 efforts on the DEEC include substantial flight and ground testing aimed toward substantiating the productionized design and software.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	35,000	TBD		TBD	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #64223F	Title: Alternate Fighter Engine
DOD Mission Area: Close Air Support and Interdiction, #223	Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The F101 Derivative Fighter Engine (DFE) Program was one of the first programs to be included in the Engine Model Derivative Program (EMDP). The EMDP fills a void which existed in the engine development process for 10 years by permitting the demonstration of potential of derivatives of current engines. The F101 DFE is a fighter version of the B-1 engine, the F101. It consists of the same core as the F101 with scaled technologies of the F404 in the fan and augmentor. The three year EMDP effort on the F101 DFE was completed in FY 1981 with the F-16 and F-14 flight tests. The test results to date of the F101 DFE have been very successful and have confirmed the design emphasis on reliability and durability. After a series of ground tests simulating 1000 equivalent mission hours for the F-16, the hardware exhibited so little wear that the same hardware was tested to 1000 equivalent mission hours for the F-14. The flight tests in F-16 and F-14 test beds have confirmed the altitude tests at the Arnold Engineering Development Center which demonstrated stable, highly responsive operation throughout the envelop. The engine performance during the technology demonstration meets or exceeds predictions. In FY 82 this Program Element was initiated to provide a transition to full scale development and to maintain the option of the F101 DFE as a competitive alternative for a mid-to-late eighties application.

(U) RELATED ACTIVITIES: This program continues the development of the F101 DFE which was initiated under Program Element 64218F, Engine Model Derivative Program (EMDP). The EMDP on the F101 DFE was conducted under a Memorandum of Understanding with the Navy. The Navy is continuing flight tests in an F-14 in FY 1982.

(U) WORK PERFORMED BY: The program is managed by the Aeronautical Systems Division, Deputy for Propulsion, Wright-Patterson AFB, OH. The F101 DFE program is being conducted by the General Electric Company, Evendale, OH.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Efforts conducted under EMDP.

2. (U) FY 1982 Program: The engineering efforts on the F101 DFE shifted to system optimization. The test program will include 150 hours of testing at the Arnold Engineering Development Center and 400 hours of accelerated mission testing. Component testing of items such as the fan, turbine, and fuel control will also be included. Long lead for additional test hardware will be procured as part of the FY 1982 program. The production configuration of the F101 DFE will be initiated, resulting in a common engine design which can be applied to the F-15, F-16, and F-14 aircraft.

3. (U) FY 1983 Planned Program: The FY 83 portion of the F101 DFE program will be heavily hardware oriented. By the end the FY 82 effort (transition phase), the common engine design effort will be completed and the redesigned hardware to support the FY 83-84 FSED will be on order. Also, testing will have been completed for ingestion capability and operability reliability improvements brought about by minor controls and augmentor changes. During the latter part of FY 83 this hardware, enough to build/convert and support five engines, will be delivered. In addition, new rotors will be procured in FY 83 and delivered in early FY 84. This engine will serve as the engine official qualification vehicle.

Program Element: #64223F   Title: Alternate Fighter Engine
DOD Mission Area: Close Air Support and Interdiction, #223   Budget Activity: Tactical Programs, #4

Full scale development of the Digital Electronic Engine Control (DEEC) for the F100 engine will also be initiated to provide enhanced operability and reduced support costs. F-16 flight testing in early FY 83 will evaluate augmentor steady state and transient envelope definitions. Aircraft accelerations and climbs will be evaluated as well as air starts in both the primary and back up mode. The productionized design will undergo tests at Arnold Engineering Development Center (AEDC) and flight tests later in FY 83.

4. (U) FY 1984 Planned Program: The F101 DFE FSED will contain over 750 test hours, composed of accelerated mission tests (AMT) and operability/mechanical performance testing. There will also be additional altitude test effort and numerous rig tests to verify structural/mechanical characteristics. Official qualification will be completed in September 1984. F-16/F-15 flight testing will be supported with engineering and hardware throughout FY 83 and 84. Qualification of the F100 DEEC will be completed with additional AEDC tests and operational evaluation.

5. (U) Program to Completion: Program completed in FY 84.

6. (U) Milestones: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64247F
DoD Mission Area: Air Warfare Support, #225

Title: Modular Automatic Test Equipment (MATE)
Budget Activity: Tactical Programs, #4

(U) RESOURCES: (Project Listing) ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	12,650*	20,224	34,580	17,578	Continuing	Not Applicable

* FY 1981 and prior year funding for advance development was contained in Program Element 63247F.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Previous and current methods used to specify, design, build and support automatic test systems have resulted in a proliferation of equipment, inadequate operational reliability and supportability and excessive lifecycle costs. Aircraft availability (force readiness) has suffered because of malfunctioning automatic test equipment at all levels of maintenance. The Modular Automatic Test Equipment (MATE) program has developed a set of guides which delineate a standard architecture and a management system for automatic test system (ATS) aquisition and support that will establish a framework for the acquisition and support of future Air Force automatic test systems. Implementation and use of the MATE system as defined in the guides will result in automatic test systems which meet Air Force readiness requirements and standard interfaces. This will assure adequate support for our forces and, at the same time, simplify the support of automatic test systems and control proliferation of hardware and software at both the module and weapon system levels. The first applications of the Modular Automatic Test Equipment system will be the Intermediate Automatic Test System (IATS) for the A-10 Inertial Navigation System (INS) and the Depot Automatic Test System for Avionics (DATSA). The acquisition of automatic test equipment for these systems is being supported as part of the Modular Automatic Test Equipment engineering development program.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funding for the development of the MATE system and its application to the A-10 Intermediate Automatic Test System for Avionics (IATS) to support the A-10 Inertial Navigation System (INS) as well as technical assistance for the development of the Depot Automatic Test System for Avionics to replace the aging General Purpose Automatic Test System (GPATS) currently in use. The GPATS equipment currently tests avionics components from the C-141, F-4, F-111, F-105 and F-106 aircraft. GPATS becomes non-supportable in 1985. Replacement of this system is essential for maintaining operational readiness of these aircraft. Similarly, the A-10 INS IATS will allow the Air Force to maintain this system in the field without contractor support and thereby attain the required readiness posture. Cost estimates are based on parametric cost analyses as of July 1981.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	13,700	20,700	35,800		29,500	110,100

Program Element: #64247F
DoD Mission Area: Air Warfare Support, #225

Title: Modular Automatic Test Equipment (MATE)
Budget Activity: Tactical Programs, #4

(U) OTHER APPROPRIATION FUNDS:	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
A-10 INS IATS						
Procurement * (aircraft) (Quantity)						
27131F	0	0	20,000 (13)	0	0	37,000 (26)

* includes initial spares

Program Element: #64247F
DoD Mission Area: Air Warfare Support, #225

Title: Modular Automatic Test Equipment (MATE)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The requirement for automatic test systems (ATS) to maintain sophisticated electronic systems has been confirmed by government and industry studies conducted over the past several years. It is agreed that automatic test equipment is essential to mission effectiveness. Without properly functioning avionics, combat aircraft do not fly. Although the Air Force spends over one billion dollars annually to design, acquire, and support ATS, the equipment is complicated to operate, malfunctions often, and is difficult to maintain. Faults in electronic equipment detected at the flight line or intermediate shop too often cannot be duplicated when the equipment is returned to the depot for repair. Hence, equipment is recycled in the supply lines and not available for use on aircraft. The studies also identified proliferation of test equipment as a reason for the high cost and unreliability of ATE. For example, there are over 100 different computers in the Air Force ATS inventory, each with its own unique maintenance and repair manuals and spare parts list. Air Force attempts to solve ATS problems through management initiatives have not been effective. The MATE program was established and funded in FY 1978 to integrate management and technical answers to ATS problems. In June 1978 the Systems Management Division of Sperry Corporation, and the Integrated Logistics Support Division of the Westinghouse Electric Company were awarded fixed price contracts to perform the system definition phase of the MATE program. The contracts included survey/study and study/verification segments and concluded with a demonstration segment in early 1981. Based on the results of these contracts and proposals for the engineering development program, Sperry was selected to perform full scale development of the MATE system and to develop the automatic test system for the A-10 Inertial Navigation System (INS). Sperry will finalize the guide books which were submitted in draft form as part of the system definition contracts and develop the software needed to implement the guide books. The finished guide books will incorporate the lessons learned from previous ATS acquisition programs and the MATE/A-10 engineering development and DATSA programs. This will provide the basis for acquisition and support of future Air Force automatic test systems. The first systems selected for MATE application include: the A-10 Inertial Navigation System and the replacement for the General Purpose Automatic Test System (GPATS) which is used at depot level to test systems from the C-141, F-111, F-4, F-105 and F-106. This set of applications will provide an operational test and evaluation of the application of the MATE system to the automatic test system aquisition/development process. During the development of the MATE system for the A-10 INS, the Air Force will buy contractor support for the A-10 INS. Any slips in the current MATE schedule will delay the date on which the Air Force can support the complete A-10 system without buying additional contractor support in the field. Current estimates show that application of the MATE system will save at least 15 percent (over $150 million per year) on automatic test equipment life cycle costs.

(U) RELATED ACTIVITIES: The Navy assigned a full time representative to the MATE Program Office in early 1979 to make sure MATE stays attuned to their needs. The Navy developed built-in test design guides and the fault isolation/fault detection work being done at the Air Force Rome Air Development Center will provide a basis for decisions concerning the partitioning of test functions between the ATS and built in test equipment. Program Element (PE) 2713?F will provide funds for procurement of up to 26 A-10 INS automatic test equipment stations. Other related program elements include: PE 62204F, Aerospace Avionics, Project No. 2003, Avionics System Design Technology, and Project No. 6069, Electronic Device and Circuit Technology; PE 63253F, Advanced System Integration Demonstration (PAVE PILLAR), PE 64219F, Integrated Digital Avionics; PE 64201F, Project No. 2560, JOVIAL Language Control Facility, and Project No. 2297, Software and Computer Standardization. To prevent duplication all cognizant Army, Navy and Air Force organization are supplying inputs to MATE program guides reviews. The MATE Program Office supports the Joint Logistics Commander's (JLC) Panel on Automatic Testing as funds and personnel permit.

Program Element: #64247F
DoD Mission Area: Air Warfare Support, #225

Title: Modular Automatic Test Equipment (MATE)
Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: This program is being implemented by the Support Equipment Systems Program Office of the Aeronautical System Division at Wright-Patterson AFB, OH. Supporting laboratories are the Air Force Avionics Laboratory located at Wright Patterson AFB, OH and the Rome Air Development Center at Griffiss AFB, NY. The system definition contractors were the Sperry Corporation, Great Neck, Long Island, NY (winner of FSD contract); the Westinghouse Electric Company, Hunt Valley,MD; and Technology Development Corporation, Arlington, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: This program began in FY 1978 under PE 63247F, Modular Automatic Test Equipment. Major Air Force activities during this period were directed at structuring a program that would solve existing automatic test equipment problems, be responsive to future requirements, and stay in tune with efforts of the Joint Logistics Commanders and the Industry in the automatic test equipment area. The program objectives and plans were established and briefed to interested Army, Navy and Air Force agencies and to numerous industrial groups. A competition involving over 20 major corporations was conducted to develop a system level definition of the MATE system resulting in the award of two contracts in June 1978. From these contracts the necessary specifications, standards, and acquisition/management tools needed to implement an improved automatic test system acquisition process were identified. Both contractors developed draft guides outlining hardware, software, human interface, testability and acquisition management standards and demonstrated how these guides could be used in the design of automatic test equipment systems. In July 1981, one contractor was selected to continue the engineering development of the MATE system (documented in updated guides), to apply MATE to the development of the A-10 Inertial Navigation System automatic test system and to provide technical assistance for the application of MATE to a depot level automatic test equipment acquisition.

2. (U) FY 1982 Program: Continue full scale development and test of the MATE system and its application to the A-10 Inertial Navigation System (INS) Test System. Begin replacement of the Depot Automatic Test System for Avionics (DATSA). A new program element number was assigned in FY 1982 to reflect the engineering development phase of the MATE program. The funding for this program was previously shown in PE 63247F, Modular Automatic Test Equipment.

3. (U) FY 1983 Planned Program: Continue full scale development of the MATE system and the A-10 INS automatic test system. Begin deliveries and operational testing of the A-10 INS Automatic Test System. Continue replacement of the Depot Automatic Test System for Avionics (DATSA) to support continuing depot level workloads on C-141, F-111, F-4, F-105, and F-106 aircraft.

4. (U) FY 1984 Planned Program: Continue full scale development of the MATE system. Complete development, deliveries and operational testing of the A-10 INS Automatic Test System. Begin deliveries of the Depot Automatic Test System for Avionics (DATSA). Plan for development of an organic Air Force capability to qualify MATE hardware and software for application to future Air Force automatic test systems.

5. (U) Program to Completion: Complete technical support for the acquisition and installation of the Depot Automat Test System for Avionics (DATSA) replacement system. Establish an organizational framework for the Air Force to continue the evolution and application of the Modular Automatic Test Equipment concept. This is a continuing program.

Program Element: #64247F
DoD Mission Area: Air Warfare Support, #225

Title: Modular Automatic Test Equipment (MATE)
Budget Activity: Tatical Program #4

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64249F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Night/Precision Attack
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	Total for Program Element	39,985 1/	84,272	103,758	93,799	102,654	504,600
2693	Low Altitude Navigation and Targeting Infrared Systems for Night (LANTIRN)	39,985 1/	84,272 2/	103,758	93,799	102,654	468,800
2882	Target Recognizer					35,800	35,800 3/

1/ Work performed under Program Element 63249F, Night Attack Program - Project 2693 (LANTIRN)
2/ Excludes $2.999M which is being reprogrammed to Program Element 63249F for Target Recognizer Advanced Development
3/ Excludes Advanced Development for Target Recognizer ($32.9M) included in Program Element 63249F.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) will provide a capability for low level precision attack during night and other than optimal weather conditions in air-to-surface interdiction and close air support missions. LANTIRN consists of navigation and targeting functions which will offer a strike capability against an enemy ground attack threat during day or nightime operations. The LANTIRN capabilities will preclude the limited sanctuary that the enemy presently has at night and under the weather. The specific Air Force needs for an improved night air-to-surface attack capability are documented in the Air Force Planning Guide Mission Area Analysis, 1 December 1979 and the Statement of Need (TAF SON) 302-81 dated 11 Mar 81.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The Night/Precision Attack funding request will continue full-scale engineering development and flight test of LANTIRN which was initiated under Program Element #63249F, Night Attack Program. F-16 integration will be completed and development pods fabricated for flight test. The Wide Angle Raster Head-Up Display (HUD) testing will be completed in preparation for a production decision. Development costs are based on contractor proposal and program office estimates for flight and qualification testing. Production costs are estimates based on contractor development contract.

Program Element: #64249F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Night/Precision Attack
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	58,800	87,600	64,500		32,700	296,100
(Quantity)			(34)		(268)	(300)
Procurement (Aircraft)	1,000	15,900	118,300		458,300	576,300
(Quantity)			(34)		(198)	(300)

(U) OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Pod Procurement (Aircraft)(PE 28031F)	1,000	5,000		0	0	6,000
(PE 27249F)		0	15,400	26,200	1,293,400	1,335,000
(Quantity)					(300)	(300)

Project: #2693 | Title: LANTIRN
Program Element: #64249F | Title: Night/Precision Attack
DOD Mission Area: Close Air Support and Interdiction, #223 | Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The threat by the enemy's formidable armored and air forces, especially of the Warsaw Pact against the North Atlantic Treaty Organization (NATO), has increased in the past few years and is projected to become stronger in both quantitative and qualitative terms. Enemy armor, equipped with night vision capability and accurate laser ranging systems, has been combined with new hardware, training and operational doctrine to assure a continued enemy thrust during night and adverse weather conditions. Successful interdiction and close air support missions against this projected threat require accurate target acquisition and weapons delivery. Even though target acquisition, laser designation and attack capability currently exist for day visual conditions, serious deficiencies occur when these same tasks are required to be performed during night and adverse weather conditions. The need is well documented in several sources including the Air Force Planning Guide, Mission Area Analysis, 1 Dec 1979; NATO Rationalization, Standardization, Interoperability (RSI) Master Plan, 5 Sep 1979; and Tactical Air Forces Statement of Need 302-81, Night Attack Capabilities. This program is primarily dedicated to improving Air Force capability to conduct close air support and interdiction missions at night and under the weather for the F-16 and the A-10 aircraft, but is readily extendible to other ground attack aircraft in the inventory.

(U) RELATED ACTIVITIES: There are no other Air Force or other Service efforts to develop an advanced fire control pod or laser designator equipped Forward Looking Infrared (FLIR) pod for single seat aircraft. The current Navy F-18 pod has growth potential for a laser designator but is unsuitable for use on the F-16 without major modifications. The Air Force is evaluating a proposed terrain following modification of the F-16 APG-66 radar in conjunction with B-1B radar development effort. LANTIRN procurement will be accomplished in Program Element (PE) 27249F beginning in FY 1984. Development efforts are coordinated with the F-16, A-10 and Maverick Missile System program offices. FY 1982, FY 1983 and FY 1984 advanced development portions of automatic target recognizer have been transferred to program element 63249F to continue target recognizer advanced development as directed by the FY 1982 Authorization Conference. Collection of FLIR data is being planned by the Air Force Avionics Laboratory in FY 1982 to support the competitive evaluation of target recognizer hardware for the LANTIRN targeting pod. In addition, the Avionics Laboratory is managing advanced development efforts of target recognizer technology in their Image Sensor Autoprocessor Program.

(U) WORK PERFORMED BY: All Air Force efforts will be managed by the Aeronautical System Division, Wright-Patterson AFB. Any F-16 or A-10 efforts will necessarily involve the aircraft prime contractor, General Dynamics, Fort Worth, TX, and Fairchild, Long Island, NY, respectively. Contractor for the Low Altitude Navigation and Targeting Infrared Systems for Night attack is Martin Marietta Corporation, Orlando, FL. The Head-Up Display for F-16 and A-10, which supports the LANTIRN system in the cockpit, is contracted to Marconi Avionics Limited of the United Kingdom.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: After the initial budget request for increased night attack capability was denied in the FY 1979 Authorization Bill, the Air Force examined existing systems (F-18 Forward-Looking Infrared pod) as directed by Congress for possible adaptation to Air Force use. FY 1980 Congressional action directed that $12.5 million requested for Airborne Tracker Laser Illuminator System (ATLIS II) in Program Element 64613F, Common NATO munition be moved to the Night Attack Program. As a result of this action, FY 1979 funds totaling $15.6M were trans-

Project: #2693 Title: LANTIRN
Program Element: #64249F Title: Night/Precision Attack
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

ferred from Program Element 64613. A new program element, #64249F, was established for FY 1982 and beyond to provide the project greater visibility for prudent management. The Single Seat Laser Designator program was terminated in June 1980 as a consequence of FY 1981 Authorization Conference direction. A competitive source selection for developing the Low Altitude Navigation and Targeting Infrared System for Night was awarded September 1980 to Martin Marietta Corporation. The Fire Control System is based on two pods: one pod incorporates a navigation FLIR and a manual terrain following radar; a second pod contains a slewable target acquisition FLIR and a laser designation system. Preliminary Design Reviews were successfully conducted in FY81 for HUD navigation pod hardware and software and targeting pod hardware and software. Preparations were completed for Critical Design Reviews to be held early FY 1982.

2. (U) FY 1982 Program: Aircraft integration and pod fabrication for flight test will be accomplished. Critical Design Reviews will be conducted on both pods. Testing will be conducted on the terrain following radar using a contractor airplane. Development and operational flight testing of the Head-Up-Display will be conducted on the F-16. The increase in FY 1983 RDT&E estimate as compared to the FY 1982 Descriptive Summary is a consequence of an independent cost study team evaluating most probable cost based on a high confidence program schedule. The corresponding decrease in FY 1982 procurement funding results from adjustments of production readiness start date to better coincide with representative milestones in flight testing.

3. (U) FY 1983 Planned Program: The ground integration will be completed and F-16 Head-Up-Display production will be initiated. A-10 integration for flight test will begin. The combined Development/Operational Test and Evaluation will be completed for the F-16. As with the FY 1982 cost estimate changes, the FY 1983 adjustments from the previous Descriptive Summary result from extensive cost study and risk reduction efforts.

4. (U) FY 1984 Planned Program: Conduct F-16 flight testing with navigation and targeting pods. Continue development and fabrication of support equipment. Initiate production readiness and long-lead procurement. Full-Scale Development will be initiated for target recognizer, based upon maturity at the technology being developed and evaluated under PE 63249F.

5. (U) Program to Completion: Production of the Head-Up-Display for A-10 will be accomplished from FY 1984 through FY 1986. Qualification testing on first production pods will include reliability and maintainability testing in FY 1985. Lot 1 production turn on will be initiated in FY 1985, although currently approved funding levels in FY 84 and beyond will not support start of production until Nov 1987. Flight testing on the A-10 will begin at conclusion of F-16 LANTIRN testing in FY 1986.

Project: #2693
Program Element: #64249F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: LANTIRN
Title: Night/Precision Attack
Budget Activity: Tactical Programs, #4

6. (U) Milestones:	Date Presented in FY82 Descriptive Summaries	Date
A. (U) Begin F-16 flight test		
Head-Up-Display	Jan 1982	Jun 1982
Pods	Dec 1982	Jul 1983
B. (U) Complete basic flight test	Oct 1983	Dec 1984
C. (U) Production Decision (DSARC III)	Jun 1984	Feb 1985
D. (U) First production pod delivery	Jun 1985	Aug 1987

(U) Explanation of Milestone Changes: F-16 flight test for Head-Up-Display and pods has been delayed six months in accordance with an ASD Commander decision in Jun 1981 to plan a higher confidence program by including more time planned for integration prior to system test. Completion of flight test was extended because of the decision to increase number of sorties flown in order to fully evaluate human factors and automatic features of LANTIRN. Although the current development program will accommodate first production delivery by Aug 1986, FY 1984 procurement funding in the FY 83 President's budget is not sufficient for first deliveries before Aug 1987.

7. (U) RESOURCES: Not Applicable

8. (U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64268F Title: Aircraft Engine Component Improvement Program (CIP)
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	105,091	123,889	120,472	156,429	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF PROGRAM ELEMENT AND MISSION NEED: Aircraft engine component improvement programs (CIP) are initiated after an engine/component has successfully completed all of the required development tests, meets the specification in the development contract, and the first production funded aircraft using the engine/component is accepted by the Air Force. Historically, systems add offensive/defensive equipment, have mission and/or tactics changes, and operate in different environments to meet the ever changing threats. It has been demonstrated that an active engine component improvement program is an effective means of reducing the cost of engine ownership, and improving system operational readiness through improvements in durability, maintainability, operability, reliability, reparability, and suitability of the engine as operational conditions change and service time is accumulated. System changes continue throughout the operational life of a system; therefore, the engine component improvement program must continue at a reasonable level to provide the engineering support required to obtain engine changes which are essential for satisfactory system performance in operational use at a cost affordable to the Air Force. The funds being requested represent the Air Force requirements only and do not include funds required from other Services or Foreign Military Sales on joint programs.

(U) BASIS FOR FY 1983 RDT&E REQUEST: A CIP is required for each operational engine in order to be able to identify and resolve operational problems and potential cost avoidance that arise during service use. The CIP for each engine generally consists of the following types of efforts: (1) analytical and test efforts to identify the life limiting parts of an engine so that corrective actions can be initiated before operational use is impacted; (2) evaluation of new hardware for reducing adverse engine impact on the environment; (3) demonstrations to provide review/revision of maintainability actions to establish and update inspection limits and techniques for field and overhaul activities; (4) investigation of field and test failures to determine the significance and, where appropriate, generate changes on a timely basis to reduce the impact on the aircraft mission; (5) reduction of maintenance and spare parts costs through the development, evaluation, qualification, and introduction of repair techniques or redesigned parts; and (6) flight and ground tests on engines/components to provide immediate investigation of service-revealed discrepancies and to evaluate proposed engineering changes. Age, use, quantity of engines and operational experience are factors considered in determining the resource allocation to each of these efforts within a given engine CIP. A continuing program is conducted for each of the following engines/components to provide the efforts deemed necessary:

Program Element: #64268F   Title: Aircraft Engine Component Improvement Program (CIP)
DOD Mission Area: Close Air Support and Interdiction, #223   Budget Activity: Tactical Programs, #4

ENGINE MODELS	AIRCRAFT APPLICATION	FY 1983 ($ IN MILLIONS)
TF41	A-7	7.31
TF34	A-10	18.13
J85-21	F-5	.95
TF33	E-3A	1.93
J79	F-4	2.09
F100	F-15	18.22
F100	F-16	42.67
J57	KC-135	1.78
J75	F-105	.94
J69	T-37	.68
T56	C-130	2.61
J85	T-38	.90
TF30	F-111	13.75
TF33	C-141	2.30
TF39	C-5	4.20
T58	HH-3	.59
T64	HH-53	.59
T400	UH-IN	.31
GTU/T76	ALL/OV-10	.52
	TOTAL	120.47

(U) The level of funding for each engine program was derived from a bottoms-up estimate of development costs required to meet the specific engines program objectives and was reviewed by the Engine Advisory Group comprised of technical/management specialists from the Air Force Logistics Command, Air Force Wright Aeronautical Laboratories and Air Force Systems Command.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	105,400	131,000	130,700		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #64268F Title: Aircraft Engine Component Improvement Program (CIP)
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

ENGINE MODELS	AIRCRAFT APPLICATION	FY 1983 ($ IN MILLIONS)
TF41	A-7	7.00
TF34	A-10	17.35
J85-21	F-5	.91
TF33	E-3A	1.85
J79	F-4	2.00
F100	F-15	17.44
F100	F-16	40.61
J57	KC-135	1.70
J75	F-105	.90
J69	T-37	.65
T56	C-130	2.50
J85	T-38	.86
TF30	F-111	13.16
TF33	C-141	2.20
TF39	C-5	4.02
T58	HH-3	.56
T64	HH-53	.56
T400	UH-1N	.30
CTU/T76	ALL/OV-10	.50
F101 CED	B-1B	5.40
	TOTAL	120.47

(U) The level of funding for each engine program was derived from a bottoms-up estimate of development costs required to meet the specific engines program objectives and was reviewed by the Engine Advisory Group comprised of technical/management specialists from the Air Force Logistics Command, Air Force Wright Aeronautical Laboratories and Air Force Systems Command.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	105,400	131,000	130,700		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #64268F Title: Aircraft Engine Component Improvement Program (CIP)
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Navy/Air Force/Army have found it necessary to maintain an engineering support capability for aircraft engines after the engine development period to address problems that occur over the operational lifetime of that engine. It is this effort that is referred to as the engine Component Improvement Program (CIP). Prior to FY 1980, this program was funded in Aircraft Procurement Appropriation, Budget Activity 7, Aircraft Support Equipment and Facilities. During the engine development program, attempts are made to satisfy all known engine requirements. These are in terms of performance, weight, durability, maintainability, reliability, and other specification requirements. It is also recognized that in the time normally available for engine development, most problems will be identified and solved. However, the limitations of ground testing and a comparatively short flight testing period will not uncover all possible operational difficulties. Experience has indicated that the engine will not achieve its final maturity level until after it has been in operational use for several years. It is during these subsequent years when many of the engine's problems are identified and solved.

(U) As the engine progresses through its life cycle, increased component failure or malfunctions, operational problems, and hardware condemnation will occur with increasing age and changing use. These service revealed problems must have timely corrective action through modification with redesigned components. Also there are instances where suppliers of new components or spare parts go out of business, discontinue manufacturing items for lack of production volume, change increasing prices for low quantity orders, or consolidate divisions within a parent company which entails relocation of tooling and training new people. Engineering surveillance and/or qualification testing of alternate or second source of parts is required to maintain a supply of needed components.

(U) The CIP is the vehicle by which engine problems are investigated and resolved. It is essential that such a program exists and operates for the engine to reach maturity and remain a useful power plant throughout its life cycle. Without timely engineering solutions of the service revealed problems, reduced operational readiness and increased maintenance overhaul costs will occur and thereby jeopardize the capability of the fleet to achieve its mission requirements.

(U) CIP is an engineering effort obtained from the original engine manufacturer and procured and managed by the Air Force or Navy, or jointly. The specific efforts undertaken are determined by the contracting agency (Air Force or Navy) after consideration of the development and operational experience, and the recommendations of all the engine users. In addition, the maturity and logistics goals established for the particular engine are used as program guidelines Historically, during the early production periods the CIP effort concentrates on resolving early operational problem found with the engine and the redesign of engine parts to reduce the production cost. As the engine matures, greater emphasis is placed on engine component durability, maintainability, reliability through redesign of parts which limits engine use and the development of repair procedures to return used parts to a serviceable condition. The end result of the CIP is a better operational readiness of the engine, longer engine useful life, and lower acquisition and support costs.

Program Element: #64268F Title: Aircraft Engine Component Improvement Program (CIP)
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: For requisite technology, this program draws on "core" engine technology (compressor, combustor, and high pressure turbine) from Program Element (PE) 63216F, Advanced Turbine Engine Gas Generator. Fan and low pressure turbine technology are provided by PE 63202F, Aircraft Propulsion Subsystem Integration. Materials processing and component fabrication demonstration come from PE 78011F, Manufacturing Technology Program. Additional component/engine test data is contributed by PE 64218F, Engine Model Derivative Program. The Navy has a supporting engine component improvement program.

(U) WORK PERFORMED BY: The overall program is managed by the Aeronautical Systems Divsion, Deputy for Propulsion, Wright-Patterson AFB, OH. Individual engine component improvement programs are managed by the Aeronautical Systems Division, Deputy for Propulsion and the Air Force Logistics Command's San Antonio Air Logistics Center and Oklahoma City Air Logistics Center. In-house test and evaluation efforts are conducted at the Arnold Engineering Development Center, Tullahoma, TN and the Air Force Flight Test Center, Edwards AFB, CA. Contractors include Detroit Diesel Allison Division, Indianapolis, IN (T56, TF41 engines); General Electric Company, Evendale, OH (J79, TF39, F101 engines); General Electric Company, Lynn, MA (J85, J85-21, TF34, T64, T58 engines); Air Research (Garrett) Phoenix, AZ (T76 and GPU); Pratt and Whitney Aircraft of Canada, Ltd (T400); Pratt and Whitney Aircraft, West Palm Beach, FL (J57, J75, F100, TF30, TF33 engines); Solar Division of International Harvester, (GTU); and Teledyne CAE, Toledo, OH (J69 engine).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This engine component improvement program was funded in the procurement appropriation in FY 1979 and prior and the R&D appropriations for FY 1980 and beyond. Specific accomplishments include:

(U) F100 Engine:
(1) (U) Developed engineering changes which resulted in over $3.0 billion cost avoidance.
(2) (U) Resolved major operational problems such as stall-stagnation
(3) (U) Reduced inflight shutdowns from over 6 to less than 2 per 1000 engine flight hours.
(4) (U) Increased the maximum operating time for the various modules by a factor of 2 to 3.
(5) (U) Reduced engine removal rate from 9.93/1000 EFH in 1979 to 8.09 in 1981.
(6) (U) Reduced maintenance manhours per EFH from 3.4 in 1979 to 2.4 in 1981.

(U) TF34 Engine:
(1) (U) Realized over $12.5 million in production savings from CIP demonstrated improvements.
(2) (U) Corrected the number 3 bearing problem.
(3) (U) Demonstrated fixes which have reduced the depot cost per flying hour from $1,176 to $305; and which have reduced the total cost per flight hour from $5,762 to $588.
(4) (U) One year's CIP effort resulted in production cost reduction of $4,300 per engine and $68 million in logistics cost avoidance.
(5) (U) Reduced engine removal rate from 1.72/1000 EFH in 1979 to 0.94 in 1981.

Program Element: #64268F Title: Aircraft Engine Component Improvement Program (CIP)
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) TF30 Engine: (1) (U) Demonstrated engineering improvements which resulted in excess of $179.8 million in logistic cost avoidance.
(2) (U) Demonstrated a redesigned first stage turbine disc with a low cycle fatigue life of 6000 hours versus an original disc life of 1600 hours.
(3) (U) Redesigned the compressor to prevent rotor drum fires which had resulted in two major aircraft accidents and one test cell incident.

(U) TF41 Engine: (1) (U) Redesigned the turbine blades to correct a safety of flight condition.
(2) (U) Identified the critical life limits on forty-one (41) cycle sensitive parts and conducted a risk assessment using service experience, test data, and finite element analysis techniques.
(3) (U) Redesigned the seventh stage high pressure compressor vane to adequately endure static and vibratory stresses.

(U) OTHER ENGINES: The maximum operating time has been increased dramatically for all engines in the Component Improvement Program (CIP). In a recent five year span, engineering changes on the J57 resulted in over $131.1 million in cost avoidance, and the TF33 has had over $249.6 million in cost avoidance changes.

2. (U) FY 1982 Program: This level of effort reflects reductions for deescalation, fuel adjustments, and funding to higher priority programs. Although this program provides continuing engineering support for all engines and related hardware in the Air Force inventory, the major effort will be directed to the following programs:

(U) F100 Engine: This program contains 109 specific tasks which are intended to (1) reduce air aborts and Class A and Class B accidents; (2) reduce premature engine removals per 1000 engine flight hours by ten percent; (3) continue to reduce maintenance manhours per engine flight hour by ten percent; (4) continue to reduce the cost of operating and supporting the engine per engine flight hour. Major effort will be directed toward improving hot section durability through verification work on 1800 cycle high pressure turbine improvements including the first and second stage disc, first stage blades and vanes; and an improved durability combustor. Efforts will be conducted to improve the life of the second stage compressor airseal and the Compressor Inlet Variable Vane (CIVV) synchronizing ring. Elimination of 12th and 13th stage vanes and case cracking will be worked. The electronic engine control will be modified to increase the augmentor Segment V lockout region to reduce augmenter blowout and engine stall. Work will be accomplished on an improved reliability ignition system and a longer life main igniter. Work on an improved life main fuel pump will be conducted. Efforts will be conducted to improve control system reliability through simplified Back-up Control (BUC) coupling, improved electrical components, and a revised cam to improve Upper Left Hand Corner (ULHC) augmentor operation. Testing will include accelerated mission testing, altitude functional suitability testing, altitude functional suitability testing, feasibility testing, and rig and core engine testing. Repair procedures will be developed and tested to reduce spare part buy requirements and extend the useful life of engines.

Program Element: #64268F   Title: Aircraft Engine Component Improvement Program (CIP)
DOD Mission Area: Close Air Support and Interdiction, #223   Budget Activity: Tactical Programs, #4

(U) TF34: This program is structured to provide a cost effective engineering program to design, qualify and introduce hardware changes to address the following goals: (1) reduce the percent of engines not mission capable down to ten percent; (2) reduce unscheduled engine removals per 1000 engine flight hours by 15 percent; (3) reduce maintenance manhours per engine flight hour by 20 percent. Effort will also be directed toward eliminating all failure modes which impact safety of flight and toward improving operational readiness. The program continues a life management program which provides a means for predicting and tracking hardware low cycle fatigue and thermal cyclic life limits; development and evaluation of component repair procedures to reduce the frequency of repair and replacement of major components. Extensive factory accelerated mission testing (AMT) and component testing will be accomplished. A damage tolerance program and hot section life improvement work will be continued.

(U) TF30: The contractual engineering effort for this engine will cover the continued redesign/modification necessary to resolve flight safety failures to evaluate the correct service revealed deficiencies, and to provide engineering designs for developing and testing repairs for depot and field implementation. Efforts will include work on improved life for compressor rotor parts, develop containment capability for fan section, improve life high pressure turbine rotor and a more durable fourth stage turbine blade. Testing will reduce air aborts per 1000 engine flight hours by 14 percent, (2) reduce unscheduled engine removals by five percent, and (3) reduce maintenance manhours per engine flight hour by eight percent.

(U) TF41: Efforts will be conducted to resolve flight safety problems, address service revealed deficiencies and assist logistics support by developing repair procedures. Effort will be expended to correct fan disc blade lug failures by redesigning the disc for increased section thickness. Compressor 11th stage seal cracking will be worked to identify cause of cracks and develop a fix. Work to develop a redundant inlet guide vane control system will be accomplished. Improved reliability fuel system components and accessories will be worked. Extensive accelerated mission testing will be accomplished. These and other planned tasks should permit: (1) reducing air aborts per 1000 engine flight hours by 20 percent, (2) reduce unscheduled engine removals by 20 percent and (3) reduce maintenance manhours per engine flight hour by ten percent.

(U) TF39: Engineering effort will be directed towards resolving service revealed problems and conducting fleet leader engine testing to provide early problem identification and correction as well as verifying fixes for service revealed deficiencies. Major effort will be directed toward the development of repair procedures to extend the useful life of expensive parts. Verification work to titanium fire fixes will be continued with work on steel compressor vanes. Tasks include improved cyclic life for the compressor rear shaft and improved reliability for the anti-ice valve. Work will be accomplished to correct sump lube supply line failures due the chafing. Testing will include a 1000 cycle endurance test and some service evaluation flight testing.

(U) T56: The program will continue to address: (1) safety of flight problems, (2) improvements to maintain operational utility, (3) reduce field maintenance manhours and costs, (4) reduce overhaul and spare parts costs, (5) reduce premature engine removals, and (6) develop repair procedures to extend useful life of high value parts. Efforts planned include continued work to improve fatigue life limited turbine blades, evaluate an erosion resistent coating to improve compressor performance deterioration characteristics and develop increased load capacity front pinion bearing. Testing includes accelerated endurance, simulated flight endurance, and component rig evaluation tests.

Program Element: #64268F Title: Aircraft Engine Component Improvement Program (CIP)
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) Other Engines: The programs for the other engines are directed toward the resolution of service revealed problems with primary emphasis on correction of all safety of flight problems. Development of repair procedures or work arounds to prevent overhaul line stoppage and maintain logistic support for the engines will be accomplished. Testing will be accomplished to verify fixes and repair procedures.

3. (U) FY 1983 and 1984 Planned Program:

a. (U) The Engine Component Improvement Program (CIP) is a continuous program carried on throughout the service life of the engines. Engineering effort will include the following general areas in conducting a CIP for each engine and related hardware.

(1) (U) Investigation, definition and correction of service revealed deficiencies.
(2) (U) Improve engine reliability and maintainability by improving on the design of marginal components.
(3) (U) Extend the maximum operating time of the engines.
(4) (U) Reduce overhaul cost by qualifying new wear limits and determining part life.
(5) (U) Maintain engine specification requirements.
(6) (U) Provide a review of maintainability actions, establish and update inspection limits and techniques for field and overhaul activities.
(7) (U) Provide early disclosure of any weakness that would limit engine life and would normally appear only after extended service operation.
(8) (U) Reduce maintenance and spare parts cost through the review, evaluation and introduction of repair techniques.
(9) (U) Initiate action to redesign and improve the marginal parts/components as soon as investigation and identification of potential weaknesses indicates such action is appropriate.

b. (U) The general activity above applies to all engines in the Air Force inventory to one degree or another. The major efforts will be as follows:

(U) F100: Investigate and develop repair procedures to extend the useful life of high value parts; conduct extensive testing to verify repairs/redesigns and to discover potential problems ahead of fleet experience; reduce engine removal rate from 8.09 to 6.0 per 1000 engine flight hours; reduce maintenance manhours per engine flight hour from 2.4 to 2.0; develop improved anti-icing capability for the fan; extend maximum operating time for the backup control; develop increased durability and reduced maintenance for the augmentor/nozzle and develop improved durability core engine components and respond to causes of unscheduled engine removals.

(U) TF34: Effort on this engine will be directed toward identifying and resolving engine problems/weaknesses before they occur in the field. This will be accomplished through extensive testing and analysis. Tasks include continuation of life management and damage tolerance assessment programs, resolution of the problem of water collecting deficiencies will also be accomplished.

Program Element. #64268F Title. Aircraft Engine Component Improvement Program (CIP)
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) TF30: Testing will be conducted to verify fixes resulting from the fatigue life improvement program to continue extending the time on lead the fleet test engines. This engine has four models that have widely different mission usages which require additional testing to evaluate improvement against these mission differences. Several impending safety of flight problems will be addressed. Tasks include continuation of fan containment capability development and life extension for fan discs. Repair procedures will be developed to salvage high value components by extending their useful life.

(U) TF41: Accelerated mission tests (AMT) will be conducted to verify/quality repair procedures and redesigns for durability and reliability improvements. Tasks include developing improved reliability main fuel pump and main fuel control. Life limit testing will be accomplished. Continue the improvement program for the turbine air seal. New repair techniques and extension of serviceable limits will be evaluated as part of the engine maturation program.

(U) TF39: The major emphasis for this engine is to reduce support costs by providing repair procedures and redesigning parts showing distress that results in premature removal of the engine. Testing will be accomplished to maintain a lead over operational engines and to verify/qualify repair procedures and redesigns.

(U) T56: This program will concentrate primarily on the investigation, definition and correction of service revealed deficiencies preventing engines from achieving the scheduled time between overhaul resulting in higher logistic support costs. Low cycle fatigue life analysis will be continued and development work for an improved durability high pressure turbine rotor will be accomplished. Effort will be directed toward maintaining engine specification requirements as the engine ages. Maintenance actions will be reviewed to establish/extend inspection limits and to develop repair techniques for field and overhaul activities.

(U) Other Engines: The remaining engines in CIP are relatively more mature and the effort on these programs is directed toward maintaining operational capability with reasonable logistic expense. As the engine ages and accumulates more time, new failure modes are identified and must be addressed. Repair and maintenance procedures are continually reviewed and modified to meet the changing characteristics of the engines.

c. (U) The cost decrease between FY 82 descriptive summary and the FY 83 descriptive summary reflects the currently approved program level of $120.5M vs the $131.0M FY 82 estimate. Program reduction was allocated to each program.

4. (U) Program to Completion: This is a continuing program.

5. (U) Milestones: Not Applicable.

6. (U) Resources: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64314F — Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
DOD Mission Area: Counter Air, #221 — Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT		138,079	207,601	192,670	260,446	798,796

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This joint Air Force/Navy program is structured in response to the Joint Service Operational Requirement and Mission Element Need Statement to significantly improve operational utility and combat effectiveness through development of an AIM-7/SPARROW follow-on air superiority air-to-air missile. A North Atlantic Treaty Organization (NATO) Staff Target titled "Operational Objective for NATO Air-to-Air Missiles for the 1980s and Beyond" has identified a similar requirement. The need described is for an adverse weather, all aspect, all environment air-to-air missile compatible with the F-14, F-15, F-16, F-18 and appropriate NATO air superiority and air defense aircraft. The missile must have a performance envelope significantly improved over the AIM-7F/M, increased missile velocity, a launch and maneuver employment capability, and the capacity for multiple target attack during a single intercept. AMRAAM will satisfy these needs. AMRAAM Full Scale Development (FSD) is funded under this program element.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funding for the FSD contractor to continue engineering design and development of AMRAAM and fabrication of missiles that will be tested during FSD. The request includes funds to introduce a second source contractor into the program. Cost estimates are based on in-house and independent cost estimates performed by and for the AMRAAM Joint System Program Office as well as contractor estimates.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		141,900	163,500		118,800	424,200

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Missile Procurement (PE 27163F)				59,000	TBD	TBD

Program Element: #64314F Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
DOD Mission Area: Counter Air, #221 Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This joint Air Force/Navy program has the overall objective of continued improvement of United States and North Atlantic Treaty Organization (NATO) air-to-air combat effectiveness. The Joint Air-to-Air Missile Requirements Study was initiated by the Under Secretary of Defense for Research and Engineering in October 1975. Combat deficiencies identified in Southeast Asia and the resultant improvements incorporated in the AIM-7F were reviewed to form the baseline for near and far term requirements definition. The study group reviewed the current and projected airborne threat spectrum, the Air Force/Navy roles and their relative priorities, and current technologies. The Joint Air-to-Air Missile Requirements Study findings were documented in a Joint Service Operational Requirement (JSOR) which was validated in September 1978. This JSOR and the Mission Element Need Statement (MENS), approved by the Secretary of Defense in January 1979, provide the basis for the Advanced Medium Range Air-to-Air Missile (AMRAAM) development effort. The threat spectrum for which AMRAAM is optimized includes: manned aircraft (fighters, bombers, fighter-bombers and interceptors) operating from [ ]feet at speeds up to Mach[ ] with maneuvering accelerations up to [ ] and a majority of the cruise missile threat which operates at altitudes up to [ ]feet and speeds up to Mach [ ] The projected aircraft threat includes: improved capability for [ ] air-to-air missiles.

(U) In August 1980, the United States signed a Memorandum of Understanding with the United Kingdom, Germany and France concerning a Cooperative Program for a Family of Air-to-Air Missile Systems. The Memorandum of Understanding calls for the European participants to develop the next short range missile and the United States to develop AMRAAM to satisfy the medium range missile requirement in the North Atlantic Treaty Organization Staff Target.

(U) The AMRAAM development effort has the objective of significantly increasing United States and NATO air-to-air capability and operational utility in the 1980s and beyond by producing a more effective, reliable, affordable, maintainable missile, with emphasis on low altitude targets in an electronic countermeasures environment. To satisfy the MENS, JSOR, and NATO Staff Target, the proposed AMRAAM design utilizes inertial midcourse guidance and an active radar terminal guidance approach. Key features which will improve operational utility include: high average missile velocity, more range than AIM-7/SPARROW, increased maneuverability, multiple target attack, and launch and leave capabilities. Mature technologies, such as solid state electronics, high rate digital computers, and terminal guidance-aided fuzing are featured. Of prime importance is the requirement for the AMRAAM to be totally compatible with the fire/weapons control systems of the F-14, F-15, F-16, F/A-18 and appropriate NATO air superiority and air defense aircraft.

(U) Two contractors were selected for a competitive Validation Phase beginning in February 1979. To validate their Advanced Medium Range Air to Air Missile concepts each contractor conducted extensive ground component simulation, captive carry, and free flight testing. Based on the results of validation testing and the contractors' proposals, Hughes Aircraft Company of Canoga Park, CA was awarded a contract to complete full scale development of his design, including development/modification of launchers. Rail launchers will be developed to provide the necessary aircraft/missile interfaces and will be capable of AMRAAM and AIM-9/SIDEWINDER carriage. Ejection launchers will be modified SPARROW launchers developed for the AMRAAM so as to maintain a SPARROW launch capability.

Program Element: #64314F   DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)   Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: The Advanced Medium Range Air-to-Air Missile development program is a Joint Service effort with the Air Force as Executive Service and Navy personnel integrated into the Joint System Program Office (JSPO). The Navy has assigned to the JSPO, the Deputy Program Manager, the Assistant Chief Engineer and various other assistants for logistics, budget, project management, and test. The Joint System Program Office is maintaining a close relationship with the F-14, F-15, F-16 and F-18 program offices to assure that proper consideration is given to the aircraft modifications that will be required. Other programs related to the full employment capability of AMRAAM include target identification and improved aircraft radar target processing techniques.

(U) In the AMRAAM Decision Coordinating Paper issued after Milestone I, the Office of the Secretary of Defense directed that an Operational Utility Evaluation (OUE) be conducted concurrent with Validation and Full Scale Development. The OUE was to include simulation, analysis and flight tests necessary to establish the operational utility of AMRAAM as well as the cost and effectiveness benefits of AMRAAM compared to alternative systems. An OUE man-in-the-loop simulation and analysis effort is underway to establish the utility of AMRAAM by comparing the effectiveness of AMRAAM and AIM-7M with and without reliable identification systems and using single and multitarget track avionics in a realistic environment. Due to the avionics implications, the OUE was initiated under Program Element 64201F (Aircraft Avionics Equipment Development). However, with the addition of funds in fiscal year 1981, funding for the OUE is in Program Element 28008F, Operational Utility Evaluation of the Advanced Medium Range Air-to-Air Missile.

(U) The AMRAAM Validation Phase was funded under Program Elements 63370F and 63370N. Funding for Navy peculiar Full Scale Development requirements and Operational Evaluation is included in Program Element 64314N. Air Force procurement of AMRAAM will be funded under Program Element 27163F beginning in fiscal year 1984.

(U) WORK PERFORMED BY: The Advanced Medium Range Air-to-Air Missile development and acquisition program is being managed by the AMRAAM Joint System Program Office at the Armament Division, Eglin Air Force Base, FL. In addition to the Armament Division, other government organizations/facilities participating in the development effort include White Sands Missile Range, NM; Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH; Air Force Materials Laboratory, Wright-Patterson Air Force Base, OH; Pacific Missile Test Center, Naval Air Station Pt Mugu, CA; and Naval Weapons Center, China Lake, CA. Hughes Aircraft Company, Canoga Park, CA was the contractor selected to continue with full scale development of AMRAAM.

Program Element: #64314F
DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS: During the first quarter of fiscal year 1977, the Advanced Medium Range Air-to-Air Missile design definition was initiated based upon the Joint Service Operational Requirement as directed by the Under Secretary of Defense for Research and Engineering. Design efforts included performance optimization, cost trade-offs, the beginning of laboratory testing and scintillation/miss distance reduction demonstrations at the White Sands Missile Range facilities. Design proposals were prepared in anticipation of the beginning of the Validation Phase in fiscal year 1978. However, the fiscal year 1978 budget did not include funding for the initiation of the Validation Phase. In July 1978 Congress approved a reprogramming request of $7.0 million from the Air Force and $6.0 million from the Navy for a continuation of the competitive design definition effort that included component development and evaluation; system performance/cost/effectiveness evaluations; aircraft fire control/radar interface investigations; evaluation of the missile's capability in an electronic countermeasures and clustered target environment; and continued analysis of surface-to-air and long range applications of AMRAAM.

(U) Initiation of AMRAAM Validation Phase was approved at Milestone I in November 1978 and documented in the Advanced Medium Range Air-to-Air Missile Decision Coordinating Paper in January 1979. Thirty-three month Validation Phase contracts were awarded to Hughes Aircraft Company and Raytheon Company in February 1979. Efforts during Validation Phase included missile subsystem and system level design, development and test; AMRAAM launcher design, development test; and Class II modifications on the F-14, F-15 and F-16. Over 180 captive carry test missions were completed. Seekers from both contractors were tested in electronic countermeasures and benign target environments in detailed hardware-in-the-loop seeker simulations at the Army Missile Command, Huntsville, Alabama and the Air Force Armament Laboratory, Eglin AFB, Florida. Other simulations were also accomplished to evaluate the missiles' flight performance. Each contractor accomplished seeker development work and demonstrated the seeker functions related to his full scale development missile. Controlled test vehicles were fired to demonstrate safe separation from the F-14, F-15, and F-16, and the contractors began a series of guided prototype launches. Test data from all areas of evaluation were compiled, reduced, and analyzed. Planning and actions for timely transition into the Full Scale Development (FSD) Phase were accomplished.

2. (U) FY 1982 PROGRAM: Flight testing of the prototype AMRAAMs was continued through 1 December 1981 under Program Elements 63370F and 63370N. Based on the results of the prototype testing and evaluation of the contractors' proposals for FSD and initial procurement options, Hughes Aircraft Company was selected to continue the development of AMRAAM. Additional prototype vehicles will be tested beginning in early 1982 and will include an evaluation of missile capability in a clustered target environment. The results of the Validation Phase and additional fiscal year 1982 test firing results will be presented at Milestone II planned for September 1982.

(U) A 50-month FSD effort was initiated under this Program Element (64314F). Engineering design and development will begin. The contractor will begin fabrication and delivery of development missile subsystems for test. Various types of ground tests will be conducted. Modification of the F-15 and F-16 aircraft to be used during Development Test and Evaluation/Initial Operational Test and Evaluation will be initiated. Hardware-in-the-loop missile simulations will be used to assess the contractor's AMRAAM design. A management decision will be made concerning the method for acquiring a second source for production.

Program Element: #64314F
DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

3. (U) FY 1983 PLANNED PROGRAM: The contractor will continue design and development, ground testing will continue and the captive carry flights will begin. F-16 aircraft modification will continue and modification of the F-18 for the full scale development (FSD) program will begin. The F-15 captive test program and delivery of FSD launchers will begin.

4. (U) FY 1984 PLANNED PROGRAM: The F-16 captive test program will begin and modification to the F-18 for flight test will begin. The missile design will be completed in FY 1984 and the Critical Design Review accomplished. Initial procurement funding for AMRAAM will be in FY 1984 under Program Element 27163F. The first Guided Test Vehicle launch will occur.

5. PROGRAM TO COMPLETION: AMRAAM FSD will continue. The F-14 will be modified for FSD testing. Extensive Development Test and Evaluation/Initial Operational Test and Evaluation will be continued. First production delivery is planned for late FY 1985 with the initial operational capability for a [ ] planned for FY

(U) The total cost to complete FSD increased due to various changes, many of which will contribute to controlling production costs in the outyears. The missile design has increased in complexity; the weight and parts count are up. The cost of integrating and testing (including modification of development test aircraft) on four aircraft will cost considerably more than previously planned. The contractor will utilize production type tooling to fabricate his FSD missiles in a production facility; thus, easing and reducing the cost of transition to full production. An increased emphasis on reliability and maintainability (R&M) to hold down life cycle cost resulted in several added R&M efforts, such as the extensive test analyze and fix program. Funds have been budgeted for the addition of a follower contractor during FSD with the intent to introduce early competition for production buys and, in turn, lower procurement costs. The use of a fixed price FSD contact was another major factor impacting FSD costs. In essence, several efforts have been included in FSD which result in higher up-front funding in development, but are intended to minimize life cycle costs/and future costs growths.

6. MILESTONES:

			Date
A.	Start Design Definition		October 1976
B.	Complete Design Definition		May 1977
C.	Start Pre-prototype Evaluations		July 1978
D.	Complete Pre-prototype Evaluations		September 1978
E.	Milestone I		November 1978
F.	Award Validation Phase Contracts		February 1979
G.	Subsystem Test Start		March 1979
H.	Free Flight Tests Start		October 1980
I.	Subsystem Test End		November 1981
J.	Free Flight Tests End	* (November 1981)	December 1981
K.	Award Full Scale Development Contract	* (November 1981)	December 1981
L.	Preliminary Design Review		September 1982

Program Element: #64314F
DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

M.	Milestone II	* (November 1981)	September 1982
N.	Full Scale Development Subsystem Tests Start		May 1982
O.	Full Scale Development Flight Tests Start	* (April 1983)	January 1984
P.	First Production Delivery		September 1985
Q.	Full Scale Development Flight Tests End	* (January 1985)	February 1986
R.	Full Scale Development Subsystem Tests End	* (February 1985)	February 1986
S.	Initial Operational Capability		[ ]

* Date presented in fiscal year 1981 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES: The contract award for full scale development (FSD) was delayed five weeks because an extension in source selection to permit the contractors to submit updated proposals. When the source selection was extended, the contractors were granted an additional five weeks to launch their prototype hardware. Negotiation of the FSD contract resulted in a rephasing of the development effort to allow an overlapping but sequential approach to integration and test on the four fighter aircraft. This rephrasing resulted in a later date for completion of flight testing. In accordance with the new Office of the Secretary of Defense initiatives for improved acquisition, the Milestone II program go-ahead decision review will be held during FSD after completion of the system preliminary design review rather than the beginning of FSD.

Budget Activity: Tactical Programs, #4
Program Element 64314F/63370F - Advanced Medium Range Air-to-Air Missile (AMRAAM)

Test and Evaluation Data:

1. (U) Development Test and Evaluation: The AMRAAM program was initiated as a joint Air Force/Navy development effort (Air Force executive service) to develop and produce a lightweight, active radar guided missile for use on the F-14, F-15, F-16, and F-18. With the signing of the Memorandum of Understanding for a Family of Air-to-Air Missile Systems, AMRAAM will be compatible also with the German F-4F and British Tornado. The Mission Element Need Statement and Joint Service Operational Requirement call for improved effectiveness (high velocity, launch and leave, multiple-target attack), operational utility (short range operational launch without airborne intercept radar), reliability, maintainability and affordability. Beginning with full scale development (FSD), AMRAAM must address the requirements in the Operational Objective for NATO Air-to-Air Missiles for the 1980s and Beyond.

(U) Development of AMRAAM is being managed by the AMRAAM Joint System Program Office at Eglin AFB, Florida. The 3246th Test Wing at the Armament Division is the Development Test and Evaluation (DT&E) test agency with Air Force Test and Evalution Center the Operational Test and Evaluation (OT&E) test agency. The Pacific Missile Test Center and the Operational Test and Evaluation Force are the Navy's development and operational test agencies.

(U) Following the completion of concept definition and Milestone I (November 1978), contracts were awarded to Hughes and Raytheon, 2 February 1979, for the 33-month competitive Validation Phase. In early fiscal year 1982, one of these contractors will be selected to begin Full Scale Development (FSD). Milestone II is planned during FSD after system Preliminary Design Review (September 1982). Combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) is planned for the Validation and Full Scale Development phases. In addition, a separate phase of Initial Operational Test and Evaluation (IOT&E) is planned near the end of Full Scale Development.

(U) Validation phase test and evaluation was initiated early in fiscal year 1980 and included a variety of ground captive carry and free flight testing intended to provide data necessary for management to confirm that the AMRAAM concept was sound and that the technical risks in proceeding with FSD were acceptable. To faciliate the validation testing, each of the competing contractors developed their own missile design and fabricated hardware which has matured in design from early checkout vehicles to prototype AMRAAMs.

(U) Each contractor's prototype hardware was tested to examine its potential for satisfying the Joint Service Operatonal Requirements such as improved end game performance, look-down shoot-down capabilities, multimode guidance flexibility, enhanced electronic counter-countermeasures potential, multi-aircraft compatibility and reliability and performance goals. Included in the free flight testing were demonstrations of AMRAAM's unique autonomous guidance mode, as well as a command-inertial active guidance mode.

(U) Ground testing included such things as wind tunnel, warhead, and fuze testing as well as integration testing. In addition, extensive simulation, including hardware-in-the-loop, was conducted to assess system performance in benign as well as electronic countermeasures environments. More than 70 integration/environmental missions were flown with F-14, F-15 and F-16 aircraft; only form and fit tests were accomplished on the F/A-18. Validation

Budget Activity: Tactical Programs, #4
Program Element: 64314F/63370F - Advanced Medium Range Air-to-Air Missile (AMRAAM)

captive carry testing also consisted of over 90 flights with the contractors' AMRAAM seeker test units studying acquisition, tracking and prelaunch functioning.

(U) Validation phase free flight testing included launches of separation, controlled and guided test vehicles. Safe separaton has been demonstrated from the F-14, F-15 and F-16 aircraft. A series of guided test vehicle launches has been initiated with four successful guided intercepts of targets. These launches were off F-15s and F-16s and included two direct hits. Additional guided prototype launches are planned for all three test aircraft.

(U) During Full Scale-Development, multi-service DT&E will begin in fiscal year 1982 and continue through early fiscal year 1986. FSD testing will be conducted using pre-production missiles and proposed support equipment. The major objectives of the DT&E testing are to:

a. (U) Provide sufficient testing to determine equipment readiness for Initial Operational Test and Evaluation. Areas that will be addressed include performance, compatibility, interoperability, reliability, maintainability and logistical supportability.

b. (U) Determine if the system meets contract specification requirements and identify technical deficiencies so that changes can be instituted before the start of production.

c. (U) Demonstrate compatibility of the ejector launcher with the AIM-7 and the rail launcher with the AIM-9.

d. (U) Demonstrate complete integration with the F-14, F-15, F-16 and F/A-18 aircraft.

(U) Although a firm schedule for Full Scale Development testing has not been prepared, Development Test and Evaluation will include extensive laboratory, captive flight and live firing tests. The tests will include electronic counter countermeasures testing, logistic support/ground support evaluations and simulated operational environments where ship suitability, electromagnetic interference and aircraft catapult/arrestment will be evaluated.

2. (U) Operational Test and Evaluation: No Advanced Medium Range Air-to-Air Missile (AMRAAM) Operational Test and Evaluation has been accomplished to date. Combined Development Test and Evaluation/Initial Operational Test and Evaluation is planned during the Demonstration and Validation Phase and Full Scale Development. In addition, a separate phase of Initial Operational Test and Evaluation will be conducted at the end of Full Scale Development. Air Force is lead service with the Air Force Test and Evaluation Center as Operational Test and Evaluation test agency.

(U) Demonstration and Validation Phase. Operational Test and Evaluation conducted during this phase will consist of monitoring Development Test and Evaluation tests. The missiles to be tested will be functionally but not mechanically similar to production items. Air Force Test and Evaluation Center will prepare an independent report on the

Budget Activity: Tactical Programs, #4
Program Element: 64314F/63370F - Advanced Medium Range Air-to-Air Missile (AMRAAM)

projected operational effectiveness and suitability of both systems tested. Demonstration and validation testing will be conducted from fiscal year 1980 through mid-fiscal year 1982.

(U) Full Scale Development Phase. Initial Operational Test and Evaluation will be combined with Development Test and Evaluation, where possible, when the AMRAAM configuration is representative of production missiles. A separate phase of Initial Operational Test and Evaluation will be conducted near the end of Full Scale Development using pilot production missiles. Data collected during both the combined and separate phases of Initial Operational Test and Evaluation will be used to provide a valid estimate of the Advanced Medium Range Air-to-Air Missile's operational effectiveness and suitability to support Milestone III. Full Scale Development testing will be conducted from late fiscal year 1983 through fiscal year 1986.

(U) Air Force Test and Evaluation Center will have the overall management responsibility for Advanced Medium Range Air-to-Air Missile Initial Operational Test and Evaluation. The United States Navy Operational Test and Evaluation Force will ensure that Navy requirements are included in the Initial Operational Test and Evaluation test plan.

(U) While specific test locations have not been determined, ranges with the capability (with modification) to test the Advanced Medium Range Air-to-Air Missile are:

(1) White Sands Missile Range, New Mexico.

(2) Eglin Gulf Test Range, Florida.

(3) Pacific Missile Test Center Range, California.

(4) Naval Weapons Center Test Range, California.

(U) Only preliminary Advanced Medium Range Air-to-Air Missile Initial Operational Test and Evaluation planning has been accomplished to date. The planned combined Development Test and Evaluation/Initial Operational Test and Evaluation program will consist of approximately 96 total missile firings from the F-14, F-15, F-16 and F-18. Navy operational testing will follow with production hardware. During the combined testing, a concurrent but separate Initial Operational Test and Evaluation test phase is planned which will include firing 29 pilot production missiles from the F-16 and a 2000 hour captive-carry reliability program using another 20 pilot production missiles. The planned testing will provide data for a decision to continue production of AMRAAM.

(U) Decision Coordinating Paper 176, 13 January 1979, levied an additional requirement on the services to perform an Advanced Medium Range Air-to-Air Missile operational utility evaluation (OUE). The operational utility evaluation is to consist of analyses, air combat simulation, and flight tests as required to establish the operational utility of AMRAAM. The Office of the Secretary of Defense (OSD) has instructed the Services to initiate the analysis and simulaton tests and present the results at DSARC II. In May 1979, the Air Force Test and Evaluaton Center contracted with McDonnell Douglas for the conduct of the air combat simulation. To date two F-15 and two F-16 test periods are complete. One additional test period for each aircraft will be finished by February 1982 to complete the test. The simulator facility has maintained a high reliability rate and testing to date has been highly satisfactory. The utility evaluation is an operational test and is funded under Program Element 28008F, AMRAAM Operational Utility Evaluation.

(U) Air Force and Navy personnel will operate the AMRAAM throughout the development program. Contractor personnel will maintain the AMRAAM during demonstration and validation and the beginning of Full Scale Development. Thereafter all equipment will be maintained by Air Force and Navy personnel.

3. Systems Characteristics: The missile is being defined in response to the Mission Element Need Statement and the Joint Service Operational Requirement and the Operational Objective for NATO Air-to-Air Missiles for the 1980s and Beyond. The objectives data listed below are tentative and reflect Joint Service Operational Requirement specifics which will continue to be subjected to cost/performance trade-offs.

TEST AND EVALUATION DATA:

A. Performance	Objectives	Demonstrated
Speed, Maximum Mach		To be demonstrated
Altitude, Feet		
Maximum		To be demonstrated
Minimum		To be demonstrated
Range:		
Maximum Nautical Miles		To be demonstrated
Minimum, Feet		To be demonstrated
Kill Probability, Percent		To be demonstrated

B. Reliability		Demonstrated
Mean Flight Hours Between Failure	450-600	To be demonstrated
Free Flight	.8-.85	To be demonstrated

Budget Activity: Tactical Programs, #4
Program Element: 64314F/63370F - Advanced Medium Range Air-to-Air Missile (AMRAAM)

C. Missle Description

Launch Weight (pounds)	200-350	
Warhead Weight (pounds)	25-50	To be demonstrated
Guidance Type	Active radar terminal/inertial mid-course	
Compatibility	F-14, F-15, F-16, F-18, F-4F (German), Tornado (British)	

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64321F
DOD Mission Area: Tactical Command and Control, #344

Title: Joint Tactical Fusion Program
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT[1]	5,423[2]	5,280	9,908	TBD	TBD	TBD

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The tactical forces have a critical need to rapidly (on a Near Real Time basis) exploit time-sensitive and high volume, multi-sensor information. The objective of this program is to develop and field an Enemy Situation Correlation Element (ENSCE) which will correlate and aggregate multi-source sensor data; provide precise location of opposing force structures or nodes; and provide ground battle situation displays to support the Tactical Air Control Centers. Information will be shared with the Army All-Source Analysis (ASAS) System.

(U) BASIS FOR 1983 RDT&E REQUEST: Includes funds to support Congressional redirection of the Battlefield Exploitation and Target Acquisition (BETA) and Tactical Fusion Division (TFD) Projects to combine with related Army projects and form the Joint Tactical Fusion Program. The Air Force configuration of the system developed in this joint effort will be the ENSCE. The cost estimate was developed by the Joint Tactical Fusion Program Management Office (JTFPMO).

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

		FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	TOTAL FOR PROGRAM ELEMENT	5,500	10,000	8,700		24,100	68,400

(U) OTHER APPROPRIATION FUNDS: Not Applicable

1/ FY 1983 funds reflect minimum funding to support the program, out-year funding will be provided when firm estimates are established

2/ These funds were previously identified under PE 27431F.

Program Element: #64321F

DOD Mission Area: Tactical Command and Control, #544

Title: Joint Tactical Fusion Program

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The employment of highly mobile and technologically advanced weapon systems by opposing tactical military forces requires early detection, identification and location. To support this requirement, sophisticated sensor systems which can detect and locate basic elements (such as electronic emitters) are being increasingly employed. There is a critical need to rapidly exploit this time-sensitive and high volume of sensor information. The purpose of this program is to develop and field an ENSCE which will correlate and aggregate the large number of elements (such as multi-channel radios and radars) detected by various sensor systems and reduce them to force structures (such as command posts and air defense batteries); provide ground battle situation displays; and provide target nomination support to the Tactical Air Control Centers. The Services have submitted the Joint Tactical Fusion Development and Acquisition Program Plan to the Office of the Secretary of Defense based on Congressional redirection of the Battlefield Exploitation and Target Acquisition (BETA), Tactical Fusion Division (TFD), and All Source Analysis System (ASAS) Projects to combine and form a joint effort called the Joint Tactical Fusion Program. Current plans are to acquire fusion systems for the Services at the earliest possible date, maximizing the use of common hardware and ensuring interoperability within and among Services.

(U) RELATED ACTIVITIES: Related Program Elements include: 64321A, Joint Tactical Fusion Program, for the Army ASAS. 27431F, Tactical Air Intelligence Systems; for the procurement, operation, and maintenance of the Air Force ENSCEs. And 63789F, Command, Control, and Communication Advanced Development; for advanced development of the software required to incorporate future Air Force sensors.

(U) WORK PERFORMED BY: The Executive Agent for the Joint Tactical Fusion Program is the Army. The JTFPMO, manned by personnel from all Services and the National Security Agency, is located at the Harry Diamond Laboratories, Adelphi, MD. All Air Force manpower (including authorizations previously at Hanscom AFB) has been transferred and collocated with the JTFPO. TRW, Redondo Beach, California, was the prime contractor for the BETA Test Bed development. BDM Corporation performs maintenance on the test beds.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A Tactical Fusion Division study was initiated and completed in FY 1977. A Battlefield Exploitation and Target Acquisition (BETA) Project Request for Proposal was released to industry in November 1977. Prime contract was awarded in February 1978 to TRW for the development of the BETA Test Bed. Modifications required to interface sensor subsystems were determined. Communication support plans were prepared and a Critical Design Review was conducted in February 1979. Plans for the modification to sensor subsystems and communication support equipment were accomplished. Subsystems to interface the sensors with the testbed were developed and installed. Development of the communication subsystem and support equipment continued. Project funds were used to continue the software development and correct testbed deficiencies.

Program Element: #64321F

Title: Joint Tactical Fusion Program

DOD Mission Area: Tactical Command and Control, #344

Budget Activity: Tactical Programs, #4

2. (U) FY 1982 Program: Continue joint-service development and acquisition of a militarized fusion system for earliest possible fielding. The FY 1982 effort will focus on performing systems engineering/integration functions, generating the Statement of Work and specifications and preparation of the Requests for Proposals for the militarized terminals, hardware for the correlation centers, continuing software development, and continuing development of the simulation program to drive the fusion system during testing and operational exercises. Congress reduced funds in FY 1982, thereby denying "funding for a European test of existing fusion testbed components." In a separate, but related action, Congress did not object to sending a testbed to Europe to fulfill a USCINCEUR urgent requirement for a limited operation fusion capability.

3. (U) FY 1983 Planned Program: A source selection process will commence in FY 1983. All necessary experimental work will have been performed, user assessments provided, user requirements prioritized, and the proposed system ready for full scale development. Work will continue on the definition and implementation of the communications, sensor and command and control interfaces. Work to support development and training will continue. The testbeds will be utilized for user evaluation, participation in Joint and Service unique exercises, and as a development tool for the evaluation of the evolving versions of the software.

4. (U) FY 1984 Planned Program: Continue development contract.

5. (U) Program to Completion: Development of the militarized production prototype hardware will continue. Acquisition of the long-lead items for the follow-on limited production run will be initiated. The continuing software development effort will yield an upgraded software configuration which will be implemented on the testbed. One production prototype hardware set will be delivered and a combined Development Test and Evaluation and an Operational Test and Evaluation will be conducted over a one-year period.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

Budget Activity: Tactical Programs, #4
Program Element: 64321F, Joint Tactical Fusion Program
Project: Enemy Situation Correlation Element

TEST AND EVALUATION DATA

1. (U) Development Test and Evaluation: The Battlefield Exploitation and Target Acquisition (BETA) Project was established to design and develop a testbed primarily in support of Army and Air Force tactical command centers. The project was to demonstrate and evaluate the feasibility and utility of correlating inputs from multiple tactical battlefield sensors and national sensors to produce ground situation displays and target nominations in near-real time for improved battle management. The BETA testbed is a joint Army/Air Force project with the Army as lead service; during Congressional review of the project for Fiscal Year 1981, it was directed that the ENSCE (formerly Automated Tactical Fusion Division) and the Army's All Source Analysis System (ASAS) be combined into a Joint Tactical Fusion System development after the Office of the Secretary of Defense approval of the program plan, currently in service coordination. Based on approval of the plan and competitive acquisition (by the Joint Tactical Fusion Program Office) of Joint ASAS/ENSCE systems in FY 83/84, Development Test and Evaluation will begin in Fiscal Year 1985. IOC is planned for FY 87.

2. (U) Operational Test and Evaluation: The Joint Tactical Fusion Program (JTFP), formerly Battlefield Exploitation/Target Acquisition (BETA), test bed will be used for demonstration and validation of automated sensor fusion concepts for the follow-on Air Force Enemy Situation Correlation Element (ENSCE) and Army All Source Analysis System (ASAS) developments. AFTEC will monitor the 1982-1984 initial operational test and evaluation (IOT&E) of the JTFP testbed at Hurlburt Field, Florida, conducted by Tactical Air Command. During 1982-1983, the Air Force Test and Evaluation Center (AFTEC) will perform an operational utility evaluation of the JTFP testbed in Europe focusing on those capabilities which are intended for the ENSCE in USAFE and NATO.

b. When the preproduction ENSCE equipments are delivered in 1985, a combined development test and evaluation/initial operational test and evaluation (DT&E/IOT&E) will be conducted in the CONUS. The AFTEC conducted IOT&E will address both the operational effectiveness and operational suitability of the ENSCE prototypes. Major IOT&E objectives will include assessments of the sensor interface software performance, as well as enhancements to the sensor coordination, intelligence correlation, situational awareness, target nomination, and battle management functions. In addition, the communications support and human factors associated with the ENSCE will be assessed.

c. The US Air Forces Tactical Air Warfare Center (USAFTAWC) will be the Tactical Air Forces lead agency for user participation in the CONUS testing with United States Forces in Europe (USAFE) providing the resources for the AFTEC conducted European assesment. Elements of the Air Force Electronics Security Command (ESC) and Air Force Logistics Command (AFLC) will also be involved. The goal of the JTFP/ENSCE program is to achieve an initial operational capability in Europe by 1985, a CONUS-deployable capability by 1986 and a capability in Korea by 1987. Specific test milestones are being formulated by the JTFPMO and will be formalized in the acquisition strategy section of the program management plan now in service/OSD coordination.

3. (U) Systems Characteristics: The Battlefield Exploitation and Target Acquisition (BETA) Testbed is a tool that is being used to develop and validate operational concepts and procedures. Specific products will be the Air Force Enemy Situation Correlation Element (ENSCE) and the Army All Source Analysis System (ASAS) that will be contractor-developed

Budget Activity: Tactical Programs, #4
Program Element: 64321F, Joint Tactical Fusion Program
Project: Enemy Situation Correlation Element

based on the Battlefield Exploitation and Target Acquisition Testbed and related technology. The Battlefield Exploitation and Target Acquisition Testbed employs Joint Interoperable Tactical Command and Control System data messages and will provide early evaluation of these standards in an automated environment. ASAS/ENSCE will provide the Department of Defense with a single joint engineering/development testbed for correlation and fusion of ground target sensor information.

(U) Air Force ENSCE currently planned performance and objectives are:

Performance	Objective	Demonstrated
Number of Sensors Inputing	15	To be tested in Fiscal Year 1985
Sensor Report Rates	250 reports per hour/sensor	
Full Situation Display Generation	10 seconds	
Cross Correlation Display	3 seconds	
Self Correlation of Reports	3 seconds	
Graphics Portrayal Transmission Between Centers	Plus or minus 15 seconds of one minute	

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64362F
DOD Mission Area: Theater-Wide TNF, #242

Title: Ground Launched Cruise Missile
Budget Activity: Tactical Programs, #4

RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	107,613	80,065	28,531	23,950		353,300

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of the Ground Launched Cruise Missile (GLCM) is to counter modernization of Soviet long-range theater nuclear forces, particularly SS-20s and Backfire bombers. The need is for a system capable of surviving a Soviet first strike and having enough range to reach targets in the western military districts of the Soviet Union, thus helping to deter a combined Warsaw Pact and Soviet numerical superiority in both conventional and theater nuclear forces. This program element provides for full scale engineering development to adapt the TOMAHAWK cruise missile into a tactical mobile ground launched system.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Continue engineering development which began in 1978. Specific development efforts are the GLCM Integrated Logistics Support program and training equipment. The Air Force Test and Evaluation program and system ground qualification tests will be completed which lead to a Defense System Acquisition Review Council III scheduled for May 1983. Procurement funding will be used to buy 120 missiles, 27 transporter erector launchers, and 15 launch control centers.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: No change since FY 82 Descriptive Summary.

OTHER APPROPRIATION FUNDS:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement*	164,100	350,500	530,700	474,000	1,014,200	2,561.900
(Quantity)	(11)	(54)	(120)	(120)	(255)	(560)
Military Construction	22,200	75,000	85,400	93,100	116,400	392,100
Department of Energy costs						

*Includes initial spares

Program Element: #64362F
DOD Mission Area: Theater-Wide TNW, #242

Title: Ground Launched Cruise Missile
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Ground Launched Cruise Missile is an adaptation of the TOMAHAWK cruise missile as a ground mobile weapon system to increase theater firepower. Faced with numerical increases and advanced technology of enemy forces, a cost effective weapon is required to sustain theater capability. Ground Launched Cruise Missile can satisfy this need for a system with a high single-shot probability of destruction of tactical targets and with coverage of a large percentage of the theater target system. The Ground Launched Cruise Missile, with a nuclear warhead, preprogrammed targeting, and a quick reaction, all weather capability can provide increased firepower and improve the non-nuclear force levels by releasing quick reaction alert aircraft for other than nuclear tasking. In effect, this provides increased conventional firepower without additional aircraft.

Technology developed in the TOMAHAWK advanced development program supports the development of a Ground Launched Cruise Missile weapon system capable of 2500 kilometers operational range and terminal accuracy of less than _Circular Error Probable. Pre-launch survivability is enhanced through system mobility which allows dispersal from main operating bases to random locations during periods of increased tension or actual hostility. Because of the missile's range, the weapon system can be located well behind the Forward Edge of the Battle Area, further complicating the enemy's prelaunch attack problem.

(U) The Ground Launched Cruise Missile program will integrate the TOMAHAWK cruise missile into an air transportable, ground mobile unit. The missiles are transported four to a launch platform and are controlled by a launch control center. Four transporters with sixteen missiles and two launch control centers constitute a flight. The design of the launch control center, transporter erector launcher, and associated electronics comprise the bulk of the program. System integration and testing make up the balance of the effort. The weapons control system software development is the pacing item in the development program.

(U) RELATED ACTIVITIES: The Ground Launched Cruise Missile as a weapon system is a new development, but it will incorporate technologies previously developed in command, communication, and control subsystems and carrier vehicles. Program Elements 64367N, TOMAHAWK and 64361F, Air Launched Cruise Missile are closely related.

(U) WORK PERFORMED BY: The Joint Cruise Missiles Project Office located in Washington, D.C. has overall responsibility for the Ground Launched Cruise Missile development and testing. The January 1977 Cruise Missile Defense System Acquisition Review Council II direction established the Joint Cruise Missiles Project Office with the Navy as lead Service to manage current cruise missile development with special emphasis placed on commonality between programs. The Air Force Ground Launched Cruise Missiles Project Office is staffed by the Air Force within the overall auspices of the Director, Joint Cruise Missiles Project Office who is the Program Manager. Air Force Systems Command, Andrews AFB, MD and Aeronautical Systems Division, Wright-Patterson AFB, OH interface and support this development activity. Air Force Test and Evaluation Center, Kirtland AFB, NM will be responsible for operational testing. The Utah Test and Training Range has been selected as the Ground Launched Cruise Missile

Program Element: #64362F
DOD Mission Area: Theater-Wide TNW #242

Title: Ground Launched Cruise Missile
Budget Activity: Tactical Programs, #4

primary test site. General Dynamics, San Diego, CA is contractor for the TOMAHAWK missile airframe. McDonnell Douglas, St Louis, MO is the navigation/guidance contractor. Williams Research, Walled Lake, MI is the contractor for the engine. General Dynamics is the weapon system integration contractor. GTE Sylvania is the communications subcontractor. Vitro, Silver Spring, MD is the weapon control system software and integrating contractor with McDonnell Douglas, St Louis, MO providing the hardware.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 Program: System development continued with critical design reviews on the weapon control system and the trailer for the transporter erector launcher and launch control center. Fabrication of preproduction articles was accomplished to support the Air Force test and evaluation. Planned test assets include five missiles and their cannisters, four transporter erector launchers, and three launch control centers. Guidance sets, engines, and warhead flight test articles also began delivery in support of the test program. The production of 11 missiles, 6 transporter erector launchers, and 6 launch control centers, and associated support equipment were funded to meet the planned December 1983 Initial Operational Capability in the United Kingdom.

2. (U) FY 1982 Planned Program: Two contractor flight and ground qualification tests occur followed by the start of Air Force test and evaluation. There is a continued development of the weapon control system software and weapon system support equipment. Definition of the Integrated Logistics Support for the Ground Launched Cruise Missile begins. Fifty-four missiles, 17 transporter erector launchers, 10 launch control centers, and associated support equipment will be funded in fiscal year 1982 in order to meet the planned force structure buildup. The FY 1982 funding estimate is an agreed upon position between Headquarters Air Force Systems Command and the Joint Cruise Missile Project Office. The estimate was developed by a special joint estimating team co-chaired by Air Force Systems Command and the Project Office, and used the latest contractor proposals for full scale development of the weapon system.

3. (U) FY 1983 Planned Program: Development of the Integrated Logistics Support (ILS) program continues along with development of the training program. The Air Force test and evaluation program and system ground qualification tests are planned to be completed in February 1983 which lead to a Defense System Acquisition Review Council III scheduled for May 1983. Procurement funding will be used to buy 120 missiles, 28 transporter erector launchers, and 15 launch control centers.

4. (U) FY 1984 Planned Program: Conclude development of the GLCM ILS program. Procure 120 missiles, 28 transporter erector launchers, and 15 launch control centers.

5. (U) Program to Completion: Follow-on Operational Test and Evaluation will be accomplished and will primarily consist of continued testing to complete residual test objectives not accomplished during Air Force test and evaluation. Deficiencies and areas of concern surfaced during prior testing will be reexamined and corrected. An analysis of operational effectiveness and suitability of the Ground Launched Cruise Missile weapon system will continue. System deployment will continue into fiscal year 1988, with procurement of another two hundred and fifty-five missiles, sixty-one transporter erector launchers, and thirty-four launch control centers.

Program Element: #64362F
DOD Mission Area: Theater-Wide TNW, #242

Title: Ground Launched Cruise Missile
Budget Activity: Tactical Programs, #4

6. (U) Milestones:

			CY Date
A.	DSARC II		Jan 1977
B.	Program Initiation		Oct 1977
C.	First Full Scale Engineering Development Flight		May 1980
D.	Critical Design Review		Mar 1981
E.	First Test Article Delivered		Sep 1981
F.	Complete Development/Initial Operational Test & Evaluation	*(Jan 1983)	Feb 1983
G.	AFSARC III		May 1983
H.	Initial Operational Capability (IOC)		Dec 1983

*Date presented in FY 1982 Descriptive Summaries

(U) EXPLANATION OF MILESTONE CHANGE: The milestone change was caused by a continued delay in development of the weapon control system software and associated slip in the planned test schedule. The change was an internal program change and did not change the IOC.

Budget Activity: Ground Launched Cruise Missile
Program Element: 64362F

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Ground Launched Cruise Missile (GLCM) test program is being managed by the Joint Cruise Missiles Project Office (JCMPO). General Dynamics is the prime integrating contractor and the Air Force Flight Test Center is the development test agency. GLCM development testing of the TOMAHAWK missile will incorporate test results from the Sea Launched and Air Launched Cruise Missile programs to reduce GLCM test requirements. Applicable areas include engine performance qualification, airframe, navigator/guidance, and missile performance.

(U) First contractor test launch of a TOMAHAWK missile from an engineering test unit of the Transporter Erector Launcher (TEL) occurred 16 May 1980 at Dugway Proving Ground, Utah.

(U) Full system testing will begin February 1982 using preproduction prototype missiles, TELs and Launch Control Centers (LCCs). Two (2) contractor flights and eight (8) Air Force flights are planned from February 1982 to February 1983. The Air Force testing will be combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E).

(U) The DT&E program has objectives to provide data in the areas of flight test, environmental test and operations, and maintenance demonstrations.

(U) Flight test objectives are to provide W84 warhead flight test data to the Department of Energy, investigate launch environment effects on the TEL, and provide data to evaluate system performance for compliance with the system specification.

(U) Environmental test objectives address the adequacy of the GLCM system to function through its specified range of environment.

(U) The operations and maintenance demonstrations will focus on maintenance of the GLCM ground systems since the GLCM maintenance concept provides for only limited maintenance on the missile.

(U) The primary test site will be the Utah Test and Training Range with tests also conducted at Aberdeen Proving Ground, MD, Eglin Air Force Base, FL, and Kirtland Air Force Base, NM. Tests will be conducted using a total of three (3) LCCs, four (4) TELs, and five (5) missiles. Recovery and refurbishment of flight tested missiles will enable multiple test launches of a single missile.

Budget Activity: Ground Launched Cruise Missile
Program Element: 64362F

(U) An Extended Storage Program (ESP) during Developmental Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) will use a Transporter Erector Launcher (TEL), a Launch Control Center (LCC), and four missiles to help assess Ground Launched Cruise Missile (GLCM) system reliability. One missile will be launched at the end of the ESP as the last of the eight Air Force launches.

2. (U) Operational Test and Evaluation:

(U) No dedicated GLCM Operational Test and Evaluation (OT&E) has yet been accomplished; however, the Joint Cruise Missile Project Office conducted an initial phase of survivability testing between January and October 1978. Seven test flights were flown with the Tomahawk Sea Launched Cruise Missile (SLCM) version against various simulated airborne and ground defensive threats to obtain generic detection and tracking data. Test data was also obtained from Phase II survivability flights during Air Launched Cruise Missile (ALCM) initial operational test and evaluation. The ongoing ALCM Phase III survivability flight program is providing additional generic data. SLCM technical evaluation/operational evaluation and GLCM combined DT&E/IOT&E will provide further data. Applicable results will be applied to the GLCM design and the planning of survivability objectives for IOT&E.

(U) The combined DT&E/IOT&E is scheduled for February 1982 through February 1983. Those aspects of SLCM mission reliability and performance which reflect GLCM operational requirements will be used in conjunction with formal GLCM OT&E flight test data.

(U) The purpose of IOT&E will be to provide a valid estimate of the operational effectiveness and suitability of the GLCM Weapon System for Defense System Acquisition Review Council III, scheduled for May 1983. The Air Force Test and Evaluation Center will manage IOT&E. The Tactical Air Command, United States Air Forces Europe, Air Training Command, Air Force Logistics Command, Military Airlift Command, and Electronic Security Command will participate. Personnel from Commander in Chief Europe may participate in IOT&E of the Mission Planning Subsystem.

(U) The principal test location will be the Utah Test and Training Range where ten flights (two contractor and eight Air Force) using preproduction prototype missiles will be launched. IOT&E will also include a four week field exercise, without missile launches, at Fort Lewis, Washington.

(U) The complete GLCM weapon system will not be available for evaluation at the start of IOT&E. Technical data and support equipment deliveries will be phased, with a complete system planned to be available in June 1982. A full evaluation of logistics supportability will be completed during Follow-on Operational Test and Evaluation (FOT&E). All test air vehicles will have telemetry packages and all but one have a recovery package in place of one fuel tank. Service personnel, representative of operational personnel, will operate and maintain the weapon system to the extent possible during IOT&E. Because of technical data and support equipment phasing, contractor personnel will perform maintenance on

Budget Activity: Ground Launched Cruise Missile
Program Element: 64362F

some parts of the weapon system during the first half of Initial Operational Test and Evaluation (IOT&E). A system approach to the evaluation of availability, reliability (both mission and logistics), maintainability, and logistic supportability is a major operational suitability test objective. Quantitative (critical, high interest, and desirable maintenance and operational demonstrations performed by Air Force personnel) and qualitative evaluations are planned. A qualitative logistics supportability evaluation will be conducted with emphasis on Air Force Logistics Command (AFLC) capability to support the system. Mature system evaluation criteria (thresholds and goals) will be established for significant areas of evaluation. The System Effectiveness Data System (SEDS) will be used to collect and analyze reliability and maintainability test data. Service reports will be submitted IAW Section V, TO-00-35D-54 (USAF Material Deficiency Reporting and Investigating System). Air Launched Cruise Missile and Sea Launched Cruise Missile program data will be used as appropriate.

(U) Operational testing of the Ground Launched Cruise Missile (GLCM) weapon system will continue after Defense System Acquisition Review Council III. This Follow-on Test and Evaluation (FOT&E) effort will be accomplished in two phases. Phase I will be managed by the Air Force Test and Evaluation Center to complete evaluations not finished during IOT&E, to refine test estimates, evaluate changes and modifications to correct previously identified deficiencies, and to identify additional deficiencies. Phase II will be conducted by Tactical Air Command to refine tactics techniques, doctrine and training programs; provide for continuing analysis of operational effectiveness and suitability to include changes in operational requirement; and to identify deficiencies and verify the subsequent corrective measures. Phase II is scheduled to begin in July 1984 after the June 1984 completion of Phase I and will continue throughout the life of the system. This testing will be managed by the Tactical Warfare Center (TAWC) at an undetermined location. Phase II will consist of Continental United States (CONUS) flight tests and ground tests conducted in both the CONUS and at operational bases. The flight test program will eventually grow to 12 flights per year, initially at the Utah Test and Training Range, with air vehicles being recovered, refurbished and returned to the operational inventory. Launches will be grouped (three or four in a 10- to 20-day period) to maximize use of both airborne and ground based support elements. Ground tests will be used to evaluate equipment modifications and to develop and/or improve operational procedures.

3. System Characteristics

Characteristic	Objective	Threshold	Demonstrated
TOMAHAWK (BGM-109)			
Length (without booster)	219 inches		Not Applicable
Weight	2700 pounds		Not Applicable
Warhead (W84)			Department of Energy Verification
Speed			Developmental Test and Evaluation (DT&E)
			DT&E

Budget Activity: Ground Launched Cruise Missile
Program Element: 64362F

Range	2500 kilometers		Initial Operational Test and Evaluation (IOT&E) DT&E/IOT&E
Circular Error Probability	[ ]		
Transporter Erector Launcher	M.A.N. Truck 4 Missiles per Transporter Erector Launcher Weight Approximately 78,000 pounds Air Transportable (C-130, C-141, C-5)		
Launch Control Center	Contains Communication and Launch Control Systems Controls 4 Transporter Erector Launchers M.A.N. Truck Weight Approximately 78,000 pounds		
System Reliability	.85	.80	
Operational Availability	— —	To Be Determined	
Mean Time to Repair (non-missile)	30 minutes		
Planned DT&E/IOT&E Flights			
Contractor Flights Completed	1		
Contractor Flights Remaining	2		
Air Force Test Flights (combined DT&E/IOT&E)	8		
	11		

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64601F

DOD Mission Area: Defensive Chemical and Biological Systems, #276

Title: Chemical/Biological Defense Equipment

Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	8,870	8,767	16,339	16,247	Continuing	Not Applicable
3320	Biological Agent Detection		100	100	100		
3321	Chemical Agent Detection	3,400	5,600	8,000	7,100		
3337	Individual Protection	2,200	1,500	3,339	2,347		
3762	Collective Protection	600	600	4,000	6,000		
3764	Decontamination	600	867	700	600		
5171	Bigeye	2,070	100	200	100		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A marked imbalance in Chemical Warfare (CW) capabilities favoring the Warsaw Pact over the North Atlantic Treaty Organization (NATO) raises a significant threat of CW employment. The objective of this program is to develop chemical and biological warfare defense equipment to ensure survival and to continue operations in a toxic environment. The program encompasses six projects: Biological Agent Detection; Chemical Agent Detection; Individual Protection; Collective Protection; Decontamination; and the Bigeye retaliatory, binary chemical bomb.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This fiscal year's funding will continue RDT&E of Air Force unique chemical and biological defense equipment which expands our combat capability and minimizes degradation of mission performance in a toxic environment. Detection and alarm systems warn of the arrival/presence of liquid/vapor chemical agents. Individual protective equipment provides improved protection and reduces physiological and thermal burdens. Collective protection systems provide filtered air for toxic free work and rest/relief areas. Decontamination reduces post-attack hazards by removing/neutralizing persistent chemical agents. Bigeye binary chemical bomb is certified for compatability, carriage and release on Air Force aircraft. Cost estimates are based on contractor information and prior negotiations.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	8,870	8,800	10,100		Continuing	Not Applicable
Procurement (3080) (PE 27593F)	11,000	16,100	13,100			

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #64601F — Title: Chemical/Biological Defense Equipment

DOD Mission Area: Defensive Chemical and Biological Systems, #276 — Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element was initiated in 1971. Efforts at that time centered on monitoring Army development. With recognition of a significant threat increase in 1974-75, Air Force requirements were expanded. Near-and long-term programs were approved. Near-term objectives stressed acquisition of available equipment. The long-term program develops a full spectrum of equipment required to sustain operations in a chemical/biological warfare environment. Part of the long-term program is dedicated to correcting limitations of the near-term equipment; ultimate goals are to provide protection against the threat into the 1990s. The program element develops protective ensembles for aircrews, ground crews and special teams; personnel shelters and filters; detection and warning devices; and decontamination systems. The Bigeye binary bomb is certified compatible with Air Force aircraft through test work conducted with the Navy, the executive developer.

(U) RELATED ACTIVITIES: DOD Directive 5160.5 establishes the Department of the Army as Executive Agent for all research, exploratory development, and advanced development. However, individual service efforts are encouraged to plan, program, budget, fund and perform exploratory and advanced development when necessary to meet service unique requirements. Air Force programs; Program Element (PE) 27593F, Chemical Warfare Defense Equipment, the procurement element for equipment developed in PE 64601F; PE 62202F, Aerospace Biotechnology, basic research into biotechnological problems of chemical warfare; and PE 63745F, Chemical Warfare Defense. Army programs: PE 62706A, Chemical/Biological Defense and General Investigation; PE 63721A, Chemical Defense Material Concepts; PE 64724A, Biological Defense Material, PE 64725F, Chemical Defense Material. Navy programs: PE 62764N, Chemical/Biological/Radiological Defense Technology; PE 64506F, BR/CW Countermeasures. Tasks are coordinated with the other Services.

(U) WORK PERFORMED BY: The Aeronautical Systems Division (AFSC), Wright-Patterson AFB, OH manages the defensive program. Principal contractors are: Honeywell, Inc., St. Petersburg, FL and Minneapolis, MN; Gentex Corporation, Carbondale, PA; Bendix Corporation, Towson, MD; ILC Dover, Frederica, DE; GTE-Sylvania, Western Division, Mountain View, CA; American Air Filter, St Louis, MO; Battelle Columbus Laboratory, Columbus, OH; Systems Research Laboratory, Dayton, OH; Rohm & Haas, Inc., Springhouse, PA; and GEOMET, Rockville, MD. The Armament Division (AFSC), Eglin AFB, FL manages Air Force certification of the Bigeye bomb.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Components of the near-term aircrew and ground crew protective ensembles were selected, evaluated, produced and delivered to the field. Design criteria for collective protection shelters at fixed installations was developed; additionally the KMU-450 shelter-modification kit was operationally tested and acquired. An automatic point-sampling chemical-agent detector completed evaluation, was produced, and entered the inventory. An evaluation of available decontaminants and dispensing equipment was accomplished. Air Force joined with the Navy in the Bigeye binary chemical bomb development program. An integrated systems analysis of United States Air Force (USAF) chemical defense requirements was conducted. Studies to determine ingestion of chemical agents into aircraft cockpits through the environmental control systems were accomplished. Four eye/respiratory systems continued competitive development to provide long-term protection to aircrews without degrading their performance in a toxic environment. The surface contamination monitor effort continued with two contractors developing competitive designs. Broad collective protection and decontamination evaluations continued.

Program Element: #64601F
DOD Mission Area: Defensive Chemical and Biological Systems, #276

Title: Chemical/Biological Defense Equipment
Budget Activity: Tactical Programs, #4

2. (U) FY 1982 Program: The effort to develop a rapid, accurate electronic detection device for surface contaminants (surface contamination monitor) will reach a first-hardware-delivery stage. Contracts will continue for development of a basewide area-detection system and for single-layered aircrew protective fabrics. Evaluations of four candidate aircrew eye/respiratory systems will be completed, thus preparing a production decision. Contractual efforts for development of modular collective protection facilities and concepts for other fixed facilities' and mobile systems protection will proceed. Additional work on defining contamination avoidance and decontamination systems will be undertaken. The Automatic Liquid Agent Detector final development contract is continued.

3. (U) FY 1983 Planned Program: First item hardware deliveries on advanced decontamination equipment and collective protection systems will be evaluated. Production decision is scheduled for the surface-contamination monitor. Other joint-service developments under evaluation will be the simplified collective protection system, and improved hand and footwear. The airbase Area Detection System will reach the preliminary design review state and the Automatic Liquid Agent Detector will complete development. Support for human performance-degradation tests to determine actual performance decrements of personnel wearing protective clothing will be provided. The increased funding will provide some progress towards sustained operational capability and will reduce mission degradation in a toxic environment.

4. (U) FY 1984 Planned Program: The Area Detection System continues development. Third generation aircrew protection systems will reach early engineering development. Improved collective protection and decontamination systems will be in advanced development stages. A biological-warfare agent detector selection/develoment program will be evaluated. Air Force operational tests of the new joint-Service groundcrew protective ensemble will take place.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

Project: #3321 | Title: Chemical Agent Detection
Program Element: #64601F | Title: Chemical/Biological Defense Equipment
DOD Mission Area: Defensive Chemical and Biological Systems, #276 | Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Chemical Agent Detection and Warning project contains four efforts. The Surface Contamination Monitor (SCM) is a small hand-held device used to detect, identify and quantify liquid and/or vapor chemical agents. The Automatic Liquid Agent Detector (ALAD) will alarm at the arrival of a liquid chemical agent. The Area Detection System (ADS) will scan the airspace around an airbase to detect and alarm at the impending arrival of a liquid and/or vapor chemical agent. The Residual Filter Life Indicator will provide warning of saturation for all types of filters.

(U) RELATED ACTIVITIES: Similar Army and Navy efforts to develop service unique detectors.

(U) WORK PERFORMED BY: The Aeronautical Systems Division (AFSC), Wright-Patterson AFB, OH manages this project. Principal contractors are: Honeywell, Inc., St Petersburg, FL; Bendix Corp., Towson, MD; and GTE-Sylvania, Western Division, Mountain View, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Initiated development of chemical agent detection equipment to replace manual, wet-chemistry detection kits.

2. (U) FY 1982 Program: Continue development of the SCM and ALAD. Complete Phase I, two contractors, of the high risk, high technology ADS.

3. (U) FY 1983 Planned Program: Complete development of the SCM and ALAD. Continue in Phase II the development of the ADS. Initiate the Residual Filter Life Indicator effort.

4. (U) FY 1984 Planned Program: Continue the FY 83 efforts.

5. (U) Program to Completion: This is a continuing project.

6. (U) Milestones: Not applicable

7. (U) Resources:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	3,400	5,600	8,000	7,100	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64602F Title: Armament/Ordnance Development

DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, # 4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

PROJECT NUMBER	TITLE	FY1981 Actual	FY1982 Estimate	FY1983 Estimate	FY1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	20,300	25,205	20,648	21,776	Cont.	N/A
2586	Dispenser Munitions	3,900	4,800	2,600	3,300	Cont.	N/A
2708	Aircraft Gun Systems	12,654	11,800	3,100	1,500	Cont.	N/A
2784	Armament Equipment Systems*		1,105	2,648	3,876	Cont.	N/A
3133	Bombs and Fuzes	2,000	4,500	5,000	7,000	Cont.	N/A
4535	Fuel Air Explosives, Flame and Incendiary	260	Program Terminated				
5613	Carriage and Release Equipment	1,486	3,000	7,300	6,100	Cont.	N/A

*Orginally part of 5613

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is the primary source for modernizing unguided air-to-surface conventional weapons and associated equipment. These weapons provide new capabilities to fill operational voids and eliminate deficiencies in current capabilities. For example, the GPU-5A 30 millimeter (MM) gun pod provides antiarmor killing capabilities to existing aircraft while modern munitions such as the Combined Effects Munition provides the operational forces with a multipurpose munition which can be carried at supersonic speeds.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The Fiscal Year 1983 program is a continuation of work started in prior fiscal years with the exception of the joint Air Force/Navy FMU-139 fuze development effort and the 30 MM gun pod programs; both were started in 1980. Specifically, this program element supports five projects which are further divided into several tasks: Combined Effects Munitions; 30 MM Gun Pod; FMU-130 Fuze; FMU-139 Fuze; Multiple Stores Ejector Rack; Container and Munition Handling Equipment Standardization Activities and an Armament/Munitions Control Focal Point. Cost estimates are provided by the respective program office and derived by those offices.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY1981	FY1982 Estimate	FY1983 Estimate	FY1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	20,000	25,300	23,200		Cont.	N/A
Procurement (Aircraft)(PE 27128)	33,000	43,000	54,400		Cont.	N/A
Procurement (Other)(PE 28030)	5,942	36,794	61,832		Cont.	N/A

Program Element: #64602F
DOD Mission Area: Close Air Support and Interdiction, #223

Title Armament/Ordnance Development
Budget Activity Tactical Program, # 4

(U) Other Appropriation Funds:

	FY1981	FY1982 Estimate	FY1983 Estimate	FY1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Aircraft)(PEs 27128F/27121F) (Project # 2708)(Quantity)	32,300 (40)	41,700 (104)	29,500 (75)	29,400 (80)	Cont. (Cont.)	N/A
Procurement (Aircraft)(PE 27133F)(Wpn Sys) (Project # 5613)(Quantity)			17,000	TBD (TBD)	Cont. (Cont.)	N/A
Procurement (Other)(PE 28030F) (Project # 2586)(Quantity)				73,312 (1,600)	Cont. (Cont.)	N/A
(Project # 3133) (Quantity)			8,340 (10,000)	90,432 (100,000)	Cont. (Cont.)	N/A

(U) DETAILED BACKGROUND AND DESCRIPTION: This program is the primary development source for aerial delivered conventional weapons. The objective of this program is to provide the tactical and strategic operational forces with an effective conventional weapon operational capability. Activities involve the engineering design, development, test and evaluation of a variety of improved conventional weapons and munitions handling equipment. It includes the following types of weapons/equipment: bomb fuzes; bomblets optimized for use against personnel, materiel, armor and other vehicles; dispensers for bomblets; munitions handling equipment; standardized aircraft release equipment, antiarmor gun pods; and devices to permit supersonic carriage and delivery. The efforts underway or planned in this program can be divided into two categories: those aimed at providing our forces with new capabilities to fill operational voids, and those aimed at eliminating deficiencies in current capabilities. For example, this program develops dispenser munitions which will permit full utilization of aircraft capabilities in terms of low altitude supersonic delivery. Also, there are programs such as bomb fuzing, standardized bomb racks, and munitions handling equipment which will use current technology to provide improved capabilities in terms of safety, reliability, operations flexibility and ease of maintenance. Efforts in this program are completed with formal standardization of the munitions/equipment and with independent assessments by the development and operations communities to the effect that the item has successfuly completed development, demonstrates operational utility and suitability, and is ready for production.

(U) RELATED ACTIVITIES: Items from the advanced development program, Program Element 63601F Conventional Weapons, are selected for continuation into a Full Scale Development under this Program Element. Close liaison is maintained between the services through the Joint Technical Coordinating Group for Munitions Development and through formal coordination with the Department of Defense Armaments/Munition Requirements and Development Committee. The Common Bomb Fuze is a joint Air Force/Navy development. The Navy is lead on the Common Bomb Fuze. The 30 millimeter antiarmor gun pod began as an Independent Research and Development project by General Electric.

Program Element: #64602F
DOD Mission Area: Close Air Support and Interdiction, #223

Title Armament/Ordnance Development
Budget Activity Tactical Program, # 4

(U) WORK PERFORMED BY: This program is managed by the Armament Division at Eglin AFB, FL. The major fiscal year 1982 contractors are Aerojet, Downey, CA (Combined Effects Bomblet); Dayron Corporation, Orlando, FL (FMU-130 Fuze); Western Gear Corporation, Jamestown, ND (Multiple Stores Ejector Rack); and General Electric, Burlington, Vermont (30MM Gun Pod). The Naval Air Systems Command, Washington, DC, is managing the FMU-139 program (Motorola Incorporation, Scottsdale, AZ).

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 81 and Prior Accomplishments:

(U) Project 2586: The Tactical Munitions Dispenser met a Critical Design Review (CDR) for the Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) of the CBU-89/B, GATOR mine system. Also the CBU-87/B, Combined Effects Munition, was fabricated. Engineering verification and Military Standards testing were conducted on the fuze and the orientation/stablization device for the Combined Effects Bomblet. The Combined Effects Bomblet packaged in the Tactical Munitions Dispenser is the CBU-87/B Combined Effects Munition. The Tactical Munitions Dispenser was used in the combined DT&E/IOT&E of the GATOR mine system.

(U) Project 2708: Contractor design deficiencies were corrected. A production contract was awarded for the initial pod deliveries.

(U) Project 3133: The FMU-130/B Phase III Full Scale Development (FSD) contract was negotiated with Dayron Corporation, Orlando FL, on a fixed price, incentive fee basis. Fuze design was finalized and CDR was conducted in Sept 81. A follow on FMU-130 development contract was awarded Nov 81. The FMU-139/B was initiated with request for proposal release and source selection activity. FMU-139/B began FSD with engineering model hardware undergoing laboratory testing at the Navy test facility. The Navy awarded the contract in Dec 80.

(U) Project 4535: Prototype models of the Navy/Air Force Fuel Air Explosive weapons were produced and ground tests completed. Air Force participation in the Fuel Air Explosive program was terminated.

(U) Project 5613: The Air Inflatable Retarder (BSU-49 and BSU-50) program completed IOT&E and production started. Multiple Stores Ejector Racks (MSER) were delivered for a limited F-16 and A-7 flight test evaluation. Current design causes unacceptable drag, and therefore, only rack qualification and limited tests on existing design were completed. The MSER program was restructured to allow redesign to reduce aerodynamic drag to limits acceptable to Tactical Air Command. Evaluation of munitions containers continued. Established Material Munitions handling Equipment (MMHE) Focal Point to analyze munitions handling effectiveness and determine deficiencies and needs.

Program Element: #64602F
DOD Mission Area: Close Air Support and Interdiction, #223

Title Armament/Ordnance Development
Budget Activity Tactical Program, #4

2. (U) FY 1982 Program:

(U) Project 2586: Development of the Combined Effects Bomblet will continue along with the start of the final test phase through the Initial Operational Test and Evaluation (IOT&E) of the Combined Effects Munition.

(U) Project 2708: Complete the initial flight tests and start Development Test and Evaluation (DT&E)/IOT&E of the 30 millimeter (MM) gun pod. A Critical Design Review was conducted. The production option for the FY 82 buy was awarded (10' pods). Initial production deliveries begin Sept 82. A contract for the Simplified Ammunition Loader will be awarded.

(U) Project 2784: A container retrieval system is maintained. A Material Munitions Handling Equipment (MMHE) Focal Point will continue analyzing weapons handling effectiveness and determining deficiencies and needs.

(U) Project 3133: The FMU-130 contractor will be designing special tools and testing fixtures and designing the research and development assembly line which will be used to demonstrate that this fuze can be assembled by automatic methods. Also, verification of assembled FMU-139 test fuze design will be conducted, prototype hardware built, and Navy Tech Eval and Air Force DT&E testing will begin.

(U) Project 5613: Development of a low drag Multiple Stores Ejector Pack (MSER) will continue, a design review will be completed and the modification of hardware will begin.

3. (U) FY 83 Planned Program:

(U) Project 2586: Full Scale Development (FSD) on the Combined Effects Munition will be completed. Functional Configuration Audit and a Production Readiness Review will be conducted. A CBU-87 production decision will be made upon completion of IOT&E.

(U) Project 2708: 30 MM gun pod development will be completed; gun pod production will continue as will the development of a Simplified Ammo Loader.

(U) Project 2784: Container and MMHE efforts will continue. An Armament/Munitions Control Focal Point will start standardization/roadmapping efforts.

(U) Project 3133: Conduct Navy OPEVAL and Air Force IOT&E of the FMU-139 joint Navy/Air Force common bomb fuze. The FMU-130 will complete tooling design, qualification test fuze assemble, and will start DT&E.

(U) Project 5613: Prototype deliveries of the MSER will start.

Program Element: #64602F
DOD Mission Area: Close Air Support and Interdiction, #223

Title Armament/Ordnance Development
Budget Activity Tactical Program #4

4. (U) FY 84 Planned Program:

(U) Project 2586: Possible new starts are the Low Altitude Dispenser System (LADS), and a Anti-Material Incendiary Submunition (AMIS). Combined Effects Munition production contract will be awarded.

(U) Project 2708: Complete development of a Simplified Ammo Loader for the gun pod. Gun pod production deliveries will continue. Total production quantity is 299 pods.

(U) Project 2784: Container, Material Munitions Handling Equipment and Armament Control/Standardization efforts will continue.

(U) Project 3133: The Joint Service Common Bomb Fuze (FMU-139) program will complete Full Scale Development. Potential new starts are the development of a standardized avionics fuze with compatible aircraft digital avionics and a new unitary bomb. An Initial Operational Test and Evaluation (IOT&E) and Development Test and Evaluation (DT&E) will be completed and a production decision for the FMU-139 will be made.

(U) Project 5613: The Multiple Stores Ejector Rack DT&E/IOT&E will be conducted and low rate initial production will be initiated.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

Project: #5613
Program Element : #64602F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Carriage and Release Equipment
Title: Armament/Ordnance Development
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Multiple Stores Ejector Rack (MSER) will satisfy TAC ROC 6-68, "Improved Aircraft and External Stores Carriage and Release System." The MSER represents the first vertical ejection rack using hydraulic ejectors and its drag will be comparable to the older MERs and TERs currently in use. The MSER will be compatible with both the F-15 and F-16 and offer the following program payoffs: expanded carriage and release envelope; reduced maintenance (longer intervals between cleanings); and improved weapon delivery (over MER/TER).

(U) RELATED ACTIVITIES: The F-15 and F-16 programs will use the MSER.

(U) WORK PERFORMED BY: Western Gear of Jamestown, North Dakota is the prime contractor.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Development of the hydraulic ejector was completed and limited test and evaluation was conducted.

2. (U) FY 1982 Program: The contract to continue Full Scale Development will be awarded. A Critical Design Review will be conducted. Prototypes will be built.

3. (U) FY 1983 Planned Program: Prototype delivery of the MSER will start. The long lead for the Low Rate Initial Program will commence.

4. (U) FY 1984 Planned Program: The test program will be concluded. Development Test and Engineering/Initial Operational Test and Evaluation followed by a production decision the last quarter will take place.

5. (U) Program to Completion: This is a continuing project.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64606F Title: Conventional Standoff Weapon
DOD Mission Area: Ground Based Anti-Air and Tactical Missile Defense, #222 Budget Activity: Tactical Programs, 4

(U) RESOURCES (PROJECT LISTING) ($ IN THOUSANDS)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT		1/	38,858	65,708	93,292	197,858

1/ Supported within PE 64742F in FY 1982

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides the Full Scale Engineering Development of an air-launched standoff missile for employment from both tactical and strategic aircraft against a variety of key targets. Equipped with a modular munition configuration, the Conventional Standoff Weapon will provide the standoff attack element of a variety of engagement systems including application with the Precision Location Strike System (defense suppression) and the PAVE MOVER Engagement System (second echelon anti-armor). Such a standoff weapon capability is needed to reduce aircraft attrition in the attack of heavily defended targets.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Funds competitive dual contracts for the engineering design and development of the initial version of the Conventional Standoff Weapon, for application with the Precision Location Strike System (PLSS). This initial version will be developed to allow growth application to other engagement systems and with other munition configurations as preplanned product improvements. Competitive down-select to a single development contractor will be accomplished at an appropriate point during the development program. The cost estimates are program office estimates; they are subject to validation/adjustment based upon contractor proposals to be obtained during late FY 1982.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable. This is a new program element for FY 1983.

(U) OTHER APPROPRIATION FUNDS:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
Procurement (Missile) Program Element 27167F					Continuing	Not Applicable

Program Element: #64606F Title: Conventional Standoff Weapon
DOD Mission Area: Ground Based Anti-Air and Tactical Missile Defense, #222 Budget Activity: Tactical Programs, 4

(U) DETAILED BACKGROUND AND DESCRIPTION: Conducts Full Scale Engineering Development of an air launched standoff missile for application with a variety of engagement systems.

(U) In recent years, surface-to-air defenses have advanced markedly. The multitude and capability of surface-to-air defenses available to the Soviets and other potential adversaries raises the risk of significant Air Force aircraft attrition per defended target killed. Operational commanders must rely heavily on defense suppression systems and utilize large tactical forces composed of attack and attack support aircraft to insure mission success. This commitment of large numbers of sorties to individual targets limits the overall effectiveness of attack aircraft, particularly during the early stages of an intense conflict. An air-to-surface standoff weapon is needed to reduce the sortie requirements and attrition losses while destroying key targets. For maximum utility, such a standoff weapon should be capable of destroying a wide variety of targets, including defense suppression, interdiction, and armor. Standoff weapon capability is needed not only for potential intense conflict areas such as in Europe versus the Warsaw Pact Forces, but also for conflicts in contingency areas in which the B-52 Strategic Projection Force might be utilized.

(U) The need for a conventional standoff weapon was emphasized during the FY 81 budget proceedings when the Congressional committees pointed out that there was no Air Force program for a Precision Location Strike System (PLSS) compatible standoff weapon providing sufficient range to allow standoff from surface-to-air threats in the target area. A PLSS weaponization study was accomplished during January to March 1981 which investigated various weapon options which could be developed to support the PLSS mission and schedule requirements. It was also recognized that the PAVE MOVER Engagement System requires a weapon with similar range and payload requirements for application against second echelon forces. Similar weapon requirements pertain to other envisioned engagement systems. As a result, a common weapon was postulated. The USAF Scientific Advisory Board meeting in June 1981 also identified the need for a weapon with similar general characteristics.

(U) The initial emphasis will be on a Conventional Standoff Weapon version for application with the Precision Location Strike System (PLSS) on a schedule compatible with PLSS operational employment. The required design architecture, including munition configurations and data link techniques, will enable this initial version to be expanded upon to address the requirements of the PAVE MOVER Engagement System and other engagement systems as preplanned product improvements.

(U) To allow PLSS and other engagement systems to provide accurate guidance update information to the Conventional Standoff Weapon in flight, the Conventional Standoff Weapon will contain a data link transponder capable of receiving and acknowledging the guidance data. To insure compatibility with the established PLSS waveform structure and gain the advantages of common development, the weapon data link transponder will be a repackaged version of the Vehicle Navigation System transponder developed by PLSS for aircraft installation. Compatibility between this data link and the PAVE MOVER signal structure is a program objective.

(U) The Conventional Standoff Weapon will be designed for employment from the F-16, B-52 and B-1 aircraft. It will also be planned, to the extent practical, for compatibility with F-4 and F-111 aircraft and with an air-to-surface missionized version of the F-15.

Program Element: #64606F | Title: Conventional Standoff Weapon
DOD Mission Area: Ground Based Anti-Air and Tactical Missile Defense, #222 | Budget Activity: Tactical Programs, 4

The Conventional Standoff Weapon will provide sufficient standoff to enable delivery aircraft to remain outside the envelope of the principal target area located threats. A minimum standoff range requirement is specified from a and of at least when delivered from A standoff range goal is specified. Beyond the stated minimum standoff range requirement, approaching the standoff range goal involves a significant tradeoff between range, payload capability, and weapon size and weight.

(U) A competitive contract award is planned with dual contract award for the initial design and development. A competitive selection will be made at an appropriate point during the development program to down-select from the initial two contractors to a single contractor.

The acquisition program places emphasis upon acquiring the initial version of the Conventional Standoff Weapon for application with the Precision Location Strike System (PLSS) in a timely manner supporting the PLSS Initial Operational Capability in

(U) RELATED ACTIVITIES: The Conventional Standoff Weapon will be capable, through preplanned product improvements, of effective application with a variety of engagement systems, including the Precision Location Strike System, Program Element 64742F; and the PAVE MOVER Engagement System, Program Element 64616F.

(U) WORK PERFORMED BY: The acquisition program for the Conventional Standoff Weapon is managed by Air Force Systems Command at the Armament Division, Eglin AFB, FL. Initial Operational Test and Evaluation will be conducted by the Air Force Test and Evaluation Center, Kirtland AFB, NM.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. (U) FY 1981 and Prior Accomplishments. No activity under PE 64606F. Standoff weapon analyses were conducted establishing the basic characteristics required for an effective, versatile standoff weapon. These analyses include the PLSS Weaponization Study conducted by Air Force Systems Command in early FY 1981, and follow-on analyses to ensure the application of such a weapon to a variety of engagement systems, including the PAVE MOVER Engagement System.

2. (U) FY 1982 Program: No activity under PE 64606F. Activities preparatory to a competitive contract award are being conducted including preparation of contracting documentation, e.g., Request for Proposal. Source selection competition will be conducted. A dual contract award is planned for the initial design and development of the Conventional Standoff Weapon. The initial version of the Conventional Standoff Weapon will be compatible with PLSS but will include design planning to allow future versions to be employed with other engagement systems. The FY 1982 activities are supported within the Precision Location Strike System, Program Element 64742F.

Program Element: #64606F
DOD Mission Area: Ground Based Anti-Air and Tactical Missile Defense, #222

Title: Conventional Standoff Weapon
Budget Activity: Tactical Programs, 4

3. (U) FY 1983 Planned Program: Design of the Conventional Standoff Weapon will be conducted under dual contracts to competing prime contractors. Preliminary Design Review will be conducted. If warranted by the design stability and use of existing subsystems, down-select to a single contractor will be accomplished. Hardware fabrication will be initiated. Subsystem testing will be initiated. Appropriate Acquisition Council Review will be conducted.

4. (U) FY 1984 Planned Program: Test item fabrication and checkout will be accomplished. Field testing with the Precision Location Strike System will be conducted.

5. (U) Program to Completion: Test and evaluation will be completed of the initial version of the Conventional Standoff Weapon for application with the Precision Location Strike System and procurement initiated. Preplanned product improvements will be developed and incorporated for application of the Conventional Standoff Weapon with other engagement systems, e.g. the PAVE MOVER Engagement System, Program Element 64616F.

6. Milestones:	Date
A. (U) Dual Contract Awards	4Q FY 82
B. (U) Preliminary Design Review	Mar 1983
C. (U) Air Force/Defense Acquisition Review Council III	May 1983
D. (U) Testing with Precision Location Strike System (PLSS)	4Q FY 84
E. (C) Initial Operating Capability with PLSS	

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64607F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Wide Area Antiarmor Munitions
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	18,758	20,722	8,503	45,701	Continuing	Not Applicable
2579	Antiarmor Cluster Munition (ACM)	18,758	20,722	8,503		∅	49,998
2581	Extended Range Antiarmor Munition (ERAM)					TBD	TBD
2582	Wasp				45,701	337,799	383,500

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Tactical Air Forces require a capability to destroy multiple enemy tanks during a single aircraft pass to overcome the existing large numerical imbalance of Warsaw Pact armor. This critical need is documented in the Mission Element Need Statement for an Improved Wide Area Antiarmor Capability The Wide Area Antiarmor Munition (WAAM) program has been initiated to address this need. It will accomplish full scale development, culminating in production decisions, of the three WAAM weapons: the Antiarmor Cluster Munition, the Extended Range Antiarmor Munition, and the Wasp missile system.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Development and Initial Operational Test and Evaluation of the Antiarmor Cluster Munition will be completed. Estimates for armor kills per pass and operational reliability will be determined. A production decision is planned for the second quarter of FY83. Cost estimates are based on contractual commitments and historical cost data for test activities.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	18,800	22,200	40,400		Continuing	Not Applicable
Procurement (OTHER) (PE 28030F)			54,400		799,130	853,530

Program Element: # 64607F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Wide Area Antiarmor Munitions
Budget Activity: Tactical Programs, #4

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
OTHER APPROPRIATION FUNDS:						
Procurement						
Antiarmor Cluster Munition (OTHER) (PE 28030F)		16,000	54,412	163,979	1,758,545	1,992,945
Extended Range Antiarmor Munition (OTHER) (PE 28030F)					TBD	TBD
Wasp (MISSILES) (PE 27166F)					TBD	TBD
(Quantity)						
Antiarmor Cluster Munition			[		]	
Extended Range Antiarmor Munition					TBD	
Wasp					TBD	

Program Element: # 64607F

DOD Mission Area: Close Air Support and Interdiction, #223

Title: Wide Area Antiarmor Munitions

Budget Activity: Tactical Programs #4

DETAILED BACKGROUND AND DESCRIPTION: The Mission Element Need Statement for an Improved Wide Area Antiarmor Capability details the critical need for the Tactical Air Forces to improve their armor kill capability against massed rear echelon armor. The Wide Area Antiarmor Munitions (WAAM) Program will improve the Tactical Air Forces sortie effectiveness by increasing the number of armor kills per pass.

The need is to develop a weapon that will provide multiple kills per pass, during all hours and weather conditions and from extremely low altitudes or standoff distances. The ability to achieve multiple kills during a single pass will greatly improve the Tactical Air Forces' antiarmor capability while decreasing attrition to enemy defenses. WAAM has been designated a major program and will use multiple contractors to reduce cost/schedule risk in order to achieve an operational capability at the earliest possible time. Three weapons -- the Antiarmor Cluster Munition, the Wasp missile, and the Extended Range Antiarmor Munition -- will be validated/developed in this program. The Antiarmor Cluster Munition is an unguided improved antiarmor area cluster weapon that may be delivered at minimum altitudes or higher. The Wasp is a missile system that employs a terminal seeker and a lock-on-after-launch guidance mode. The Wasp is intended for delivery from aircraft-mounted pods for minimum altitude attack. The Extended Range Antiarmor Munition is an air-delivered cluster weapon containing target-activated land mines that provide a standoff kill capability against armor. The target does not have to contact the Extended Range Antiarmor Munition submunition to effect a kill; rather the mine's sensor classifies the target, determines the closest point of approach, and then fires a warhead at the target.

(U) RELATED ACTIVITIES: WAAM technology support is ongoing in Program Element 62602F, Conventional Munitions, and Program Element 63601F, Conventional Weapons Technology. Warhead, sensor, seeker, and dispenser technology programs in these program elements provide the basis for the WAAM concepts. Weapon concept demonstration/validation is accomplished in Program Element 63609F Advanced Attack Weapons. Other related Air Force programs can be integrated with WAAM to provide a total wide area antiarmor system capability.

(U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command, Andrews Air Force Base, MD and its subordinate organization, Armament Division, Eglin Air Force Base, FL. Contractor support for the Antiarmor Cluster Munition is provided by Honeywell Incorporated, Minneapolis MN. Contractor support for the Extended Range Antiarmor Munition will be provided by one of the two contractors currently competing in the validation program: AVCO Corporation, Wilmington MA and Honeywell. Likewise, one of the two contractors currently competing in the Wasp minimissile validation program - Boeing Aerospace Company, Seattle WA and Hughes Aircraft Company, Canoga Park CA - will be selected as the contractor for Wasp full scale development.

(U) PROGRAM ACCOMPLISHMENTS & FUTURE PROGRAMS:

1. (U) FY 1981 & Prior Accomplishments: The final phase of validation for the Antiarmor Cluster Munition (ACM) was successfully completed in FY 1980 with system development and validation tests. ACM advanced in mid FY 1980 into this

Program Element: # 64607F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Wide Area Antiarmor Munitions
Budget Activity: Tactical Programs, #4

program element to begin subsystem design, fabrication, and testing. Honeywell was selected as the full scale development contractor. Full scale development continued in FY 1981 and basic design details were completed. A Preliminary Design Review was completed and flight tests conducted. Minor redesign of some components was accomplished and sucessfully flight tested. Fabrication of hardware for Development Test and Evaluation/Initial Operational Test and Evaluation was begun.

2. (U) FY 1982 Planned Program: The Antiarmor Cluster Munition (ACM) will continue full scale development. The system design and qualification and development test will be completed as well as a significant portion of the combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E). This testing is intended to measure the probable number of kills per pass and the operational suitability of the system. One hundred and seventy ACMs are scheduled to be tested in the DT&E/IOT&E program. Long lead production items will be procured for ACM. The Extended Range Antiarmor Muntion (ERAM) will complete validation in Program Element 63609F in the third quarter of FY 1982. It was originally scheduled to transition to full scale development in late FY 1982, however, DoD budget reductions dictated that ERAM be delayed in order to fund higher priority programs. ERAM funding for FY 1982 and 1983 was reduced for this reason. ACM long lead production activities will begin in FY 1982.

3. (U) FY 1983 Planned Program: The Antiarmor Cluster Munition will complete full scale development and Initial Operational Test and Evaluation in the second quarter of FY 1983. The estimated funding has been increased to allow completion of these tests. Production will begin for ACM in the second quarter of FY 1983. The Wasp missile program will complete validation in Program Element 63609F in the third quarter of FY 1983 and be ready to transition to full scale development. Due to funding constraints Wasp full scale development is being delayed until FY 1984.

4. (U) FY 1984 Planned Program: Production for ACM will continue under Program Element 28030F. The Wasp missile program will start full scale development in FY 1984 and begin basic design, development, and test of critical subsystems.

5. Program to Completion: The Wasp program will complete development testing in FY 1987 and transition into production under Program Element 27166F. Production long lead for Wasp is planned for FY 1986. The Extended Range Antiarmor Munition could begin full scale development in FY 1984 depending on the availability of funds. The inventory inventory of both these programs have not been determined. The total estimated costs of procurement are increased due to an increase in the inventory objective from Antiarmor Cluster Munitions. This inventory objective does not include any future sortie surge requirements.

6. (U) Milestones:

			Date
A.	Antiarmor Cluster Munition (ACM) Milestone II (Full Scale Development) Review		Jul 1980
B.	ACM Milestone III (Production Decision) Review	*(Jan 1983)	Mar 1983
C.	Extended Range Antiarmor Munition (ERAM) Milestone II Review	*(Apr 1982)	TBD
D.	Wasp Milestone II Review	*(FY 1983)	FY 1985
E.	ERAM Milestone III	*(FY 1985)	N/A
F.	Wasp Milestone III	*(FY 1986)	N/A

* Date presented in FY 1982 Descriptive Summary

Program Element: # 64607F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: Wide Area Antiarmor Munitions
Budget Activity: Tactical Programs, #4

EXPLANATION OF MILESTONE CHANGES:

B: ACM production decision delayed slightly to allow completion of all Initial Operational Test and Evaluation.
C: ERAM full scale development decision delayed due to funding constraints preventing start of this effort.
D,E,F: Change in DoD acquisition policy eliminates Milestone III decision for major programs and changes Milestone II date to coincide with Critical Design Review date in full scale development.

7. (U) Resources:

Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

Not Applicable

Project: 2579 | Title: Antiarmor Cluster Munition
Program Element: #64607F | Title: Wide Area Antiarmor Munitions
DoD Mission Area: Close Air Support and Interdiction, #223 | Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Antiarmor Cluster Munition (ACM) will meet the Tactical Air Forces' need for a multiple armor kill-per-pass capability against rear echelon wide area armored forces and for delivery from aircraft at minimum altitudes. This capability is required to blunt the Soviet massed armor threat by interdicting Soviet rear echelon armored forces before they can reinforce first echelon forces and achieve a breakthrough. The major goal of the ACM effort in this program element is to demonstrate the system capability to achieve multiple kills per pass under realistic test conditions. These tests will then form the basis for a production decision.

(U) RELATED ACTIVITIES: Wide Area Antiarmor Munitions (WAAM) technology base advancement is ongoing in Program Element (PE) 62602F, Conventional Munitions, and PE 63601F, Conventional Weapons Technology. Validation of concepts is ongoing in PE 63609F, Advanced Attack Weapons. Warhead, sensor, seeker, and dispenser technology projects in these PEs provide the basis for the WAAM concepts. Other related Air Force programs (e.g., F-16 and A-10) will be integrated with WAAM to provide a total wide area antiarmor system capability.

(U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command, Andrews Air Force Base, MD and its subordinate organization, Armament Division, Eglin AFB, FL. Prime Contractor support is provided by Honeywell, Inc., Minneapolis, MN.

(U) PROGRAM ACCOMPLISHMENTS & FUTURE PROGRAMS:

1. (U) FY 1981 & Prior Accomplishments: The final phase of concept validation for the Antiarmor Cluster Munition was successfully completed in FY 1980 with system development and validation tests. An Air Force Acquisition Review Council conducted a Milestone II review of the program in July 1980 and recommended initiation of full scale development based on the success of the validation tests. A contract for full scale development was awarded to Honeywell, Inc., in July 1980 and design, development, and test of the ACM has continued since that time. Preliminary flight tests have been conducted and fabrication of development test hardware has begun.

2. (U) FY 1982 Planned Program: Fabrication of 170 Antiarmor Cluster Munitions will be completed and the Development Test and Evaluation/Initial Operational Test and Evaluation program will be initiated. This program will measure the operational reliability and probable number of kills per pass of the ACM. Procurement of long lead items will begin in FY 1982.

3. (U) FY 1983 Planned Program: The Antiarmor Cluster Munition will complete Initial Operational Test and Evaluation and full scale development in the second quarter of FY 1983. If a favorable recommendation is rendered at the Milestone III review, full production will be initiated.

4. (U) FY 1984 Planned Program: There is no planned development effort for the Antiarmor Cluster Munition in FY 1984. Production will continue

Project: 2579
Program Element: #64607F
DoD Mission Area: Close Air Support and Interdiction, #223

Title: Antiarmor Cluster Munition
Title: Wide Area Antiarmor Munitions
Budget Activity: Tactical Programs, #4

5. Program to Completion: Production will continue until the ACM inventory objective is met. Total estimated costs of procurement have increased due to an increase in the inventory objective from units.

6. (U) Milestones:

			DATE
A.	Antiarmor Cluster Munition (ACM) Milestone II (Full Scale Development) Review		Jul 1980
B.	ACM Milestone III (Production Decision) Review	*(Jan 1983)	Mar 1983

* Dates presented in FY 1982 Descriptive Summary

EXPLANATION OF MILESTONE CHANGES:

B. Production decision has been delayed to allow completion of Initial Operational Test and Evaluation.

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	18,758	20,722	8,503			49,998
Procurement (OTHER) (PE 28030F)		16,000	54,412	163,979	1,758,545	1,992,945

8. (U) COMPARISON WITH FY 1982 BUDGET DATA:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	18,800	21,200	4,100			46,099
Procurement (OTHER) (PE 28030F)			54,400		799,130	853,530

(U) The FY 1982 estimate reflects an inflation adjustment. The FY 1983 increase of $4,403 thousand reflect increase to allow completion of all Initial Operational Test and Evaluation.

Inventory objective is increased from [ ] Antiarmor Cluster Munition units resulting in higher total estimated costs.

Budget Activity: Tactical Programs, #4
Program Element: #64607F-Wide Area Antiarmor Munitions, Antiarmor Cluster Munition

Test and Evaluation Data

1. (U) Development Test and Evaluation:

(U) Validation Phase: Development testing was conducted in 1979-1980 by the competing validation phase contractors, Honeywell and Martin Marietta. The primary Development Test and Evaluation (DT&E) objectives for the validation phase were to demonstrate achievement of satisfactory pattern and kill mechanism performance. The contractors conducted extensive development and environmental tests of critical subsystems including the warhead, fuze, and orientation and stabilization device. Flight tests of inert Antiarmor Cluster Munitions were also conducted to establish patterns and accuracy. Live-round tests of individual submunitions were conducted. Contractor technician and development engineers conducted the development testing at contractor facilities, Eglin Air Force Base, and other test ranges. Air Force Systems Command's Armament Division, Eglin Air Force Base, Florida, managed the Development Test and Evaluation Program. The Air Force Test and Evaluation Center monitored these tests and provided an evaluation of the operational effectiveness and suitability of the system. The results of the validation tests were considered in the Air Force Systems Acquisition Review Council meeting in July 1980 which gave approval to proceed into full scale development.

(U) Full Scale Development: Honeywell was selected as the full scale development contractor and has conducted extensive military qualification and environmental tests of the Antiarmor Cluster Munition (ACM). Most of these tests were conducted at their contractor facilities. The Development Test and Evaluation (DT&E) will be combined with the Initial Operational Test and Evaluation (IOT&E). The majority of the DT&E is being conducted by the Air Force Systems Command Armament Division in Fiscal Year 1982. Air Force Test and Evaluation Center will have overall management responsibility for the IOT&E program and this testing is scheduled for Fiscal Year 1982 and early Fiscal Year 1983. Primary test objectives for the full scale development phase are to establish baseline performance characteristics, to verify the predicted number of kills per pass against specified targets, and to determine the effect of probable countermeasures and environmental effects on system performance. An assessment of the system support concept in meeting logistics requirements will be made. The majority of the DT&E/IOT&E testing will be conducted at Eglin Air Force Base, Florida, with other tests planned for Utah and Alaska. Tests to date have demonstrated safe weapon release, dispenser functioning, pattern generation, single submunition kill capability, and proper subsystem functioning. Minor difficulties with submunition operations have resulted in correction and modification to the submunition.

(U) The DT&E/IOT&E hardware will be very similar, if not identical, to the planned production hardware. Most of the planned production processes will be used to manufacture the 170 units planned for testing. The entire system will be tested in this phase including reliability, availability, and logistics support. The results of this phase's testing will be used by the Air Force Systems Acquisition Review Council in making the production decision for the Antiarmor Cluster Munition.

Budget Activity: Tactical Programs, #4
Program Element #64607F - Wide Area Antiarmor Munitions, Antiarmor Cluster Munition

2. (U) Operational Test and Evaluation:

(U) Demonstration and Validation Phase: Critical component and submunition tests were conducted during this phase. The Air Force Test and Evaluation Center participated in the Demonstration and Validation testing to determine, as much as possible, the projected operational effectiveness and suitability of the Antiarmor Cluster Munition; however, no separate operational test and evaluation was conducted. The objective of the Demonstration and Validation phase operational test and evaluation was to determine the expected kills per pass of the concept when used in a realistic environment. This was accomplished primarily by evaluating computer simulation and component test data. Most tests were conducted by contractor personnel at contractor facilities. The remaining tests were conducted by Air Force Systems Command personnel at Eglin Air Force Base, Florida.

(U) Full Scale Development: Operational test and evaluation will be conducted by Air Force Test and Evaluation Center during full scale development with Development Test and Evaluation (DT&E) and Initial Operational Test and Evaluation (IOT&E) events combined where feasible. Separate IOT&E will be conducted for operational test and evaluation objectives which cannot be combined with DT&E. Combined and separate IOT&E for the Antiarmor Cluster Munition will be conducted during Fiscal Years 1982 and 1983. IOT&E objectives for operational effectiveness during this phase are: (1) measure the expected number of kills per pass against armored company arrays, (2) estimate performance in various battlefield and countermeasures environments, (3) estimate operational reliability, and (4) estimate the effect of target location error. The operational suitability objectives include determining the availability, maintainability, reliability, and logistics supportability of the systems. The Antiarmor Cluster Munition requires a ten year shelf life which presents a unique suitability issue to be evaluated during IOT&E. Test assets used during DT&E/IOT&E will be soft tooled items which are representative of production items. One hundred and two (102) Antiarmor Cluster Munition test assets are programmed for separate IOT&E. At this time specific support equipment requirements have not been identified.

(U) The Air Force Test and Evaluation Center will have overall management responsibility for the IOT&E. Test locations for the Antiarmor Cluster Munition will be Eglin Air Force Base, Florida; Utah Test and Training Range, Utah; and Eielson Air Force Base, Alaska. Preliminary IOT&E planning including the Test and Evaluation Master Plan and the IOT&E plan have been accomplished and published. Air Force personnel will operate and maintain the Antiarmor Cluster Munition throughout the IOT&E program.

Budget Activity: Tactical Programs, #4
Program Element: #64607F - Wide Area Antiarmor Munitions, Antiarmor Cluster Munition

3. (U) System Characteristics:

Characteristics for the Antiarmor Cluster Munition are being finalized in the full scale development phase. System characteristics and thresholds (if applicable) are as follows:

Characteristics	Objective	Threshold	Demonstrated
(C) Kills per pass			
(U) Reliability	0.939	0.9	
(U) Minimum Release Altitude	200 ft	200 ft	200 ft
(U) Service Life	1 year	1 year	
(U) Defeat Capability	Latest Soviet Threat		Latest Soviet Threat

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64608F
DoD Mission Area: Close Air Support/Battlefield Interdiction, #223

Title: Close Air Support Weapon Systems
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	46,760	24,906	5,412	570		22[illegible],491
2551	Imaging Infrared	39,300	14,600	5,412	570		173,682
2552	Alternate Warhead	900					20,793
2556	Aircraft Integration	360					4,510
2676	Infrared Attack Weapon System (IRAWS)	6,200	10,306				2[illegible],506

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The USAF and USN must be able to successfully attack small hard fixed and mobile targets such as tanks, armored vehicles, bunkers, and small ships during night and adverse weather. The AGM-65 family of Maverick missiles is being expanded to fill this need. The current deployed television model, AGM-65 A/B, provides an excellent daytime capability against tanks and other similiar targets but is not suitable during night or adverse weather. Modular infrared and laser guidance units and an alternate warhead are completing development to fill this need. Specifically, the Air Force as executive agency for the Maverick program is developing: (1) a laser guided Maverick for Marine Corps use; (2) an Imaging Infrared seeker and guidance unit for Air Force and Navy direct attack missiles; and (3) alternate warhead to expand the Maverick target spectrum. The imaging infrared seeker will also be used on the GBU-15 data link weapon.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The funding requested completes the qualification of the support equipment, continues the second source qualification program for the imaging infrared missile; and completes correction of minor problems identified in the imaging infrared missile during the test program. The second source qualification is in preparation for competitive procurement beginning with the fourth production increment.

(U) COMPARISION WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Total Additional to Completion	Total Estimated Cost
RDT&E	46,900*	14,900	5,600		600	285,300**
Procurement		204,159	357,688		3,672,197	4,234,044

* The FY 1982 R&D request was increased by Congressional action for the Navy Infrared Attack Weapon System (IRAWS) by adding the funds requested by the Navy to this Air Force program element. A similar action occurred in FY 1981.

Program Element: #64608F
DoD Mission Area: Close Air Support/Battlefield Interdiction, #223

Title: Close Air Support Weapon Systems
Budget Activity: Tactical Programs, #4

** The FY 82 Descriptive Summary included the Air Force LASER Maverick and Single Rail Launcher projects. This work is now complete.

(U) OTHER APPROPRIATION FUNDS:

	FY 1981 Actual	FY1982 Estimate	Fy1983 Estimate	FY1984 Estimate	Total Additional to Completion	Total Estimate Cost
Missile Procurement -27313		235,201	353,100	468,700	3,563,799	4,620,800
Quantity		490	2,560	4,600	53,014	60,664

Program Element: 64608F | Title: Close Air Support Weapon Systems
DoD Mission Area: Close Air Support/Battlefield Interdiction, #223 | Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Program Element (PE) 64608F was established to develop improved capability for air-to-surface missiles for use against the massive armor threat of the Warsaw Pact. The imaging infrared Maverick provides a common seeker subassembly for Air Force and Navy use. The imaging infrared seeker extends Maverick capability to night and limited adverse weather employment while retaining the launch and leave flexibility associated with the television guided Maverick. The Laser Maverick development provides for 24 hour attack against Laser designated targets. The advanced warhead development will expand the target spectrum of the Maverick family of weapons to include earth burdened structures and ship targets. Funding is also provided for development of common test equipment for all Maverick variants.

(U) RELATED ACTIVITIES: The Tri-Service laser seeker developed under this program is being used in the the Marine Corps Laser Maverick missile program. The common infrared seeker subassembly is being developed for GBU-15, WALLEYE and Maverick. Management responsibilities are contained in Memoranda of Agreements between the system program offices. The Navy currently plans to employ the Maverick with their A-6, A-6, F/A-18 and AV-8B. The Air Force plans to employ the imaging infrared Maverick with A-7, A-10, F-4, F-16, and F-111 aircraft. The imaging infrared Maverick missile has also been designated as the primary antiarmor weapon system to be employed with the Low Altitude Navigation and Targeting Infrared System (LANTIRN). Future infrared seeker developments for this class of weapons are required by the Office of Secretary of Defense to maintain compatibility with the Maverick. An example of this, is the Army's work on focal plane array technology for the next generation of infrared Hellfire missiles. The Hellfire infrared seeker is required to be compatible with the Maverick missile thereby eliminating duplication of effort by the Army and Air Force in focal plane array infrared technology.

(U) WORK PERFORMED BY: This program element is managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The Armament Division, Eglin AFB, FL is the Responsible Developmental Test Organization and the Air Force Test and Evaluation Center, Kirtland AFB, NM serves as the Operational Test Agency. Prime contractors are Hughes Aircraft Corporation, Canoga Park, CA, and Rockwell International Corporation, Anaheim, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Full-scale engineering development of Laser Maverick was initiated in July 1975. Contractor flight testing was initiated with Block I laser seeker hardware in January 1976 and consisted of five successful free flight launches. Contractor flight test of missiles with Block II seekers was initiated in September 1977 and completed during April 1978 after launching 10 missiles. Combined DT&E/IOT&E was initiated during May 1978. Testing was suspended in August 1978 to save the remaining test assets for Navy/Marine Corps peculiar test requirements.

Of the 22 missiles launched ___ impacted the intended target. During August 1978, the Air Force terminated plans to procure Laser Maverick, and the program was restructured to initiate configuration changes peculier to Marine Corps/Navy use. The changes included the low cost laser seeker, the alternate warhead, and an out of line safety device for the rocket motor. Engineering development of the Laser Maverick for the Marine Corps completed with FY 1980 funds. The delay in completion of the Alternate Warhead was due to problems associated with the warhead fuze structural design. These problems have been resolved and the test program resumed in FY 1980.

Program Element: #64608F | Title: Close Air Support Weapon Systems
DoD Mission Area: Close Air Support/Battlefield Interdiction, #223 | Budget Activity: Tactical Programs, #4

(U) A Defense Systems Acquisition Council Review of the imaging infrared Maverick advanced development program in September 1976 led to a decision by the Deputy Secretary of Defense to transition the program to full-scale engineering development. A Joint Operational Test and Evaluation during Jan and Feb 1977 assessed the system's utility in a scenario representative of Central Europe. The Joint Operational Test and Evaluation demonstrated the Air Force concept of deductive target recognition. This concept allows target detection, recognition, and missile launch from stand-off ranges with exposure times which result in acceptable attrition rates from Warsaw Pact defenses. The House Armed Services Committee in August 1977, concurred with expenditure of FY 1977 funds to continue advanced development of the IIR seeker and to support testing of the digital centroid tracker. These tests were initiated in November 1977 at Ft Polk and were completed in February 1978 in West Germany. The European tests again demonstrated the capability of flight crews, using normally available target information, to navigate to designated geographic locations, locate the target area, transition to the attack phase of flight and successfully attack armor targets. The capability of the digital centroid tracker to maintain lock-on to valid targets against a thermally cluttered background was demonstrated. Office of the Secretary of Defense Under Secretary of Defense Research and Engineering reviewed the imaging infrared program and the previous Defense Systems Acquisition Review Council II decision during October of 1978. This review led to the release of FY 1979 funds to initiate the full-scale development program. The contract was awarded on 30 October 1978. The initial design efforts were completed and the imaging infrared Maverick Preliminary Design Review was conducted in June 1979. Engineering development of the Maverick Alternate Warhead was initiated during 1977. Development of the Maverick Alternate Warhead was incorporated into the Laser development program for the Marine Corps. The imaging infrared Maverick Critical Design Review was completed in June 1980. Full scale development testing began in July 1980. The Maverick maintenance concept and support equipment study was completed in FY 1980 and work begun on the development of a common support equipment package for all Maverick missiles.

(U) The FY 1981 funding will complete the development tasks associated with the Alternate Warhead and aircraft integration. The major efforts in FY 1981 were the conduct of the infrared Maverick engineering development test program and the Initial Operational Test and Evaluation program. Twelve of the thirty four flight launches planned for the Air Force's combined Developmental Test and Evaluation/Initial Operational Test and Evaluation and Navy's Operational Evaluation were conducted. Also started during 1981 were the qualification, electromagnetic interference, and reliability test programs. Applicable Maverick test data is being used by the GBU-15 program to prevent duplication of effort. The Navy's operational evaluation has been tailored to use the results of the Air Force test program as baseline.

2. (U) FY 1982 Program: Imaging Infrared Maverick missile development will be completed except for correction of the minor deficiencies found during the test program. The common support equipment development will be completed except for minor changes which will be identified during the support equipment qualification program. A milestone III review will be conducted leading to a production decision and production contract award in mid-FY 1982. A contract will also be awarded to qualify a second production source. Current plans are to have the qualification completed in time to compete the FY 1985 production buy between the two qualified imaging infrared Maverick producers. Production of the common support equipment will begin. The Air Force expects to continue the development of the Navy's variant of the Maverick including completing the Operational Evaluation. The Laser Maverick production for the Marine Corps will begin.

Program Element: #64608F Title: Close Air Support Weapon Systems
DoD Mission Area: Close Air Support/Battlefield Interdiction, #222 Budget Activity: Tactical Programs, #4

3. (U) FY 1983 Planned Program: Residual imaging infrared Maverick development and common test set development will be completed in FY 1983. The second increment of imaging infrared production is planned for FY 1983. The qualification and flight test program for the second production is planned. Life cycle cost reduction efforts will continue. The decrease in the development cost total is due to the completion of the LASER seeker development. The increase in the procurement cost is due the seeker being slightly more complex than esimated in 1980.

4. (U) FY 1984 Planned Program: FY 1984 funds are required to complete the qualification of the imaging infrared Maverick second production source.

5. (U) Program to Completion: Not Applicable

6. (U) Milestones: (See Milestones for Project 2551, Imaging Infrared Maverick)

7. (U) Resources: Not Applicable

8. (U) Comparison with FY82 Budget Data: Not Applicable

Project: # 2551 Title: Imaging Infrared (IIR) MAVERICK
Program Element: #64608F Title: Close Air Support Weapon Systems
DoD Mission Area: Close Air Support/Battlefield Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Development under this project will provide a common imaging infrared seeker subassembly for Joint Navy and Air Force use with the WALLEYE, Infrared Attack Weapon System, Maverick and GBU-15 systems. Imaging infrared seeker/ guidance technology will provide 24 hour capability across a wide target spectrum for both direct and indirect attack weapons. The imaging approach provides for maximum system flexibility and utility with the largest number of attack aircraft because it is not dependent on a Forward Looking Infrared acquisition device. It can be used autonomously or with any acquisition device which will provide an azimuth and an elevation pointing signal. The Maverick imaging infrared seeker provides a direct attack capability for the 1980s which no other system currently planned or in inventory can offer.

(U) RELATED ACTIVITIES: Imaging infrared has been a Joint Air Force/Navy development since 1973. Program management has been accomplished through a formal Memorandum of Agreement between the Maverick Program Office and the Naval Avionics Center at Indianapolis, IN. Management of the effort necessary for the GBU-15 application is being accomplished through a formal agreement with the GBU-15 Program Office at Eglin AFB, FL. A formal charter between the Aeronautical Systems Division and the Naval Air Systems Command has been signed for the development of Joint Air Force/Navy Maverick developments. The imaging infrared seeker/guidance unit is designed to be compatible with target acquisition systems which can provide azimuth and elevation pointing signals. These currently include the Navy TRAM and the Air Force's PAVE TACK, PAVE PENNY and Wild Weasel APR-38 systems. The imaging infrared Maverick missile has also been designated as the prime antiarmor weapon system to be employed with the Low Altitude Navigation and Targeting Infrared System.

(U) WORK PERFORMED BY: The imaging infrared Maverick Program is managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH, and the Naval Air Systems Command, Wash, DC. The Armament Division, Eglin AFB, FL, is the responsible Test Organization and the Air Force Test and Evaluation Center, Kirtland, AFB, NM, serves as the Operational Test Agency. Navy peculiar system tests will be performed by the Naval Avionics Center and the Naval Weapons Center, China Lake, CA. Hughes Aircraft Corp, Canoga Park, CA is the prime contractor.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments. The imaging infrared (IIR) Maverick advanced development was completed in December 1975 under Program Element (PE) 63601F (Conventional Weapons). Preliminary engineering development planning and studies were initiated under PE 64603F in FY 1975. This effort included aircraft interoperability testing on the F-4 Wild Weasel, F-4 PAVE TACK, and A-7 aircraft in operational scenarios, and included night and autonomous visual operations. The imaging infrared guidance unit was evaluated side-by-side with the TV Maverick guidance unit in Germany during February and March 1976. This test demonstrated the utility of the imaging infrared Maverick in the winter European weather environment. An extensive producibility effort was conducted to insure that critical guidance unit components could be manufactured at high rates and would meet shelf-life requirements. A Milestone II Program Review was accomplished by Office of the Secretary of Defense in September 1976 and resulted in a Deputy Secretary of Defense decision to transition the program into full-scale engineering development. A Joint Operational Test & Evaluation (JOT&E) was accomplished during January and February 1977. This JOT&E demonstrated the capability of crew

Project: # 2551 | Title: Imaging Infrared (IIR) MAVERICK
Program Element: #64608F | Title: Close Air Support Weapon Systems
DoD Mission Area: Close Air Support/Battlefield Interdiction, #223 | Budget Activity: Tactical Programs, #4

members in single seat aircraft to detect and recognize valid targets and launch a missile at long enough slant ranges to result in acceptable attrition from ground based defenses. The JOT&E was accomplished using advanced development hardware with edge tracking logic which is susceptible to break locks due to thermal clutter. This fact was recognized by the Air Force in early 1975 and design efforts were started by Hughes Aircraft to develop a digital centroid tracker. The digital tracker was captive flown with a helicopter during 1976 and the test results were reviewed by the OSD Deputy Director for Test and Evaluation during the Milestone II Program Review process. The digital tracker was tested in Europe during January and February 1978. The tracker maintained lock-on to valid targets against operationally realistic thermal background clutter with a success rate. Prior to the European tests, the Air Force had identified computer software changes to be made to the engineering development guidance unit which we estimate will improve the lock-on tenacity success rate to . Analysis of the European test results further indicated that, even with a perfect tracker, there would have been an break lock rate. The Under Secretary of Defense Research and Engineering reviewed the imaging infrared program and the previous Milestone II decision during October 1978. This review led to the release of FY 1979 funds to initiate the full scale development program and the contract was awarded on 30 October 1978. Engineering design efforts were completed and a Preliminary Design Review (PDR) held in June 1979. Additionally, fabrication and testing of prototype tracking algorithms and tracking gate changes were combined with countermeasures hardening techniques in prototype hardware and tested via helicopter captive flight testing. The Navy and Air Force completed the engineering definition of the changes needed to satisfy Navy IRAWS requirements. Testing of full up guidance units was started during the first quarter of the FY 1980. The second series of helicopter captive flight test and aircraft captive flight test of all up missiles began during the third quarter of the fiscal year. The imaging infrared Maverick Critical Design Review was conducted June 1980 followed by the initiation of contractor flight testing. Contractor flight testing was completed during the last quarter of FY 1980 as government flight testing phased in. The FY 1981 program focused on the combined Development Test and Evaluation/Initial Operational Test and Evaluation Program. The flight test phase of this program initiated at Eglin AFB. Testing was conducted under winter conditions at Ft Riley, Kansas and Camp Drum, New York, and will be conducted under desert conditions at the Utah Test and Training Range and Naval Weapons Center at China Lake in California during FY 1982. Systems Qualification, Electronic Interference and Reliability testing was started during FY 1981. The software for the Navy version of the infrared Maverick started development and Navy Development Test and Evaluation of this software package will be initiated. The Navy will also evaluate data from Air Force DT&E/IOT&E to ascertain their readiness to enter Navy Operational Test and Evaluation. A contract was awarded for the development of a common test set.

2. (U) FY 1982 Program: The funds requested for FY 1982 will be used for completion of the infrared Maverick full-scale development program including Functional Configuration Audit and Production Readiness Review. Residual testing efforts and analysis of that data will be completed with a Milestone III review and production decision. Life Cycle cost reduction efforts will be continued. Development of the Maverick missile family test set will continue. Qualification of a second production source will begin.

Project: # 2551
Program Element: #64608F
DoD Mission Area: Close Air Support/Battlefield Interdiction, #223

Title: Imaging Infrared (IIR) MAVERICK
Title: Close Air Support Weapon Systems
Budget Activity: Tactical Programs, #4

3. (U) FY 1983 Planned Program: Residual imaging infrared Maverick development and common test set development will be completed in FY 1983. The second increment of imaging infrared production for FY 1983 will begin. The second source qualification program working toward second source rate production will continue. Life cycle cost reduction efforts will continue with emphesis on the training missile.

4. (U) FY 1894 Planned Program: FY 1984 funds are required to correct any problems found during the qualification of the second source.

5. (U) Program to Completion: N/A

6. (U) Milestones:

A.	Defense Systems Acquisition Review Council II	September 1976
B.	European Test Complete	February 1978
C.	Full Scale Development Initiated	October 1978
D.	Initiate Helicopter Flight Tests (Changes to tracker algorithms)	June 1979
E.	Engineering Development Model Delivery	May 1980
F.	Critical Design Review	June 1980
G.	Intitate DT&E/IOT&E	June 1980
H.	Complete DT&E	February 1982
I.	Production Readiness Review	Second Quarter FY 1982
J.	Complete IOT&E	March 1982
K.	Milestone III and Production Decision	Third Quarter FY 1982

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	39,300	14,600	5,412*	570*		173,682*
Missile Procurement (Missiles & Initial Spares)		235,201	353,100	468,700	3,563,799	4,620,800
(Quantity)		(490)	(2,560)	(4,600)	(53,014)	(60,664)

* Common test equipment funds included with missile RD to provide a vehicle to report the progress of this project.

Project: # 2551
Program Element: #64608F
DoD Mission Area: Close Air Support/Battlefield Interdiction, #223

Title: Imaging Infrared (IIR) MAVERICK
Title: Close Air Support Weapon Systems
Budget Activity: Tactical Programs, #4

8. (U) Comparison with FY 1982 Budget Data:

RDT&E	36,300	10,900	5,400		600	167,000
Missile Procurement (Missiles & Initial Spares)		204,159	357,688		3,672,197	4,234,044
(Quantity)		(490)	(3600)		56,514	(60,664)

Budget Activity: Tactical Programs, #4
Program Element: #64603F, (Close Air Support Weapons Systems)

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Imaging Infrared (IR) Maverick AGM-65D weapon system is being developed for 24 hour operation to counter the threat of an existing enemy force which has the capability to operate offensively at night and under poor visibility conditions. It will provide enhanced capability during light fog, haze, smog, and dust because of its longer wavelength sensitivity by exploiting the thermal signature of the target. As a member of the Maverick missile family, the infrared Maverick has the same "launch and leave" capability as the AGM-65 and retains the demonstrated system reliability, high single-pass kill probability and flexibility of employment. The infrared seeker replaces the television seeker on the AGM-65A/B airframe using the existing mounting provisions.

Background Engineering Tests

(U) General. The concept of an imaging infrared guidance system was evaluated by the Night Owl studies in 1970 and 1971. From this study, the Imaging Infrared Guidance and Control Sections were developed. Various designs have been extensively tested from 1973 to present time. The test results are in the following paragraph.

(U) Captive Flight Tests. A captive test program was flown during 1974 using hardware developed from the studies. Targets for these sorties were tanks, vehicles, ships and radar sites. The results of the captive flight test demonstrated the system's aim point and tracking capability. The results quantified detection and lock-on ranges as well as the atmospheric effects on performance and established the base for design improvements. A follow-on captive flight test program was conducted in 1975. The targets included power plants, hangarettes, and special radar targets. Like the first captive tests, these tests were flown at locations throughout the United States, including New Mexico, the northern Gulf Coast of Florida, and southern California. These tests further quantified detection and lock-on ranges and the atmospheric effects on performance. An infrared Countermeasure Static Test was performed in conjunction with the follow-on captive flight tests. These tests performed by the Office of the Test Director for Joint Services Guided Weapons Countermeasures Test Program at White Sands Missile Range. The objectives of these tests were to determine the susceptibilities and limitations of seeker and guidance unit in a countermeasures environment. The static test results provide a data base sufficient to evaluate the missile's susceptibility to countermeasures for future flight tests.

Budget Activity: Tactical Programs, #4
Program Element: #64608F, (Close Air Support Weapons Systems)

(U) Free Flight Demonstration. The Free Flight Advanced Development Program was conducted at Eglin Air Force Base, Florida, from July 1975 - December 1975. The objectives of this program were to:

Evaluate the seeker's ability to maintain target lock-on during launch transient.

Evaluate the missile's tracking capability after launch.

Evaluate the missile's capability to hit typical close air support targets.

Obtain data on seeker/missile system performance.

A total of 57 sorties were flown during this evaluation. Four missile launches were accomplished. Three of the four resulted in hits. Launch No. 4 missed the target due to a tracker design deficiency. This problem has been corrected by incorporation of a digital centroid tracker.

(U) European Tower Tests. During February and March 1976, the Imaging Infrared Guidance units were statically tested at Grafenwohr, Germany, in conjunction with the Army's Phase II Imaging tests. A Television guidance unit was used during this test to obtain comparison data between the guidance units during low visibility daylight conditions. The performance of the infrared guidance unit was assessed qualitatively against tactical close air support targets under European atmospheric conditions. Test data obtained showed good correlation with infrared guidance unit data, target signature data, meterological data and spectral transmission data from previous test programs. The Infrared Guidance and Control Section showed enhanced target detection over television in degraded visibility conditions.

(U) Digital Centroid and Terminal Correlation Tracker Demonstration. In late 1975, a new tracker for Infrared Maverick was developed. This tracker uses digital centroid tracking for long ranges and correlation tracking at terminal ranges. Helicopter flight tests were conducted in February 1976 at Camp Pendleton, California. The purpose of using a helicopter test aircraft was to permit better investigation and evaluation of the terminal correlation portion of the guidance unit while simulating the trajectory of the missile. The objective of this test was to demonstrate the feasibility of the tracker concept and to obtain as much development data as possible. Small tactical targets as well as large stationary targets were used. These tests were very successful and verified the engineering development tracker design.

Budget Activity: Tactical Program, #4
Program Element: #64608F, (Close Air Support Weapons Systems)

Applications Tests. During May and June 1976, tests were conducted in Florida to demonstrate operational applications of the infrared Maverick weapons system. The objectives of this evaluation were to demonstrate the autonomous night capability of the system against large pre-briefed targets, to demonstrate the capability of infrared Maverick to detect and attack targets during daylight hours when television weapons are limited (fog, haze, dust, limited contrast), and to demonstrate capability against a wide variety of tactical targets such as camouflaged vehicles and multiple targets in the field-of-view.

(U) Infrared Maverick Joint Operational Test and Evaluation. In the Defense Systems Acquisition Review Council II decision on infrared Maverick dated 19 November 1976, the program was approved to transition to Full Scale Engineering Development. One of the conditions was that an aggressive operationally oriented test would be conducted under realistic battlefield conditions to more fully understand any operational uncertainties or limitations that may exist. Specific uncertainties to be investigated in a realistic battlefield environment containing thermal clutter and countermeasures were (1) capability to transition from the navigation phase of flight to the attack phase of flight (2) capabilities of the system when employed on a single seat aircraft and (3) interoperability with existing acquisition aids. The test consisted of captive carry and simulated launch of Advanced Development missiles on A-7 and A-10 aircraft. The newly designed digital centroid and terminal correlation tracker was not used in this test since only a breadboard tracker existed. No missiles were fired. A total of 23 missions (105 data passes) were flown. Each pass was structured to be a first pass attack. The test demonstrated that transition was not a problem for the conditions tested. The pilots used realistic Forward Air Controller information and on-board navigation systems to navigate accurately from the Initial Point to a pop-up point the point of transition from navigation to attack. Closely related to the issue of transition, the test demonstrated that current tactics, procedures, on-board navigation systems, and visual battlefield activity provide sufficient cueing information for target area acquisition and target detection. The test demonstrated valid targets can be selected from a target array containing substantial thermal clutter. It emphasized the importance of proper ground training and practical experience in interpreting thermal signatures. It also demonstrated that the infrared Maverick can also be employed effectively on single-seat aircraft. Single-seat employment was successful both day and night in limited visibility conditions of rain, fog, haze, and blowing dust, and heavy battlefiled smoke.

(U) Infrared Maverick Helicopter Tracker Tests. Tests of the digital tracker were conducted in December 1977 at Camp Grayling, MI and in January at Ft Polk, LA. The tracker was mounted on a helicopter. Tests at Camp Grayling were used to verify and optimize the digital tracker and to obtain data against targets in a snow environment. The digital tracker showed a significant improvement over the previous analog tracker.

Budget Activity: Tactical Programs, #4
Program Element: #64608F, (Close Air Support Weapons Systems)

Infrared European Tracker Test. The joint test prompted Congressional questioning of certain deficiencies as well as concern over the lack of substantive data on the centroid tracker proposed for engineering development. Congress indicated the desire to conduct an operationally oriented captive carry test in European weather conditions. This test was conducted at Baumholder during January-February 1978. Maverick scenarios and profiles tested were similar to those in the joint test. Aircraft involved were A-10 and F-4. One refinement in tactics was to attempt to optimize standoff range versus survivability. Lock-on to all aspects of a tank at approximately feet was demonstrated. Results demonstrated that the infrared guidance unit (of the type proposed for engineering development) could be successfully employed in European winter weather conditions against both glide weapon and Maverick targets.

(U) Phase I, Infrared Maverick Helicopter Tracker Engineering Development Program. Phase I of the tracker development testing was conducted during July 1979 to February 1980 as part of the engineering development program. Testing was conducted using an advanced development guidance unit and developmental tracker hardware mounted on a helicopter. The main objectives were to: (1) provide a test bed for developing, refining, and evaluating tracker software algorithms and (2) to obtain additional video data for tracker software development of Maverick and glide weapons. The following chart summarizes Phase I of helicopter testing:

(U) Phase I, Engineering Development Helicopter Tracker Tests

DATE	LOCATION	ACCOMPLISHMENTS
July/August 1979	Dugway Proving Grounds	Tank and gunflash signature data in hot/dry climate, uncluttered desert background
November 1979/January 1980	Eglin Air Force Base, FL	Tank and gunflash signatures in humid climate, low-medium clutter
January 1980	Redstone Arsenal	T-62 tank and T-62 tank simulator signature comparison, low and high thermal heating, low-medium clutter
February 1980	Ft Riley, KS	Armor and tank gunflash signatures in winter (snow) weather, low-medium clutter

Budget Activity: Tactical Programs, #4
Program Element: #64608F, (Close Air Support Weapons Systems)

(U) Current Test Program. The Infrared Maverick weapon system is being evaluated in a combined test program conducted in accordance with Air Force Regulation 80-14. This program began July 1980 and will continue for 21 months. It will involve the launch of up to 24 missiles and include 120 captive flights. All test missions (captive and launch) will be flown by Air Force personnel. Data collected from every test mission will be available to participating organizations for their evaluation. The purpose of the combined test is to:

Evaluate capability in limited visibility and night operations.

Evaluate lock-on and tracking capability.

Evaluate accuracy and trajectory characteristics within the specified launch envelope.

Evaluate reliability, maintainability, availability.

Evaluate military operational suitability and effectiveness.

(U) Development Test and Evaluation. A minimum of 16 missiles will be launched and a minimum of 64 effective captive carry sorties will be flown during this test to satisfy primary objectives. An Air Force Preliminary Evaluation was based on test results from five launches against Air Force specified test parameters defined in the Weapon Systems Specification. These launches are intended to demonstrate the compliance of delivered hardware with contractual performance requirements. Eleven launches are currently planned to satisfy primary objectives by verifying performance requirements and evaluating missile capabilities in various day/night environments against tactical targets. Missile captive flights and launches will be supported with extensive computer simulation of each launch condition and post mission comparison of test results with predicted results. Special emphasis will be placed on obtaining airborne and ground thermal measurements of each target/background scenario. These data will be used to characterize each scenario and mission profile with respect to observed target/background. Extensive atmospheric weather measurement will also be made during each captive-carry and free flight mission to provide a data base for evaluating the performance of the system during varying weather conditions. An assessment of adverse weather capabilities of the infrared missile will be based upon data gathered at three different test locations over a wide spectrum of climatic conditions.

Budget Activity: Tactical Programs, #4
Program Element: #64608F, (Close Air Support Weapons Systems)

Special emphasis will be on exercising the infrared system during the winter months and under realistic tactical employment conditions. The data gathered from captive-carry, and free-flight testing will be subject to the limitations imposed by range and test safety constraints. Therefore, a supplemental adverse weather assessment is planned. This program will involve tower testing of an infrared missile over an extended period of varying atmospheric conditions. The objective will be to study and quantify the acquisition and lock-on performance of the infrared system.

(U) Development Test and Evaluation. Flight Test Objectives. Air Force Development Test and Evaluation objectives will be satisfied by accomplishing a combination of helicopter, captive-flight, and free flight (launch) testing. Specific objectives are divided into helicopter, captive-flight and free-flight objectives.

(U) Helicopter Tests

(U) Evaluation terminal tracking characteristics of the missile against tactical targets and backgrounds in a broad spectrum of atmospheric conditions.

(U) Gather data on tactical target signatures, characteristics, and backgrounds.

(U) Evaluate tracker performance.

(U) Captive Flight Tests.

(U) Verify missile, launcher and carrier aircraft electrical and mechanical compatibility in a prelaunch environment.

(U) Verify weapon system ability to meet specification requirements in terms of target acquisition, operational modes, missile lock-on and tracking capability against targets at or above the specified size and temperature differential in a variety of low to high cluttered backgrounds.

(U) Collect data on captive flight environment effects (temperature, vibration, pressure, humidity, sun exposure, etc.) on the missile and its subsystems.

(U) Evaluate missile video output (display).

(U) Evaluate the accuracy and operational usability of missile boresight and missile slaving.

Budget Activity: Tactical Programs, #4
Program Element: #64608F, (Close Air Support Weapons Systems)

(U) Collect failure data for support of reliability and maintainability analysis.

(U) Demonstrate compatibility with the electromagnetic environment of the carrier aircraft.

(U) Evaluate human performance factors in the operation of the system.

(U) Determine that planned mission parameters are compatible with test aircraft, missiles, and test ranges before free-flight launches are undertaken.

(U) Free-Flight Launches.

(U) Evaluate the ability of the missile to maintain lock-on from launch to impact during day or night against a variety of specified targets in differing atmospheric conditions and backgrounds.

(U) Verify and demonstrate the system meets requirements such as:

- (U) Acoustical noise and vibration
- (U) Missile operating envelopes
- (U) Tracking capability
- (U) Acquisition capability
- (U) Preparation and missile ready time
- (U) Boresight alignment
- (U) Probability of hit

In addition to flight test program previously described, the Air Force will conduct environmental, electromagnetic, reliability, and acceptance testing of the infrared Maverick missile. The Air Force will also integrate the seeker into the on-going program for Thermal Signature Measurement and Environmental Effects (a study of atmospheric effects on infrared system and techniques).

Budget Activity: Tactical Programs, #4
Program Element: #64608F, (Close Air Support Weapons Systems)

2. (U) Operational Test and Evaluation: The infrared (IR) Maverick missile contains an IR Guidance Control Section (GCS) which mounts on the Maverick (AGM-65) airframe with existing mounting provisions. The GCS, consisting of a seeker section and an electronics section, senses incident infrared energy and provides a video signal to a monitor in the cockpit via the missile, launcher, and aircraft wiring. The seeker section contains the optical system which collects and courses the incident IR radiation and generates the IR image. The electronics section includes circuits for signal processing and scan conversion to standard TV video format for pilot viewing. The GCS which will be evaluated is essentially identical to the system to be procured. Hughes Aircraft Company is the developer and will provide contractor test support.

(U) Ft Polk Evaluation. An IR Maverick Joint Operational Test and Evaluation (JOT&E) was conducted during February 1977 on the Ft Polk Military Reservation, Louisiana. The Air Force, as Executive Service by direction of the Director of Defense Research & Engineering, conducted the test jointly with the Army and Navy. The JOT&E, managed by the Air Force Test and Evaluation Center (AFTEC), consisted of captive-carry and simulated launch of advanced development IR Maverick guidance units against close air support and interdiction scenario armor target arrays. A-7 and A-10 aircraft provided by the Tactical Air Command (TAC) were used in an environment representative of mid-intensity conflict in Central Europe. The test of two missiles was intended to be a short-term effort to gather specific data required to address identified uncertainties. Accordingly, certain areas of operational effectiveness maintainability, and reliability were not addressed. GCS maintenance was provided by the contractor.

(U) Conclusions from the Ft Polk JOT&E indicated that:

(U) Valid targets can be selected from a target array containing substantial thermal clutter.

(U) Current tactics, procedures, onboard navigation systems, and visual battlefield activity provide sufficient cueing information for target area acquisition and target detection.

(U) The IR Maverick can be effectively employed from single seat aircraft under the conditions tested.

(U) European Testing. A second operational test program, the IR Tracker European Test and Evaluation, was conducted by AFTEC in Jan-Feb 1978 to address congressional concerns on seeker deficiencies in target acquisition, lock-on, and discrimination that surfaced as a result of the JOT&E and to furnish more substantive data on the proposed centroid tracker.

(U) The overall objective of this test program was to evaluate the IR GCS with the digital centroid/terminal correlation (DCTC) tracker operation in European weather conditions with respect to the following:

Budget Activity: Tactical Programs, #4
Program Element: #64608F, (Close Air Support Weapons Systems)

(U) On-range testing.

(U) Objective 1. Assess aircrew ability to transition from navigation to the attack mode, given initial (IP) departure, using forward air controller, Pave Penny, inertial navigation system, or simulated Pave Tack pathfinder as target area cueing aids.

(U) Objective 2. Assess the ability of the IR tracker system to launch at a valid target, given attack mode.

(U) Objective 3. Assess the capability of the IR tracker to maintain lock after launch to point of minimum descent altitude.

(U) Off-range testing.

(U) Objective 4. Assess the ability of the IR tracker system to initially lock-on, given line-of-sight to the assigned target.

(U) Objective 5. Assess the capability of the IR tracker to maintain lock to minimum descent altitude after inital lock-on or final relock after inadvertent breaklock against the assigned target.

(U) Both on- and off-range testing.

(U) Objective 6. Assess the survivability of the A-10 and F-4 during weapons delivery.

(U) Objective 7. Assess the effects of inadvertent IR countermeasures on system effectiveness.

(U) Objective 8. Compare thermal image appearance and thermal measurements of various vehicle targets.

(U) Since both of the DCTC trackers used in the test were hand-built advance development models, and were entirely maintained by the contractor, no suitability objectives were addressed.

(U) The entire test was conducted in West Germany with TAC A-10 aircraft and aircrews and US Air Forces in Europe (USAFE) F-4 aircraft and aircrews operating out of Ramstein Air Base to the Baumholder Military Training Area. European test results:

Budget Activity: Tactical Programs, #4
Program Element: #64608F (Close Air Support Weapons Systems)

(U) Reinforced the JOT&E results

(U) Demonstrated that the IR seeker, employed as the guidance medium for GBU-15 and Walleye weapons, is tactically feasible under both day and night conditions, and offers significant enhancement of the tactical performance of both weapons.

(U) Initial operational test and evaluation (IOT&E) of IR Maverick (IR MAV). The IOT&E portion of a combined DT&E/IOT&E is being managed by AFTEC with the participation of TAC, Air Force Logistics Command (AFLC), Air Weather Service (AWS), Air Training Command (ATC), and the US Army. The IOT&E will be full scale engineering development hardware representative of the production version. Testing to satisfy IOT&E objectives will require approximately 110 captive missions and at least 10 valid missile launch missions from F-4, F-16, A-10, and F-111 aircraft. Original test plans called for testing by qualified aircrew and maintenance personnel from TAC at Ft Riley, Kansas; Eglin AFB, Florida; the Utah Test and Training Range (UTTR), Utah; and the Naval Weapons Center (NWC), California. However, unseasonably warm and dry weather at Ft Riley, January-March 1981, precluded satisfactory testing and Ft Drum, New York, was added for testing in November-December 1981. Testing at Ft Riley did achieve 19 missions with one live launch. At the completion of Ft Riley testing a decision was made incorporate minor design changes into the test hardware. This action was completed prior to the September Eglin IOT&E test. About one-half of all IOT&E missions will be flown at night. Non-availability of Soviet armor for live launch targets will limit the test to launches against US built armored vehicles

(U) Major IOT&E milestones include the following:

Event	Date
Testing at Ft Riley	Jan-Mar 81
Testing at Eglin AFB	Sep-Oct 81
Testing at Ft Drum	Nov-Dec 81
Testing at UTTR	Jan-Apr 82
Testing at NWC	Mar-Apr 82

(U) Data from UTTR/NWC will not be available for the January 1982 program review. Countermeasure testing originally planned for UTTR, was included with the Eglin testing so the data would be available for the January 1982 review. This testing was accomplished through a series of captive carry missions.

Budget Activity: Tactical Programs, #4
Program Element: #64608F, (Close Air Support Weapons Systems)

(U) IOT&E objectives are listed below:

(U) Operational effectiveness objectives.

(U) Objective 1. Assess the operational performance capability of the IR Mav weapon system against tactical type targets under day and night conditions.

(U) Objective 2. Evaluate IR MAV compatibility with other on-board aircraft systems.

(U) Objective 3. Assess IR MAV interoperability with other systems.

(U) Objective 4. Assess the survivability of the delivery aircraft during weapons delivery.

(U) Objective 5. Assess the accuracy and suitability of weather forecast techniques as a potential aid for operational employment decisions for the IR MAV.

(U) Operational suitability objectives.

(U) Evaluate the reliability, maintainability, and availability of the IR MAV missile.

(U) Evaluate logistic supportability.

(U) Evaluate suitability of the IR MAV software.

(U) Planned missile firings for IOT&E (subject to change) include:

Aircraft	Day/Night	Target
F-4E	Day	Mobile Artillery (completed 8 Oct 81)
A-10	Day	Tank
A-10	Night	Tank (completed 2 Mar 81)
A-10	Night	Tank
F-111F (Pave Tack)	Day	Fuel Storage Facility

*F-16	Day	Tank and Armored Personnel Carrier
F-4C	Night	Simulated ZSU-23-4
F-111F(Pave Tack)	Night	Tank
F-16	Night	APC

*Dual launch.

(U) A major portion of the IOT&E will be dedicated to the reliability, availability, and maintainability (RAM) evaluation including all associated support and test equipment. TAC and AFLC maintenance and handling personnel will perform preflight and post flight checkout, uploading, downloading, and all maintenance possible using preliminary technical manuals provided by the Hughes Aircraft Company. Approximately 160 hours of captive-carry flight time will be accumulated for RAM evaluation of the test items.

(U) Current planning calls for DT&E to be completed prior to the pilot or low rate production decision. IOT&E will be completed prior to the high rate production decision. Follow-on operational test and evaluation (FOT&E) test dates have not been established.

(U) The DT&E and IOT&E missiles to be tested are of the same configuration and are representative of the intended procurement configuration except that warheads in eight of the ten missiles have been replaced by telemetry units to facilitate missile performance data collection. Additionally, IOT&E missiles will not be configured with the reduced smoke rocket motor (RSRM) which is not expected to affect overall test results. Furthermore, data on the performance of the RSRM on the IR MAV will be available from the operational evaluation of the AGM-65E (Maverick Alternate Warhead Missile) by the US Navy.

2. (U) The Imaging Infrared Maverick missile will have the following major performance characteristics demonstrated during the test program.

(U) Prelaunch reliability of .935[1]/

(U) Launch reliability of .985[2]/

Budget Activity: Tactical Programs, #4
Program Element: #64603F, (Close Air Support Weapons Systems)

(U) A target impact probability of .87 3/

(U) Useful life of 10 years 4/

1./ (U) Prelaunch Reliability is defined as the probability that the system, launcher and missile, will survive for the period from checkout through all mission phases up to initiation of missile launch, given that the system was operable when checked-out. Pre-launch reliability will be determined from the actual launch missions and approximately 120 captive carry missions.

2./ (U) Launch Reliability is defined as the probability that a missile will launch and perform inflight guidance, arming, and detonation, given that it had been malfunction free during prelaunch. Launch reliability will be determined by test data and analysis.

3./ (U) Test Impact Probability is the probability of hit given a malfunction free launch and guidance phase. It is determined by combining flight test results, six degree of freedom missile Monte Carlo simulations (random error sources and a Monte Carlo performance model for deterministic errors. The accuracy of this method has been substantiated by experience with the AGM-65A/B.

4./ (U) The 10 year useful life is a design requirement and is supported by the AGM-65A/B experience with the continuing age out program accomplished by Air Force Logistics Command.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64612F
DoD Mission Area: Close Air Support and Interdiction, #223

Title: Low Level Laser Guided Bomb
Budget Activity: Tactical Programs, #4

RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	6,639 1/	8,269	3,016			29,659
2657	Low Level Laser Guided Bomb						

1/ The FY 1981 Authorization Conference has directed that this funding support a Navy approach to modify inventory laser guided bombs in addition to this Low Level Laser Guided Bomb program.

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Current laser guided bombs cannot be accurately delivered from the extremely low altitude required for acceptable aircraft attrition in the presence of significant surface to air threats. In addition, limitations on acquisition field of view and sensitivity, and on bomb maneuverability restrict the delivery envelope of current laser guided bombs. The Low Level Laser Guided Bomb is an improved laser guided bomb which greatly expands the delivery envelope including low altitude level launch from feet altitude. The Tactical Air Forces require the tactical flexibility, accuracy, and reduced attrition provided by the Low Level Laser Guided Bomb.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Funds fabrication of Low Level Laser Guided Bombs for testing and initial operational test and evaluation. Ensures availability of necessary numbers of "full-up" Low Level Laser Guided Bombs and related spares and checkout equipment to enable a thorough assessment of operational utility and exploration of the full delivery envelope. Ensuing operational testing will be conducted by the Air Force Test and Evaluation Center. Funds qualification testing and detailed engineering and reviews to ensure readiness for production. Cost estimates are based on the fully negotiated firm fixed price contract option with the development contractor plus Air Force estimates of funding requirements to conduct Air Force operational testing.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,900	8,500	4,200			29,335
Procurement (Other) (PE 28030F)		17,500	120,300			
(Quantity)			(2,000)			

Program Element: #64612F
DoD Mission Area: Close Air Support and Interdiction, #223

Title: Low Level Laser Guided Bomb
Budget Activity: Tactical Programs, #4

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Other)(PE#28030F)		38,998	99,047	243,541	TBD	TBD
(Quantity)			(2,000)	(12,850)	(TBD)	

Program Element: #64612F Title: Low Level Laser Guided Bomb
DoD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This program is to extend our laser guided bomb delivery capability down to]feet altitude and extend the acquisition, maneuverability, and accuracy as demanded by weather and defensive environments in Europe. The Tactical Air Forces need the versatile effectiveness of the laser guided bomb to attack the bridges, depot and airfield facilities, fixed radar installations, and structures of all kinds that are too large for an antitank munition and too numerous for the GBU-15. The laser guided bomb showed in Southeast Asia an advantage of from [ ]to as much as [ ]increase in effectiveness over unguided weapons, at a very low cost. The Production Engineering Program improved reliability, shelf life, handling, etc., but left performance essentially unchanged. With inventory laser guided bombs, minimum release altitude required for specified accuracy is [ ]feet, depending on airspeed and other parameters. Low delivery tactics have been developed recently to provide some low altitude capability with the Production Engineering Program Laser Guided Bomb, but, under those conditions, accuracy is degraded by a factor of [ ] While low altitude delivery increases the survivability of the delivery aircraft, it increases the terrain masking of most land targets. As a result, the laser guided bomb must possess the capability to rapidly acquire the laser energy following launch and the maneuverability to fly to the target over a wide footprint. As compared to current laser guided bombs, the Low Level Laser Guided Bomb incorporates an enlarged seeker field of view and improved seeker sensitivity to provide effective acquisition of laser energy under reduced visibility conditions. The larger airfoils, proportional control, microprocessor logic, and proportional guidance of the Low Level Laser Guided Bomb provide increased range, maneuverability, and accuracy. These improvements provide the delivery aircraft tactical flexibility. This improved laser guided bomb can be launched at low altitude and successfully acquire and fly to the target under visibility conditions common to Europe from the range limits at which the target can be identified and designated. Using "buddy" designation, even greater standoff is provided the delivery aircraft. In sum, the Low Level Laser Guided Bomb will improve our ability for accurate delivery of ordnance while reducing attrition of the delivery aircraft. The Low Level Laser Guided Bomb system consists of a conventional warhead, a laser bomb guidance kit, support equipment, and special tooling. The laser bomb guidance kit, consisting of an airfoil group and a guidance and control unit, is installed on an appropriate warhead to provide a guided weapon capability against laser designated targets. Primary emphasis will be on the MK-82 (500 lb) and MK-84 (2000 lb) bombs; however, the Low Level Laser Guided Bomb kit can be compatible with the MK-83 (1000 lb) bomb and adaptable to the Hard Structure Munition Warhead. Two concept studies and a recent Design to Cost evaluation have shown that these new capabilities can be obtained at only a small increase in Laser Guided Bomb unit cost. No modifications to aircraft are necessary to provide the Low Level Laser Guided Bomb drop capability since no electrical interface is required between the aircraft and the Low Level Laser Guided Bomb. The Low Level Laser Guided Bomb will be designed for compatibility with the F-4, F-16, F-111, A-7, and A-10 aircraft. Laser designation will be performed by the delivery aircraft, by another "buddy" aircraft, or by a ground designator dependent upon the tactical situation.

(U) RELATED ACTIVITIES: Procurement of the present design Production Engineering Program Laser Guided Bomb kit is continuing under Program Element 28030F (War Readiness Material, Ammunition). A phase-in from that procurement to the Low Level Laser Guided Bomb kits is contemplated for FY 1983 based upon a successful outcome of this development program. In accordance with the direction contained in the FY 1981 Authorization Conference Report, a Navy suggested modification to inventory laser guided bombs is being investigated. The Naval Weapons Center has conducted a basic feasibility demonstration of this "gravity bias" modification for MK-83 application. In addition, the Air Force and the Navy have conducted analyses of the relative benefits of the Low Level Laser Guided Bomb and the Navy proposed modification. The Air Force is preparing to conduct a flight demonstration of the two weapons against a scenario representative of the Air Force NATO land attack mission.

Program Element: #64612F Title: Low Level Laser Guided Bomb
DoD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command (AFSC), Andrews AFB, MD and Armament Division, Eglin AFB, FL. Texas Instruments, Inc., is the contractor for this development.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Concept feasibility studies conducted under Program Element 63601F, Conventional Weapons Technology, were completed in January 1977. Those studies, performed by Texas Instruments, Inc., and Rockwell International Corp., indicated that substantial performance improvement could be realized by changing the seeker, adding an autopilot based on microprocessor technology, modifying the controls, and/or changing fin and wing design. The Air Force tactical operating commands examined those findings and determined that such an improved weapon would meet their requirements, as stated in Tactical Air Forces Required Operational Capability 315-17, published 31 August 1977. In FY 1979, the acquisition program plan was finalized and contracting activities begun. In FY 1980 a competitive source selection process resulted in award of a firm fixed price contract for Phase I of full scale development with a negotiated firm fixed price option for completion of development and test (Phase II) and a Not-to-Exceed price for initial production. Under Phase I, design and prototype fabrication was conducted. Under Phase II, Development Test & Evaluation was completed, demonstrated an average CEP of An additional launch, using residual development assets, featured the direct-hit destruction of a moving truck. Planning was conducted for the LLLGB/Navy modification flight demonstration.

2. (U) FY 1982 Program: Low Level Laser Guided Bombs and related support equipment will be fabricated for a thorough initial operational flight testing. Operational testing, conducted by the Air Force Test and Evaluation Center, will begin, examining the operational employment and utility of the expanded delivery envelope and improved accuracy provided by the Low Level Laser Guided Bomb. Qualification testing will be conducted. Producibility studies and related efforts will be completed to ensure availability of all data needed for a production decision and readiness for production. Production tooling will be procured via Program Element # 28030F. The changes in estimated costs from those estimated in FY 1982 are due to reassessment of costs for initial operational test and evaluation, and inflation adjustments.

3. (U) FY 1983 Planned Program: Complete Initial Operational Test and Evaluation. Obtain production decision and begin production.

4. (U) FY 1984 Planned Program: Not applicable.

5. (U) Program to Completion: Conduct Follow-on Operational Test and Evaluation. Continue production.

6. (U) Milestones: Not Applicable.

7. (U) Resource: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64614F
DOD Mission Area: Interdiction/Naval Strike, #223

Title: Medium Range Air-to-Surface Missile
Budget Activity: Tactical Programs, #4

(U) RESOURCES ($ in thousands):

FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
14,000	48,916	42,682	23,045	23,197	151,840

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force, the Office of the Secretary of Defense and the Congress agree that there is a need for an air-launched conventional standoff missile capable of being employed against tactical targets by aircraft of the Strategic Air Command and the tactical air forces. This standoff missile is needed to destroy well protected, high value targets rapidly while minimizing the exposure of launch aircraft to the massive quantity of current and projected enemy lethal air defense systems. Air Force analysis concluded that the optimum solution to this need, based on range, payload, survivability, supportability, growth potential and technical risk assessments, would be met by a subsonic, low flying cruise missile system. The Medium Range Air-to-Surface Missile will satisfy the standoff missile requirement.

(U) BASIS FOR FY 1983 RDT&E REQUEST: FY 1983 funds will be used to complete the system integration of the following major components into the Air Force version of the Medium Range Air-to-Surface Missile; lower cost strapdown inertial guidance unit, Digital Scene Matching Area Correlator and airfield attack submunition dispenser warhead. The first AGM-109H Full Scale Development test vehicles will be delivered and contractor test and evaluation initiated.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	14,000	49,100	TBD	TBD	TBD	TBD
Procurement (PE 27164F)			7,200	TBD	TBD	TBD

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #64614F

DOD Mission Area: Interdiction/Naval Strike, #223

Title: Medium Range Air-to-Surface Missile

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The vast quantities, complementary capabilities, redundancy and ever increasing lethality of newer Soviet surface-to-air defensive systems led the Air Force to assess alternative methods of attacking heavily defended high value targets located deep inside enemy territory. Numerous Service studies, notably the Air Force's Strike Options Comparison Studies, completed in 1978, and Advanced Conventional Standoff Missile studies, published in 1979, as well as the Navy's Tactical Air Capabilities/Options Project of 1977 concluded that a

Additionally the Institute for Defense Analyses conducted an extensive series of studies for the Department of Defense which assessed the potential effectiveness of both aircraft and conventionally armed missiles for deep attacks against the complex of Soviet/Warsaw Pact air bases in Central Europe.

In addition, the

The Medium Range Air-to-Surface Missile will supplement conventional direct attack unguided and guided weapons as well as short range air-to-surface and anti-radiation missiles by providing operational commanders an alternative to the commitment of a large force to attack fixed, high value, heavily defended targets. The ability to attack these targets from beyond the range of effective defenses will enhance aircraft survivability and free tactical aircraft for employment against fluid targets. The Medium Range Air-to-Surface Missile program was initiated as a Joint Services program in FY 1979 at Congressional direction. The principal required system characteristics are: launch range sufficient to remain outside most lethal surface-to-air defenses, autonomous strike capability in adverse weather, effectiveness against land targets, compatibility with both tactical and strategic aircraft and an early operational capability. In March 1980, following analysis of various system options, the Office of the Secretary of Defense decided that a tactical variant of the TOMAHAWK cruise missile provided the greatest return in operational capability at the least investment cost. The Medium Range Air-to-Surface Missile variant of the TOMAHAWK will take advantage of the significant development effort which has been invested in the Joint Cruise Missile Program. The scope of effort needed to develop and deploy the Medium Range Air-to-Surface Missile variant of the TOMAHAWK is limited primarily to a modular adaptation of new warhead and guidance modules to meet specific service requirements and to integration of the missile with various delivery aircraft weapon systems. The Air Force version of the Medium Range Air-to-Surface Missile, AGM-109H, has the primary mission of airfield attack. For this purpose, it is fitted with a dispenser warhead section which carries specialized runway cratering submunitions.

(U) RELATED ACTIVITIES: This development is supported by related developments in the Sea Launched Cruise Missile (PE 64367N), Air Launched Cruise Missile (PE 64361F) and the Ground Launched Cruise Missile (PE 64362F) programs. The TOMAHAWK airframe, navigation, guidance and mission planning systems were developed under these program elements. Additionally, the Midcourse Guidance Demonstration Project under PE 63601F, Conventional Weapons Technology, is employing TOMAHAWK to flight test new lower cost guidance concepts which will be applied to the Medium Range Air-to-Surface Missile. The Navy portion of this development effort is being conducted under PE 63369N.

Program Element: #64614F

DOD Mission Area: Interdiction/Naval Strike, #223

Title: Medium Range Air-to-Surface Missile

Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: The airframe for the Medium Range Air-to-Surface Missile is manufactured by the General Dynamics Corporation, Convair Division and the guidance system integrator is McDonnell Douglas, Astronautics Division. The missile turbojet engine is produced by Teledyne Continental Aircraft Engines. Inertial Navigation System components are being developed by Singer-Kearfott and Litton Industries. Major development agencies for the missile are the Air Force's Armament Division, Eglin AFB, Florida and the Naval Weapons Center, China Lake, California. A number of other commercial and governmental agencies will be involved in subsystem design, development and testing as the development progresses.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Full Scale Development of the Medium Range Air-to-Surface Missile was initiated. Integration studies were conducted to determine the modifications required to integrate the lower cost strapdown inertial guidance system, Digital Scene Matching Area Correlator and the lower cost Teledyne turbojet engine in place of the William's turbofan engine used in the longer range strategic variants of Tomahawk. Ground testing of the Lawrence Livermore designed submunition, the Tactical Airfield Attack Munition, was conducted. Development of a kinetic energy penetrator, as an alternative submunition for the Medium Range Air-to-Surface Missile was initiated.

2. (U) FY 1982 Program: Continue integration of the lower cost guidance, turbojet engine and Digital Scene Matching Area Correlator into MRASM. Initiate integration studies of the Medium Range Air-to-Surface Missile with the B-52G aircraft. Complete testing of the Tactical Airfield Attack Munition and the Kinetic Energy Penetrator submunitions. Conduct flight tests of the Tactical Airfield Attack Munition using a modified T-33 to simulate the Medium Range Air-to-Surface Missile dispenser. Submunition selection will be made in Fourth Quarter FY 1982.

3. (U) FY 1983 Planned Program: Complete system integration of the Air Force version of the Medium Range Air-to-Surface Missile using a lower cost strapdown inertial guidance system, Digital Scene Matching Area Correlator and the lower cost Teledyne turbojet engine in place of the turbofan engine used in the longer range strategic variants of TOMAHAWK. Continue the integration of the Medium Range Air-to-Surface Missile with the B-52 aircraft and weapon delivery systems. Conduct a study of transportation, handling and storage requirements for the Medium Range Air-to-Surface Missile in order to define compatibility with existing Air Force support systems and facilities and to define logistics support requirements. Complete development, subsystems integration and testing of the selected runway cratering submunition and initiate qualification testing of full-up live rounds against actual runway targets. Complete submunition dispenser design, development, and integration into the Medium Range Air-to-Surface missile system. Adapt the existing TOMAHAWK mission planning system for use in conjunction with tactical air operations.

4. (U) FY 1984 Planned Program: Conduct Development Test and Evaluation and Initial Operational Test and Evaluation of the Air Force version of the Medium Range Air-to-Surface Missile to include free flight tests delivering complete patterns of live submunitions against actual runway type targets. Complete system integration development of the missile into the weapons delivery system of the B-52. Develop and evaluate additional modular program warhead concepts designed to improve the effectiveness of the Medium Range Air-to-Surface Missile against a wide range of tactical targets.

Program Element: #64614F
DOD Mission Area: Interdiction/Naval Strike, #223

Title: Medium Range Air-to-Surface Missile
Budget Activity: Tactical Programs, #4

5. Program to Completion: Complete Development Test and Evaluation and Initial Operational Test and Evaluation leading to approval for service use of the AGM-109H and production decision. Investigate the use of Medium Range Air-to-Surface Missile on other Air Force launch platforms. Evaluate various alternative for use in follow-on Air Force variants to enhance mission effectiveness and reduce cost.

6. Milestone:

	Milestone	Date
A.	Initiate Joint Full Scale Engineering Development Program	Jul 80
B.	First Live Flight Test of Cratering Submunition	(Jul 81*) Nov 81
C.	First AGM-109H Contractor Test and Evaluation Flight	
D.	First Air Force Development Test and Evaluation Flight	
E.	Complete Development Test and Evaluation/Initial Operational Test & Evaluation	
F.	Production Approval	

* Date presented in Fiscal Year 1982 Descriptive Summaries

(U) EXPLANATION OF MILESTONE CHANGES: Program has experienced delays due to Navy attempts to withdraw from the joint program and inadequate Navy funds provided in FY 1982 and FY 1983.

7. (U) RESOURCES:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	14,000	48,916	42,682	23,045	23,197	151,840
Procurement (missile)(PE 27164F)						

8. (U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	14,000	49,100	TBD	TBD	TBD	TBD
Procurement (missile)(PE 27164F)			7,200	TBD	TBD	TBD

Budget Activity: Tactical Programs, #4
Program Element: #64614F Medium Range Air-to-Surface Missile (MRASM)

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Medium Range Air-to-Surface Missile (MRASM) test program is being managed by the Joint Cruise Missiles Project Office. The Air Force version of MRASM is the AGM-109H variant of the TOMAHAWK Missile. General Dynamics, San Diego, California, is the prime integrating contractor.

(U) MRASM development testing of the TOMAHAWK missile will incorporate test results from the Sea Launched Cruise Missile (SLCM), the Air Launched Cruise Missile (ALCM) and Ground Launched Cruise Missile (GLCM) programs to reduce MRASM test requirements. ALCM, GLCM, and SLCM are all variants of the basic TOMAHAWK design.

(U) A number of AGM-109 tests and demonstrations have been conducted to date which directly relate to the development of the Air Force version of the MRASM weapon system. These efforts include extensive Development Test and Evaluation efforts in conjunction with the SLCM program. The AGM-109 also participated in the competitive flyoff phase of the Air Launched Cruise Missile competition during which it was launched from a modified B-52G. The ALCM flight test program began in April 1979 with B-52 flutter and jettison tests. The modified B-52G arrived at Edwards AFB, California in May 1979 with actual AGM-109 flight testing running from July 1979 through February 1980. This test program consisted of B-52 performance evaluations with AGM-109s loaded, captive carry testing as required, ten live flights, reliability and maintainability demonstrations, mid-air recovery and survivability and vulnerability testing. The ten AGM-109 flights were further divided into three Development Test and Evaluation flights conducted by General Dynamics and seven Development Test and Evaluation/ Initial Test and Evaluation flights conducted by a joint Air Force Development Test and Evaluation/Initial Operational Test and Evaluation test team. Initial Operational Test and Evaluation was managed by the Air Force Test and Evaluation Center.

(U) Through September 1981, a total of 76 A/BGM-109 TOMAHAWK flight test missions had been accomplished of which 40 were launched from aircraft (both Air Force B-52G and Navy A-6). These missions provided generic cruise missile data applicable to MRASM development in the areas of engine performance, airframe stability and control, navigation/guidance and missile performance.

(U) A most significant test milestone was the May 1978 AGM-109 mission which demonstrated the feasibility of using the TOMAHAWK/Tactical Airfield Attack Munition dispenser combination to attack runway targets. This mission, launched from an A-6 aircraft and flown over realistic operational ranges, actually delivered dummy runway cratering submunitions. Ten of the twelve submunitions dispensed impacted on the runway target (Michael Army Airfield, Dugway Proving Ground, Utah).

(U) A recent conventional land-attack Tomahawk flight, launched from an A-6, demonstrated the capability of the system to perform accurate Digital Scene Matching Area Correlator (DSMAC) updates at night. Specified target accuracy (CEP) requirements were met on all target passes.

Budget Activity: Tactical Programs, #4
Program Element: #64614F Medium Range Air-to-Surface Missile (MRASM)

(U) The Air Force version of the Medium Range Air-to-Surface Missile, the AGM-109H, is expected to fly for the first time during fiscal year 1984 with contractor test and evaluation (CTE) taking place during second and third quarter fiscal year 1984. A combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) will be conducted during the period from fourth quarter fiscal year 1984 through first quarter fiscal year 1985. Follow-on Test and Evaluation will continue through mid fiscal year 1985. The Air Force Armament Division is the development test agency and the Air Force Test and Evaluation Center is the operational test agency. Most of the developmental flight testing will be conducted at the Utah Test and Training Range and the Eglin Air Force Base, Florida, range complex.

(U) Specific development test and evaluation objectives include verifying vehicle performance, stability and control and propulsion as well as terminal effectiveness of the runway cratering submunition. System effectiveness in accomplishing the mission will be evaluated to include launch, navigation, target acquisition, munitions dispensing and pattern effectiveness. Environmental testing, to include adverse weather tests in the climatic hanger at Eglin Air Force Base, Florida, will also be conducted.

2. (U) Operational Test and Evaluation (OT&E): The Air Force Test and Evaluation Center (AFTEC) will manage the operational testing on the Air Force's variant of the AGM-109 Tomahawk cruise missile, the AGM-109H. AFTEC will also participate in the Navy's combined DT&E/OT&E and operational evaluation on the Navy variant to maximize use of test data having both Air Force and Navy applicability. Personnel from Strategic Air Command (SAC), Tactical Air Command (TAC), Air Force Logistics Command (AFLC), and Air Training Command (ATC) will serve with AFTEC representatives on the OT&E test team. The Air Force combined DT&E/IOT&E and dedicated IOT&E testing are tentatively scheduled to begin in the fourth quarter of fiscal year 1984 and will continue through the first quarter of fiscal year 1985. The Navy testing will be conducted concurrently. The AFTEC managed initial phase of Air Force FOT&E will be conducted following the production decision during fiscal year 1985.

(U) The Navy test vehicles will be very similar to the Air Force vehicles, allowing a transfer of representative operational test data that can be used to augment the baseline for Air Force operational testing. The Air Force test program will focus on the unique operational characteristics of the Air Force's MRASM and will use the Navy's data base to minimize redundant testing requirements.

(U) Air Force operational effectiveness objectives will stress the Air Force configuration and mission differences from the Navy configuration. However, because of differing operational concepts and environments, Air Force operational suitability assessments will be based primarily on Air Force generated data.

Budget Activity: Tactical Programs, #4
Program Element: #64614F Medium Range Air-to-Surface Missile (MRASM)

3. (U) System Characteristics:

Physical Characteristics	General Dynamics AGM-109H
(U) Length (inches)	232
(U) Diameter (inches)	21
(U) Weight (pounds)	2,897
(U) Payload Weight (pounds)	1,000
(U) Useable fuel Weight (pounds)	331
(U) B-52 Internal Carriage (each)	4
(U) B-52 External Carriage (each)	8
(U) F-16 Carriage (each)	2

Performance Data

	Threshold	Goal	Demonstrated
Maximum Range (Nautical miles)			To Be Determined
Launch Altitude (feet)			
Minimum			To Be Determined
Maximum			To Be Determined
Maximum Launch Speed (Mach Number)			To Be Determined
Terminal Accuracy (feet)			To Be Determined

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64616F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: PAVE MOVER Engagement System
Budget Activity: Tactical Programs, 4

(U) RESOURCES (PROJECT LISTING) ($ IN THOUSANDS)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT		24,009	29,328	76,379	230,920	360,636
2814	PAVE MOVER Radar/Fire Control		12,809	25,628	64,679	191,820	294,936
2727	PAVE MOVER Interfaces		2,200	3,700	11,700	39,100	56,700
2728	Assault Breaker Air Launched Missile*		9,000				9,000

* For FY 1982 demonstration of standoff missile guidance as part of Assault Breaker Technology Demonstration program only. Full Scale Development of a suitable air-launched missile is conducted, beginning in FY 1983, in Program Element 64606F, Conventional Standoff Weapon.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A critical need exists for an effective new capability to delay, disrupt, and destroy second echelon Warsaw Pact armored forces to hamper their use in breakthrough of Allied positions. To fill this need, the Department of Defense has initiated the Assault Breaker concept as a high-priority effort.

The airborne PAVE MOVER Engagement System is the of the Assault Breaker concept. The PAVE MOVER Engagement System is unique in that it is a closed loop system for the real time detection, tracking, and attack of second echelon forces. Utilizing Moving Target Indicator and Synthetic Aperture Radar techniques, the PAVE MOVER radar can detect and track second echelon enemy forces. Via its control interfaces, the PAVE MOVER Engagement System integrates accurate attack of those forces by providing guidance updates to standoff missiles and by cue-vectoring attack aircraft against the enemy targets.

(U) The PAVE MOVER Engagement System is also needed in contingency conflicts to provide a rapidly deployable, effective air-to-ground attack capability.

The RDT&E efforts described in this Descriptive Summary will develop a PAVE MOVER Engagement System consistent with a

(U) BASIS FOR FY 1983 RDT&E REQUEST: This program element conducts the Full Scale Engineering Development of the PAVE MOVER Engagement System drawing upon the advanced development model PAVE MOVER radar work demonstrated in FY 1982 via the Assault Breaker End-to-End Technology Demonstration.

Program Element: #64616F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: PAVE MOVER Engagement System
Budget Activity: Tactical Programs, 4

(U) During FY 1983, the advanced development model PAVE MOVER radar will be employed in a field exercise under unified or joint command cognizance to validate the effectiveness of PAVE MOVER radar and fire control capabilities to affect the ground battle. Army and Air Force personnel will be jointly involved in planning and evaluating the PAVE MOVER role in the exercise. This exercise experience will ensure effective operational input to the specifications for the Full Scale Engineering Development program.

(U) Design definition will be conducted in FY 1983 for the integration of the PAVE MOVER radar into an operationally desirable airborne platform. The anticipated airborne platform is a 707 type aircraft providing endurance, range, and capability for on-board radar processing and weapon control.

(U) The PAVE MOVER Full Scale Development model radar will draw heavily upon the advanced development model radar experience, incorporating necessary militarization and ruggedization but encompassing only low-risk improvements in performance to insure an achievable development schedule at affordable cost. Cost estimates are program office estimates based upon advanced development radar experience and contractor estimates, and will be adjusted based upon modifications to the advanced development capabilities found necessary as a result of on going FY 1982 Assault Breaker demonstrations and from the FY 1983 Operational Field Exercise.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E		24,537	128,781		290,105	443,423

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #64616F Title: PAVE MOVER Engagement System
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, 4

(U) DETAILED BACKGROUND AND DESCRIPTION: Provides Full-Scale Engineering Development of the PAVE MOVER Engagement System. The PAVE MOVER Engagement System consists of a standoff airborne radar and fire control system for detection and track of ground mobile targets in all weather, day or night integrated with real time control capability to guide accurate attack. The PAVE MOVER Engagement System can provide accurate attack by providing guidance update to standoff missiles in-flight as well as by cue-vectoring penetrating direct attack aircraft.

(U) This program element draws extensively upon the advanced development PAVE MOVER radar efforts conducted in Program Element 63747F. Those efforts developed and demonstrated the basic PAVE MOVER radar/fire control capabilities beginning in FY 1978 via a jointly funded program with the Defense Advanced Research Projects Agency.

(U) The PAVE MOVER Engagement System will provide an airborne, advanced radar capability for the wide area surveillance and accurate detection and tracking of enemy forces. The PAVE MOVER radar possesses both Moving Target Indicator and Synthetic Aperture Radar operating modes.

The advanced development model PAVE MOVER radars are capable of detecting and tracking moving ground vehicles to ranges of the aircraft. They also provide a small area spot image mode having a

To provide a high probability of target destruction, the PAVE MOVER Engagement System will use and attacking aircraft. This is accomplished by providing final attack guidance relative to target location by Total system strike accuracy (including target location, weapon location and guidance and control errors) using the PAVE MOVER

(U) The above capabilities of the advanced development model PAVE MOVER radars are being demonstrated/validated during FY 1982 during the Assault Breaker Technology Demonstration program at White Sands Missile Range.

(U) The PAVE MOVER Engagement System Full Scale Engineering Development program will draw upon the advanced development radar model experience. It will develop the radar capability by appropriately militarizing and ruggedizing the previous design, adding expanded capability only where it is clearly warranted by operational experience or where low development risk is involved.

(U) The Full Scale Engineering Development program will integrate the radar into an appropriate airframe providing: (1) sufficient space for on board radar processing and weapons control/command and control interfaces; (2) long on-station loiter time; (3) rapid deployment capability; and (4) capability to operate at reasonably high standoff altitude to minimize terrain radar shadowing. A 707 type aircraft is the anticipated platform for the PAVE MOVER Engagement System.

Program Element: #64616F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: PAVE MOVER Engagement System
Budget Activity: Tactical Programs, 4

(U) Project 2814 within this Program Element develops the PAVE MOVER radar and fire control capabilities and, during FY 1983, will support the involvement of PAVE MOVER in an operational exercise. Project 2727 addresses the interfaces with elements of the command and control system as well as interfaces to the standoff missiles and direct attack aircraft for PAVE MOVER guidance updates and cue-vectoring respectively.

(U) Project 2728 was shown in the FY 1982 Descriptive Summary for the development of an air launched missile for application with PAVE MOVER. That effort has been consolidated with the airborne standoff missile needs of other engagement systems and is now pursued within Program Element 64606F, Conventional Standoff Weapon.

RELATED ACTIVITIES: There is no other system planned to provide closed loop target detection and tracking as well as real time guidance/cue-vectoring of attack platforms against second echelon armor. Currently, this mission is performed

(U) Program Element 63747F, PAVE MOVER, has developed the advanced development model PAVE MOVER radars. Continuing efforts within the program element are directed toward advanced development of improved electronic counter countermeasure techniques and target discrimination techniques for transition into the Full Scale Engineering Development program conducted within Program Element 64616F.

(U) Assault Breaker Air Launched Missile, pursued as a project within Program Element 64616F in FY 1982, has been merged with the standoff missile requirements of other engagement systems, e.g., the Precision Location Strike System, and transitioned to Full Scale Engineering Development as the Conventional Standoff Weapon. Via Program Element 64606F, the Conventional Standoff Weapon will be developed for employment from both tactical and strategic aircraft against a variety of key targets. Equipped with appropriate antiarmor submunitions, the Conventional Standoff Weapon will provide the standoff missile element of the Assault Breaker concept for application with the PAVE MOVER Engagement System.

(U) WORK PERFORMED BY: This Full Scale Engineering Development Program for the PAVE MOVER Engagement System is managed by the Air Force Systems Command at the Electronic Systems Division, Hanscom AFB, MA. MITRE Corporation, Bedford, MA, assists the Electronic Systems Division program office in overall concept studies, test planning and evaluation of demonstration results, preparation of technical specifications, and technical analyses and advice.

(U) The advanced development model PAVE MOVER radars have been developed under Program Element 63747F. That effort is managed by Air Force Systems Command at the Rome Air Development Center, Griffiss AFB, NY. The contractors for the two advanced development model radars are Hughes Aircraft, El Segundo, CA, and Grumman Aircraft, Beth Page, NY, teamed with Norden Systems, Norwalk, CT.

(U) The Air Force Test and Evaluation Center, Kirtland AFB, NM, will be responsible for the conduct of Initial Operational Test and Evaluation of the PAVE MOVER Engagement System.

Program Element: #64616F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: PAVE MOVER Engagement System
Budget Activity: Tactical Programs, 4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. (U) FY 1981 and Prior Accomplishments: Not Applicable. Advanced development was conducted within Program Elements 63747F and 63616F.

2. (U) FY 1982 Program: The two advanced development model PAVE MOVER radars are undergoing evaluation and participating in the Defense Advanced Research Projects Agency/Air Force/Army jointly funded Assault Breaker End-to-End Technology demonstration at White Sands Missile Range. This evaluation and demonstration will form a major basis for the design definition for Full Scale Engineering Development of the PAVE MOVER Engagement System.

(U) The two advanced development model radars, each installed in an F-111 aircraft for demonstration purposes only, are undergoing evaluation in two phases: (1) baseline PAVE MOVER demonstrations and (2) Assault Breaker End-to-End demonstrations. The baseline PAVE MOVER radar demonstrations include: (1) radar and related subsystem checkout and accuracy verification experiments and (2) demonstration of PAVE MOVER low probability of intercept and electronic counter countermeasures features, to include "red team" evaluation.

(U) The Assault Breaker Demonstration will involve PAVE MOVER for: (1) the detection and tracking of moving targets; (2) the providing of accurate guidance updates to standoff missiles; and (3) the cue-vectoring of a low-altitude, penetrating attack aircraft for the effective delivery of antiarmor munition against moving tank targets.

3. (U) FY 1983 Planned Program: The advanced development model PAVE MOVER radar systems installed in the demonstration F-111 will participate in an operational field exercise under unified or joint command auspices. This field exercise, drawing upon the experience gained via the FY 1982 White Sands Missile Range demonstrations, will provide a significant basis for evaluating the operational effectiveness of a PAVE MOVER system on the ground battle. Further, it will indicate the areas wherein the Full Scale Engineering Development program should concentrate activities in integrating and improving the capabilities of the advanced development model radars to develop the operational PAVE MOVER Engagement System.

(U) Design definition for the PAVE MOVER Engagement System will be conducted in FY 1983. The PAVE MOVER Full Scale Engineering Development radar will draw heavily upon the experience with the advanced development model radars gained via the FY 1982 Technology Demonstrations and the FY 1983 Operational Exercise. The approach will be to upgrade and militarize the advanced development model radar capabilities, encompassing only those improvements in overall capability that have been demonstrated as needed and/or are technologically low-risk. This approach is intended to insure an achievable development schedule at affordable and controllable cost.

(U) Design definition in FY 1983 will address the integration of the PAVE MOVER radar into an operationally desirable airborne platform. The anticipated platform is a 707 type aircraft. That aircraft provides the capability for a self contained, long endurance, highly deployable system with sufficient space for data processing, operator consoles, and interfaces to weapons and to the command and control network.

Program Element: #64616F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: PAVE MOVER Engagement System
Budget Activity: Tactical Programs, 4

(U) Competitive contract awards are planned for the activities of: developing the PAVE MOVER radar; and integrating the radar, processing, control positions, interfaces, etc, into a 707-type aircraft.

(U) The FY 1983 resource estimate contained in the FY 1982 Descriptive Summary was based upon a more rapid and ambitious initiation of the Full Scale Engineering Development program than is currently planned. To insure an achievable development schedule at affordable and controllable cost, the Full Scale Engineering Development program is now structured to draw more heavily upon the capabilties demonstrated with the advanced development model PAVE MOVER radars. Those capabilities will be upgraded and militarized but the Full Scale Engineering Development model will encompass only those improvements in overall capability that have been demonstrated to be operationally essential and/or of low technological risk. The FY 1983 operational field exercise is intended to assist in defining essential improvements.

4. (U) FY 1984 Planned Program: The design and integration of the PAVE MOVER radar integrated into the 707-type aircraft will continue. Operator consoles, command and control interfaces, and weapon interface requirements will be addressed and integrated into the aircraft.

5. (U) Program to Completion: The Full Scale Engineering Development model PAVE MOVER Engagement System will be fabricated. Development Test and Evaluation and Initial Operational Test and Evaluation will be conducted. Testing will address radar system performance along with command and control for the real time, closed loop attack of moving targets. This attack will utilize direct attack aircraft equipped for cue-vectoring via the PAVE MOVER Engagement System. Follow-on testing will be conducted utilizing the Conventional Standoff Weapon, developed under Program Element 64606F. In this testing, the PAVE MOVER Engagement System will provide accurate guidance update to the in-flight Conventional Standoff Weapon.

6. (U) Milestones: Not Applicable.

7. (U) RESOURCES: Not Applicable

8. (U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable

Project: #2814
Program Element: #64616F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: PAVE MOVER Radar/Fire Control
Title: PAVE MOVER Engagement System
Budget Activity: Tactical Programs, 4

(U) DETAILED BACKGROUND AND DESCRIPTION: Provides Full-Scale Engineering Development of a wide area target acquisition weapon delivery system (PAVE MOVER System), to include a standoff airborne radar sensor and fire control center for all weather, day/night, real time standoff detection, precise location track and attack against ground mobile second echelon targets, with emphasis on antiarmor. This project carries the products of Program Element 63747F, PAVE MOVER advanced development, through engineering development. The PAVE MOVER Engagement System enables simultaneous engagement of multiple moving and stationary ground targets by cue-vectoring penetrating tactical aircraft and using standoff missiles guided by PAVE MOVER.

The PAVE MOVER radar features advanced electronic counter countermeasures and low probability of intercept techniques to provide protection against enemy attempts at jamming, exploitation and interference. The radar features wide area continuous moving target indicator detection. It also features simultaneous small spot hybrid moving/fixed target indicator real time radar modes for [ ] ground targets with an overall weapon delivery accuracy of [ ]

(U) This project integrates the PAVE MOVER radar, radar processing, operator console positions, displays, and command and control and weapon interfaces (developed in Project 2727) into the operational aircraft for the PAVE MOVER Engagement System. The anticipated operational aircraft is a 707 type, providing needed size, endurance, range and altitude for an effective system capable of not only responding to Warsaw Pact actions but also of rapid, self contained, deployment to contingency areas.

RELATED ACTIVITIES: There is no other system planned to provide closed loop target detection and tracking as well as real time guidance/cue-vectoring of attack platforms against second echelon armor. Currently, this mission is performed [ ]

(U) Program Element 63747F, PAVE MOVER, has developed the advanced development model PAVE MOVER radars. Continuing efforts within that program element are directed toward advanced development of improved electronic counter countermeasures techniques and target discrimination techniques for transition into the Full Scale Engineering Development program conducted within Program Element 64616F.

(U) Assault Breaker Air Launched Missile, pursued as a project within Program Element 64616F in FY 1982, has been merged with the standoff missile requirements of other engagement systems, e.g., the Precision Location Strike System, and transitioned to Full Scale Engineering Development as the Conventional Standoff Weapon. Via Program Element 64606F, the Conventional Standoff Weapon will be developed for employment from both tactical and strategic aircraft against a variety of key targets. Equipped with appropriate antiarmor submunitions, the Conventional Standoff Weapon will provide the standoff missile element of the Assault Breaker concept for application with the PAVE MOVER Engagement System.

(U) WORK PERFORMED BY: This Full Scale Engineering Development Program for the PAVE MOVER Engagement System is managed by the Air Force Systems Command at the Electronic Systems Division, Hanscom AFB, MA. MITRE Corporation, Bedford, MA, assists the Electronic Systems Division program office in overall concept studies, test planning and evaluation of demonstration results, preparation of technical specifications, and technical analyses and advice.

Project: #2814 | Title: PAVE MOVER Radar/Fire Control
Program Element: #64616F | Title: PAVE MOVER Engagement System
DOD Mission Area: Close Air Support and Interdiction, #223 | Budget Activity: Tactical Programs, 4

(U) The advanced development model PAVE MOVER radars have been developed under Program Element 63747F. That effort is managed by Air Force Systems Command at the Rome Air Development Center, Griffiss AFB, NY. The contractors for the two advanced development model radars are Hughes Aircraft, El Segundo, CA, and Grumman Aircraft, Beth Page, NY, teamed with Norden Systems, Norwalk, CT.

(U) The Air Force Test and Evaluation Center, Kirtland AF, NM, will be responsible for the conduct of Initial Operational Test and Evaluation of the PAVE MOVER Engagement System.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. (U) FY 1981 and Prior Accomplishments: Not Applicable. Advanced development was conducted within Program Elements 63747F and 63616F.

2. (U) FY 1982 Program: The two advanced development model PAVE MOVER radars are undergoing evaluation and participating in the DARPA/Air Force/Army jointly funded Assault Breaker End-to-End Technology Demonstration at White Sands Missile Range. This evaluation and demonstration will form a major basis for the design definition for Full Scale Engineering Development of the PAVE MOVER Engagement System.

(U) The two advanced development model radars, each installed in an F-111 aircraft for demonstration purposes only, are undergoing evaluation in two phases: (1) baseline PAVE MOVER demonstrations and (2) Assault Breaker End-to-End demonstrations. The baseline PAVE MOVER radar demonstrations include: (1) radar and related subsystem checkout and accuracy verification experiments and (2) demonstration of PAVE MOVER low probability of intercept and electronic counter countermeasures features, to include "red team" evaluation.

(U) The Assault Breaker Demonstration will involve PAVE MOVER for: (1) the detection and tracking of moving targets; (2) the providing of accurate guidance updates to standoff missiles; and (3) the cue-vectoring of a low-altitude, penetrating attack aircraft for the effective delivery of antiarmor munitions against moving tank targets.

3. (U) FY 1983 Planned Program: The advanced development model PAVE MOVER radar systems installed in the demonstration F-111s will participate in an operational field exercise under unified or joint command auspices. This field exercise, drawing upon the experience gained via the FY 1982 White Sands Missile Range demonstrations, will provide a significant basis for evaluating the operational effectiveness of a PAVE MOVER system on the ground battle. Further, it will indicate the areas wherein the Full Scale Engineering Development program should concentrate activities in integrating and improving the capabilities of the advanced development model radars to develop the operational PAVE MOVER Engagement System.

(U) Design definition for the PAVE MOVER Engagement System will be conducted in FY 1983. The PAVE MOVER Full Scale Engineering Development radar will draw heavily upon the experience with the advanced development model radars gained via the FY 1982 Technology Demonstrations and the FY 1983 Operational Exercise. The approach will be to upgrade and militarize the advanced development model radar capabilities, encompassing only those improvements in overall capability that have been demonstrated as needed and/or are technologically low-risk. This approach is intended to insure an achievable development schedule at affordable and controllable cost.

(U) Design definition in FY 1983 will address the integration of the PAVE MOVER radar into an operationally desirable airborne platform. The anticipated platform is a 707 type aircraft. That aircraft provides the capability for a self-contained, long endurance, highly deployable system with sufficient space for data processing, operator consoles, and interfaces to weapons and to the command and control network.

(U) Competitive procurement awards will be conducted for the PAVE MOVER radar development and for integration of all required elements in the 707 type aircraft

4. (U) FY 1984 Planned Program: The design and integration of the PAVE MOVER radar integrated into the 707-type aircraft will continue. Operator consoles, command and control interfaces, and weapon interface requirements will be addressed and integrated into the aircraft.

5. (U) Program to Completion: The Full Scale Engineering Development model PAVE MOVER Engagement System will be fabricated. Development Test and Evaluation and Initial Operational Test and Evaluation will be conducted. Testing will address radar system performance along with command and control for the real time, closed loop attack of moving targets. This attack will utilize direct attack aircraft equipped for cue-vectoring via the PAVE MOVER Engagement System. Follow-on testing will be conducted utilizing the Conventional Standoff Weapon, developed under Program Element 64606F. In this testing, the PAVE MOVER Engagement System will provide accurate guidance update to the in-flight Conventional Standoff Weapon.

6. (U) Milestones:

	Date:
A. Operational Exercise/Design Definition	FY 1983
B. Award FSED Contract	Jul 1983
C. Air Force/Defense Systems Acquisition Review Council II	Feb 1984
D. Complete Development Test and Evaluation	Sep 1987
E. Complete Initial Operational Test and Evaluation	Jul 1988

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		12,809	25,628	64,679	191,820	294,936

Project: #2814 | Title: PAVE MOVER Radar/Fire Control
Program Element: #64616F | Title: PAVE MOVER Engagement System
DOD Mission Area: Close Air Support and Interdiction, #223 | Budget Activity: Tactical Programs, 4

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		10,617	84,200		168,600	263,417

(U) The RDT&E FY 1983 resource estimate contained in the FY 1982 Descriptive Summary was based upon a more rapid and ambitious initiation of Full Scale Engineering Development than is currently planned. The currently planned program provides for operational evaluation in FY 1983 of the advanced development model PAVE MOVER radars to assist in defining essential improvements for incorporation in the Full Scale Engineering Development design.

(U) The RDT&E Total Estimated Costs contained in the FY 1982 Descriptive Summary were based upon limited, if any, on-board processing display and control capability. The current estimate of total RDT&E costs is based upon extensive on-board processing, display and control capability consistent with a 707-type aircraft as the anticipated operational platform.

Project: #2727
Program Element: #64616F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: PAVE MOVER Interfaces
Title: PAVE MOVER Engagement System
Budget Activity: Tactical Programs, 4

(U) DETAILED BACKGROUND AND DESCRIPTION: Provides Full Scale Engineering Development of interfaces between the airborne radar platform with standoff air and ground launched missiles, direct attack aircraft, and elements of the theater command and control network.

(U) Develops secure, jam resistant direct communication interfaces to the respective weapons/aircraft to provide updated target location data and in-flight weapon guidance data. For application with the Conventional Standoff Weapon, being developed under Program Element 64616F, primary emphasis will be on adapting the weapon data terminal used by the Conventional Standoff Weapon with the Precision Location Strike System to a common usage data terminal. Provides development, as needed, of transponders/interfaces for direct attack penetrating aircraft to enable their cue-vectoring via the PAVE MOVER Engagement System.

(U) Develops appropriate interfaces for integration of the airborne PAVE MOVER Engagement System with the theater command and control network to include mechanisms for transfer of data between sensor systems, other engagement systems, and other Service and Allied systems. The use of a flexible, distributive, communications network such as provided by the Joint Tactical Information Distribution System, Program Element 64754F, is envisioned for making PAVE MOVER collected and processed data available to appropriate command and control elements. Develops command and control interfaces as needed for deployment to contingency areas and operation with Rapid Deployment Force elements.

(U) RELATED ACTIVITIES: This project provides integration and interfaces between the PAVE MOVER radar/fire control center and other external air and surface launched standoff missiles, penetrating tactical aircraft, existing and planned Command, Control and Communication elements, and other complimentary sensor systems. The development of the Conventional Standoff Weapon, an air-launched standoff missile for application with PAVE MOVER and other engagement systems, is conducted under Program Element 64606F. Complementary sensor systems include the Advanced Synthetic Aperture Radar System, Program Element 64756F and the Precision Location Strike System, Program Element 64742F.

(U) WORK PERFORMED BY: Development of the interfaces for the PAVE MOVER Engagement System is managed by the Air Force Systems Command via the PAVE MOVER Engagement System Program Office, Electronic Systems Division, Hanscom AFB MA. The Air Force Test and Evaluation Center, Kirtland AFB, NM, will be responsible for the conduct of Initial Operational Test and Evaluation.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Program: Analyses of command and control interfaces are conducted. As a result, an Interoperability Requirements Document was prepared and is being coordinated. That document details the communications and data flow requirements between the PAVE MOVER Engagement System and the existing and planned command and control network.

Project: #2727
Program Element: #64616F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: PAVE MOVER Radar Interfaces
Title: PAVE MOVER Engagement System
Budget Activity: Tactical Programs, 4

3. (U) FY 1983 Planned Program: Based upon the experience gained with the advanced development model PAVE MOVER radars in the FY 1982 Technology Demonstration and the FY 1983 Operational Exercise, the draft Interoperability Requirements Document will be modified as warranted. This will provide the basis for interface design definition and preparation of specifications to ensure proper integration of the PAVE MOVER Engagement System with the command and control network.

4. (U) FY 1984 Planned Program: Design, simulation analyses, development and test of PAVE MOVER Engagement System interfaces, hardware and software, will be conducted.

5. (U) Program to Completion: Hardware fabrication is accomplished along with software development and checkout. Development Test and Evaluation and Initial Operational Test and Evaluation is conducted.

6. (U) Milestones:

		Date
A.	Operational Exercise/Design Definition	FY 1983
B.	Award FSED Contract	Jul 1983
C.	Air Force/Defense Systems Acquisition Review Council II	Feb 1984
D.	Complete Development Test and Evaluation	Sep 1987
E.	Complete Initial Operational Test and Evaluation	Jul 1988

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		2,200	3,700	11,700	39,100	56,700

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		1,020	25,081		59,905	86,006

(U) The FY 1983 resource estimate contained in the FY 1982 Descriptive Summary was based upon a more rapid and ambitious initiation of Full Scale Engineering Development than is currently planned. The currently planned program gains the advantages of operational field experience with the advanced development model radars during FY 1983 to assist in defining essential improvements in capability needed for the Full Scale Engineering Development program.

Project: #2727
Program Element: #64616F
DOD Mission Area: Close Air Support and Interdiction, #223

Title: PAVE MOVER Radar Interfaces
Title: PAVE MOVER Engagement System
Budget Activity: Tactical Programs, 4

(U) The Total Estimated Costs shown in the FY 1982 Descriptive Summary included the development of a totally new data link/transponder for an appropriate air-launched standoff missile. The estimate has been reduced since the current objective is to utilize, or modify as needed, the data link structure provided by the Conventional Standoff Weapon, PE 64606F.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64706F — Title: Life Support System
DoD Mission Area: Air Warfare Support, #225 — Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING: ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	9,120	10,959	12,417	20,130	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is to provide centralized management and development of life support equipment and subsystems necessary to assure maximum functional capability of aircrews throughout all mission environments and to enhance safe escape, descent, survival and recovery in emergency situations. Also provides for development, test and standardization of emergency equipment and protective clothing and devices for non-flying personnel. This is the only United States Air Force Program Element devoted to engineering development of life support equipment.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Funds are required for continuing and starting new efforts to develop life support equipment and protective clothing for flying and non-flying personnel. Over 25 different development tasks are included in this program. Each development task is the result of a validated requirement to either correct deficiencies in existing equipment or to develop new equipment. This program also directly supports all future weapon system development for life support systems considerations. The tasks within the program have been coordinated with the other Services to avoid duplication of effort. The United States Air Force has Tri-Service research and development responsibility for some of the tasks. The estimates are based on detailed implementation plans prepared by field agencies in support of the validated operating command requirements.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	11,500	11,152	18,829		Continuing	Not Applicable

Other Procurement — Life support equipment is procured under many weapon system and air base support Program Elements.

(U) OTHER APPROPRIATION FUNDS: Life support equipment is procured under many weapon system and air base support Program Elements. Program Element 64706F funds are not used to satisfy production requirements. Funding for initial production of replacement items is normally provided by the Air Force Logistics Command System or Item Manager under various budget authorizations. Government Furnished Aeronautical Equipment acquisitions are funded by weapon system program elements. New items being introduced into the inventory for the first time are programmed by Air Force Systems Command and budgeted under Aircraft Program Elements; the thermal/nuclear flashblindness goggles for the Strategic Air Command are procured under several Air Base Support Program Elements; the Rocket Fuel Handler's Clothing Outfit is procured with funds from the Space Shuttle Program Element.

Program Element: #64706F | DoD Mission Area: Air Warfare Support, #225

Title: Life Support System | Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Life Support System is composed of two major areas. The first includes the development or improvement of aircrew equipment such as flight clothing, oxygen equipment, helmets, anti-g pressure suits, nuclear flashblindness goggles, aircrew armor, ejection seats, restraint harnesses, automatic opening lab belts, parachutes, cartridge and propellant actuated devices, passenger egress systems, life preservers, rafts, anti-exposure suits, arctic clothing, survival kits, escape and evasion devices, survival radios and signaling devices. The other area includes the development or improvement of life support equipment for non-flying personnel and includes foot wear, eye protection, oxygen equipment, head protection, and hazard monitoring and protective devices. The system provides aircrews, passengers and non-flying personnel with equipment and protective clothing necessary to maximize both their functional contribution to assigned missions and to enhance the probability of their survival during emergency situations. The program provides for continual design, development, test, acquisition and operational support of personal equipment, mission related equipment and aircraft installed life support equipment.

(U) RELATED ACTIVITIES: There are several Program Elements which provide exploratory development that contribute to full scale engineering development of life support equipment. Among these are Program Element 62201F, Aerospace Flight Dynamics; Program Element 62202F, Aerospace Biotechnology; Program Element 63205F; Flight Vehicle Technology; Program Element 64601F, Chemical/Biological Defense Equipment, Program Element 62723A, Clothing, Equipment and Shelter Technology; Program Element 63747A, Clothing and Equipment, Soldier Support/Survivability; Program Element 64204A, Air Mobility Support Equipment; Program Element 64713A, Combat Feeding, Clothing and Equipment; Program Element 62241N, Ejection Seat Bio-Dynamics; Program Element 62758N, Biomedical Technology; Program Element 63216N, Mission Oriented Clothing and Devices; Program Element 64264N, Life Support Equipment. All tasks within this program are coordinated with the other Services. A formal Tri-Service Steering Committee was established in 1980 to achieve standardization and prevent duplication of efforts.

(U) WORK PERFORMED BY: The Aeronautical Systems Division, Air Force Systems Command, located at Wright-Patterson Air Force Base, Ohio, provides program management responsibility. Close interaction is maintained with other Air Force System Command Product Divisions, Test Centers and Laboratories. Support is also provided by other Service organizations, i.e.: the Army Natick Research and Development Command, Natick, MA; Naval Ordnance Station, Indian Head, MD; Naval Air Development Center, Warminster, PA. The ten major contractors in FY 1981 were: Air Research Manufacturing Company, Torrance, California; Douglas Aircraft Company, Long Beach, California; H. Koch & Sons, Anaheim, California; Irvin Industries Canada, Ltd, Ft. Erie, Ontario, Canada; Cubic Corporation, San Diego, California; Bendix Corporation, Davenport, Iowa; Gentex, Carbondale, Penn.; Talley Industries, Phoenix, Arizona; Frost Engineering, Englewood, Colorado; Motorola, Albuquerqe, New Mexico and nine other contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and prior Accomplishments: Prior accomplishments include the development of numerous personal equipment, escape and descent, and survival and recovery equipment items now used by aircrews. Some of these items include oxygen masks and regulators, life rafts and inflation systems arctic clothing and survival kits, fire retardant flight clothing, improved aircrew helmets, survival radios and beacons, parachutes, the Advanced Concept Ejection Seat for A-10, F-15 and F-16 aircraft, Open Loop Oxygen Generating Systems for fighter and bomber aircraft and thermal flashblindness devices for the Strategic Air Command.

Program Element: #64706F
DoD Mission Area: Air Warfare Support, #225

Title: Life Support System
Budget Activity: Tactical Programs, #4

2. (U) FY 1982 Program: Continue with development of on-going tasks. Included are: Tri-Service Survival Avionics System for Search and Rescue Service; non-helmeted thermal flashblindness devices for the Tactical Air Command, Military Airlift Command and Strategic Air Command; joint United States Air Force/Canada Automatic Inflation Modulation Parachute; Joint United States Air Force/United States Navy Open Loop Oxygen Generating System for two-man fighter aircraft; lightweight helmet for the Tactical Air Command; high performance anti-g systems (valves and suits) for high acceleration aircraft; Rocket Fuel Handler's Clothing Outfit for space shuttle personnel; active arm and leg restraint systems for high speed ejection; advanced aircrew armor for the Military Airlift Command; pararescue radios and other smaller life support efforts. New starts in FY 1982 will include: Vacuum packed sleeping bags, safety toed arctic boots and a one-piece arctic fire retardant flying coverall for the Alaskan Air Command; escape and evasion viewing devices, and smoke masks for ground alert personnel for the Strategic Air Command; single-point release system for the advanced concept ejection seat.

3. (U) FY 1983 Planned Program: Continue with development of the FY 1982 new starts and complete the development of the Survival Avionics System, Open Loop Oxygen Generating System and six other efforts. Proposed new starts will include: advanced escape system propulsion systems; wind blast protective devices for high speed ejection; high performance ballistically powered restraint system and advanced aerodynamic decelerators for open ejection seats; advanced digital sequencer and pitot/static sensor for the advanced concept ejection seat. Several programs were cancelled and/or program schedules revised to account for the differences from the FY 1982 estimate.

4. (U) FY 1984 Planned Program: Continue with development efforts begun in previous years. Initiate the following new starts: integrated aircrew ensemble for survival in all global environments; design and test subsystems and components for the next generation open ejection seat; design and test advanced aircraft canopy removal systems.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 DESCRIPTIVE SUMMARY: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64708F Title: Other Operational Equipment
DOD Mission Area: Air Warfare Support, 225 Budget Activity: Tactical Programs, #4

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	11,446*	12,155	16,553	18,257	Continuing	Not Applicable
2054	Aerospace Facilities Eng	983	1,205	928	1,057	Continuing	Not Applicable
2479	Common Support Equipment	818	1,550	925	1,700	Continuing	Not Applicable
2505	Aircraft Firefighting Equip	550	600	300	300	Continuing	Not Applicable
2536	Mobile Acft Arresting Equip	786	1,500				3,286
2621	Rapid Runway Repair	4,500	6,300	7,300	5,100	18,700	41,900
2674	Tactical Shelters**	715	0	600	900	Continuing	Not Applicable
2783	Ground Power Generator***	0	0	6,500	9,200	4,400	20,100
5973	Visually Coupled Systems	1,300	400				5,681

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Technological advancements and changing threat scenarios create a continuing need to improve operational forces readiness and support equipment. This program element contains a group of projects which develop, test, and evaluate a variety of readiness and support components and equipments in response to these needs. This program develops improved means for rapid recovery of an airbase to operational readiness after an attack; standardized, low life cycle cost, support equipment and tactical shelters for many weapon systems; and durable, reliable, efficient and safe aerospace facilities. Work performed within this element is done in close cooperation with sister military services, civilian government organizations and/or friendly foreign governments.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funding for continuing the following efforts in FY 83: Aerospace Facilities Engineering, Common Support Equipment, Aircraft Firefighting Equipment, Rapid Runway Repair, Tactical Shelters, Ground Power Generator and Weapons Effects Tests. The above estimates are based on engineering judgment and contractor inputs.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	9,776	13,200	16,300		Continuing	Not Applicable

* Total for FY 1981 includes funds reprogrammed to continue the Weapons Effects Tests.
** Total for FY 1982 includes funds being held in reserve for Project 2674 pending resolution of congressional language reducing FY 82 funding for tactical shelters.
***Ground Power Generator development was initiated within Project 2479 prior to FY 1983.

Program Element: #64708F
DOD Mission Area: Air Warfare Support, 225

Title: Other Operational Equipment
Budget Activity: Tactical Programs, #4

(U) OTHER APPROPRIATION FUNDS:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement						
PE 27128F						
Ground Power Generator					231,700	231,700
(Quantity)					(720)	(720)
PE: Various						
Common Support Equipment*			2,507	1,308	Continuing	Not Applicable
(Quantity)			(561)	(481)		
Other Procurement						
PE 27596F						
Mobile Acft Arresting Equip				5,795	106,005	111,800
(Quantity)				(7)	(89)	(96)
Rapid Runway Repair**					59,520	59,520
(Quantity)					(30)	(30)
PE 41896F						
Rapid Runway Repair**					1,984	1,984
(Quantity)					(1)	(1)

*Universal Towbars, X/Ku Band Radar Test Sets
**Concrete Mobile, Resin Tank Truck, Minimobile

Program Element: #64708F | Title: Other Operational Equipment
DOD Mission Area: Air Warfare Support, 225 | Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The projects in this program element address operational force deficiencies, the need to reduce proliferation and operational costs of support equipment, and public law requirements dealing with environmental quality and protection. A brief description of these projects follows. Project 2054, Aerospace Facilities Engineering, provides research and development in four broad areas of Air Force Civil Engineering-Base Survivability, Environmental Engineering, Aircraft Operational Surfaces, and Alternate Energy Sources. Project 2479, Common Support Equipment, provides opportunities to reduce the proliferation of non-standard support equipment and to increase fuel efficiency of this equipment. Equipments developed under this project are applicable to many different weapons systems. Project 2505, Aircraft Firefighting Equipment, provides a continuing effort to improve the Air Force's capability to fight aircraft fires. Project 2621, Rapid Runway Repair addresses the problems of rapidly restoring runways and other aircraft operational surfaces for service following an airfield attack. Project 2674, Tactical Shelters, makes sure the Air Force has reliable, cost effective tactical shelter systems for its operational support needs. Project 2783, Ground Power Generator, provides for a much more fuel efficient ground power generator and compatible air conditioner for flight line support of aircraft. Baseline determination of weapons effectiveness is also planned.

(U) RELATED ACTIVITIES: Program Elements 63723F, Civil and Environmental Engineering Technology, and 63203F, Advanced Avionics for Aircraft, provide advanced development in the Civil Engineering and Avionics Engineering areas. Program Element 27596F, Base Operations (Tactical Air Forces), provides for procurement of Mobile Aircraft Arresting Equipment and Rapid Runway Repair. Program Element 41896F also provides procurement for Rapid Runway Repair. Program Element 27128F, F-4, provides for procurement of the Ground Power Generator.

(U) WORK PERFORMED BY: Program Management is provided by the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH; Electronic Systems Division, Hanscom Air Force Base, MA; and the Air Force Engineering and Services Center, Tyndall Air Force Base, FL. In-house facilities include the Wright Aeronautical Laboratories (Avionics, Materials, and Flight Dynamics), Wright-Patterson Air Force Base, OH; Rome Air Development Center, Griffiss Air Force Base, NY; Air Force Flight Test Center, Edwards Air Force Base, CA; and the Air Force Engineering and Services Center, Tyndall Air Force Base FL. Contractors include Boeing, Brunswick, National Bureau of Standards, Lear Siegler, Sperry Rand, Gitchner Mobile Systems. General Telephone and Electronics, IES Texas, Kaman Avidyne and Allied Electronics Corporation, Goodyear Aerospace Corp, Radian Corp, Lockeed, BDM Corp, General Dynamics, McDonnell Douglas, Fairchild-Hiller, Battelle Columbus Labs, University of California at Berkley, University of New Mexico, Fire Research Laboratory, and Naval Air Engineering Center.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Completed test and evaluation of a replacement for the A-20 fire extinguisher and compatible extinguishing agent. Developed X/Ku band radar test set. Completed final design of mobile aircraft arresting equipment. For Rapid Runway Repair, completed F-4 surface roughness criteria used this criteria to finalize procedures for manual selection of a minimum operating strip. Completed a comprehensive airfield pavement recycling test plan. Completed design of an advanced panel for mobile shelters. In environment engineering, the

spill assessment model is now available for use as a management tool to assess spills of hydrazine fuels and other hazardous materials into water bodies. Techniques for biological treatment of phenolic wastes and solvent removal from groundwater were developed. The range planning hazard analysis model was developed which applies state-of-art risk analysis techniques to a data base of weapons/tactics delivery descriptors employed in weapons test scenarios and aircrew training events.

2. (U) FY 1982 Planned Program: In bomb damage repair, continue development of advanced crater repair materials and techniques and develop a near term repair method using fiber reinforced polyester mats. Continue development of F-15, F-16, and C-5 surface roughness criteria. Complete surface roughness criteria for C-130 and C-141. Complete evaluation of alternate surface designs, investigate pavement weapon damage effects and methods to reduce damage. Establish criteria for heavy load, high tire pressure, recycled airfield asphaltic pavements. In environmental engineering, continue efforts to define the toxic corridor associated with either a planned or accidental release of toxic fuels. Evaluate the performance of an aerated trickling filter bioreaction in treating paint stripping wastewater. Complete test and evaluation of mobile aircraft arresting systems to permit use of short sections of suitable landing strips for aircraft recovery on a contingency basis. Continue to develop more reliable, low life cycle cost, standardized support equipment, fire protection equipment/methods, and alternate energy systems applicable to many ground and aircraft weapons systems. Complete helmet mounted sight units. Complete pre-award contract work for the fuel efficient ground power generator. Continue test and evaluation of inventory weapons.

3. (U) FY 1983 Planned Program: Continue development of rapid repair techniques for pavement using advanced materials and develop equipment for handling of these materials. Complete F-16, F-15 and C-5A surface roughness criteria. Initiate development of surface roughness criteria for F-111. Complete aircraft/soil interaction study and finalize alternate surface and damage resistant runway designs. Establish criteria for selection of the minimum operating strip for multiple aircraft. Initiate work to recycle portland cement concrete for heavy load airfield pavements. Continue hardened structure overlay development and initiate airbase survivability assessment for 1990's threat. In the area of environmental engineering, develop methods for cost effective investigation and cleanup of AF contaminated groundwater. Provide recovery, reduction and treatment technology to handle AF hazardous wastes. Award contracts to design and develop fuel efficient ground power generator. Continue to develop more reliable, low life cycle cost, standardized support equipment, tactical shelters, fire protection equipment/methods, and environmental protection systems applicable to many ground and aircraft weapons systems. Continue test and evaluation of inventory weapons. Complete Technical Data Package for the Mobile Aircraft Arresting System.

4. (U) FY 1984 Planned Program: The planned program will continue to emphasize development of improved materials, procedures, and equipment which enhance the Rapid Runway Repair capability, the ability to recycle airfield pavements, airfield pavement performance, and facilities operation and maintenance. Continue efforts on foreign object damage protection to aircraft passing over repaired craters. Continue development of means for reducing smoke visibility in aircraft engine exhaust plumes and for reducing smoke from aircraft test facilities. Continue testing of remote sensing equipment for aircraft pollutants, toxic vapor clouds and chemical warfare agents. Complete prototype of two ground power generator designs. Initiate test and evaluation of these prototypes. Initiate development of a standard hydraulic

Program Element: #64708F
DOD Mission Area: Air Warfare Support, 225

Title: Other Operational Equipment
Budget Activity: Tactical Programs, #4

test stand and a standard aircraft flight line X-Ray Unit. Continue development of a shelter hardened to ballistic, chemical-biological and nuclear threats. Complete development of a fiber reinforced plastic shelter. Continue development of improved fire protection equipment/methods for Air Force unique applications. Initiate development of improved bare base shelters, latrines and field kitchens to meet the needs of the DOD Rapid Deployment Joint Task Force.

5. (U) Program to Completion: This is a continuing program. For the other procurement funding for the Mobile Aircraft Arresting System, the increase in the additional to completion cost estimates is due to an increase in cost per unit and an increase in the quantity needed for operational requirements.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

Project Number: #2621
Program Element: 64708F
DOD Mission Area: Air Warfare Support, #225

Title: Rapid Runway Repair
Title: Other Operational Equipment
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The existence of hardened aircraft shelters at United States Air Force bases in Europe makes airfield operating surfaces lucrative targets. Rapid Runway Repair is a development project whose objectives are to provide methods, materials and equipment for rapid repair of airfield pavements after an enemy attack; and to design alternate launch and recovery surfaces for aircraft operations that are independent of, and redundant to, conventional pavements. This project has four major technical thrusts: (1) Damage Assessment and Recovery Plan, (2) Bomb Damage Repair, (3) Surface Roughness Criteria Determination, and (4) Alternate Surfaces.

(U) RELATED ACTIVITIES: Program Element 63723F, Civil and Environmental Engineering Technology, Project 2104, Civil Engineering Technology, provides the technology base for Rapid Runway Repair.

(U) WORK PERFORMED BY: Program Management is provided by the Air Force Engineering and Services Center, Tyndall AFB, FL and the Aeronautical Systems Division, Wright-Patterson AFB, OH. In-house facilities include the Wright Aeronautical Laboratories, Wright-Patterson AFB, OH, Air Force Flight Test Center, Edwards AFB, CA and Air Force Engineering and Services Center, Tyndall AFB, FL. Contractors include BDM Corp., Boeing, Lockheed, General Dynamics, McDonnell Douglas, Fairchild-Hiller, and Battelle Columbus Laboratories.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1981 and Prior Accomplishments: Completed F-4 surface roughness criteria, and used this criteria to finalize procedure for manual selection of minimum operating strip. New bomb crater fill and crown materials were investigated. A post attack environment reconnaissance sensor was prototyped. Completed computer simulations and validation testing of surface roughness criteria for the F-4E, C-130 and C-141. Concepts for alternate operating surfaces were drafted. Two new crater repair techniques were demonstrated and recommended for procurement: (a) crushed limestone for large and small craters, and (b) silikal polymer concrete for spall damage.

2. (U) FY 1982 Planned Program: In bomb damage repair, continue development of advanced crater repair materials and techniques and develop near term repair method using fiber reinforced polyester mats. Continue development of F-15, F-16, and C-5 surface roughness criteria. Complete surface roughness criteria development for C-130 and C-141. Complete evaluation of alternate surface designs, investigate pavement weapon damage effects and methods to reduce damage. Establish criteria for heavy load, high tire pressure, recycled airfield asphaltic pavements.

3. (U) FY 1983 Planned Program: Continue development of repair techniques using advanced materials and develop equipment for handling of these materials. Complete F-16, F-15 and C-5A roughness criteria. Initiate development of surface roughness criteria for F-111. Complete aircraft/soil interaction study and finalize alternate surface and damage resistant runway designs. Complete minimum operating strip selection criteria for multiple aircraft.

Project Number: #2621 Title: Rapid Runway Repair
Program Element: 64708F Title: Other Operational Equipment
DOD Mission Area: Air Warfare Support, #225 Budget Activity: Tactical Programs, #4

4. (U) FY 1984 Planned Program: The planned program will continue to emphasize development of improved materials, procedures and equipment which enhance the Rapid Runway Repair capability. Continue efforts on foreign object damage protection to aircraft passing over repaired craters.

5. (U) Program to Completion: This is a continuing project.

6. (U) Milestones: Not Applicable

7. (U) Resources:

		FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		4,500	6,300	7,300	5,100	18,700	41,900
Other Procurement	PE: 27596F					59,520	59,520
	PE: 41806F					1,984	1,984

8. (U) Comparison with FY 1982 (Descriptive Summary)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,000	6,766	8,500		21,634	41,900
Other Procurement	Not addressed					

Dollar difference between the FY 1982 and FY 1983 Descriptive Summaries is due to reduction of funds for all projects of PE 64708F, except project 2783, Ground Power Generator. In the FY 1982 Descriptive Summary, the Ground Power Generator was one of several tasks within Project 2479 and the FY 1983 funding estimate for project 2479 was $4,100K. In the FY 1983 Descriptive Summary, the Ground Power Generator is a distinct project, 2783, with its funding estimate established at $6,500K by tranferring funds into PE 64708F for that specific purpose, and the FY 1983 funding estimate for Project 2479 is $1,003K.

Project Number: #2783
Program Element: 64708F
DOD Mission Area: Air Warfare Support, #225

Title: Ground Power Generator
Title: Other Operational Equipment
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force inventory of flight line generators and air conditioners, AM 32A-60 and AM 32C-10 series respectively, is near the end of its life cycle and soon must be replaced. These generators and air conditioners are very expensive to operate primarily due to high fuel consumption. The objective of this project is to develop a flight line ground power generator and air conditioner that are much more fuel efficient. This will significantly reduce the operational cost, life cycle cost and the need for excessive quantities of fuel.

(U) RELATED ACTIVITIES: The Ground Power Generator development was initiated within Project #2479, Common Support Equipment, PE 64708F, and will be a discrete project in FY 1983.

(U) WORK PERFORMED BY: Program Management is provided by the Aeronautical Systems Division, Wright-Patterson AFB, OH.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1981 and Prior Accomplishments: Completed project documentation, such as specifications, Statement of Work, source selection criteria and Determination and Findings.

2. (U) FY 1982 Planned Program: Release request for proposal for the ground power generator and compatible air conditioner. Conduct source selection.

3. (U) FY 1983 Planned Program: Award contracts to two contractors for competitive design and development of two differently designed prototypes.

4. (U) FY 1984 Planned Program: Complete system design. Complete fabrication of prototypes. Initiate component and system tests.

5. (U) Program to Completion: Perform Initial Operational Test and Evaluation of prototypes. Perform qualification testing. Determine best system. Award production contract.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	0	0	6,500	9,200	4,400	20,100
Aircraft Procurement					231,700	231,700

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64710F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Reconnaissance Equipment
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	14,855	11,357	7,695	23,781	Continuing	Not Applicable
1155	Electro-Optical Collection/ Reconnaissance (COMPASS SEVEN)	3,150	4,900	3,895	6,000	Continuing	Not Applicable
1156	Radiation Intelligence (RINT)	1,050	667	0*	0*		
2096	Interim Tactical ELINT Processor (ITEP)	4,200	1,500	100	500	0	10,000
2337	Advanced Reconnaissance Sensor (ADRES)	0	2,200	2,000	5,500	10,200	19,900
2501	Electronic Warfare Support Measures (EWSM)	0	0	0	2,981**	9,219**	12,200**
2533	Electronic Warfare/Close Air Support Joint Test (EW/CAS)	3,500	390	0	0	0	9,700
2704	Tactical Electronic Reconnaissance Sensor (TEREC)	2,955	1,700	1,700	1,900	4,200	25,500
2660	AAQ-X Infrared Sensor	0	0	0	6,900	26,200	33,100

* Project transferred to Tactical Cryptologic Program, Program Element 35885G, in FY 1983.
** Action being taken to transfer project to the Tactical Cryptologic Program.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Projects in this program element support Air Force operating commands' reconnaissance requirements by providing engineering development of airborne and ground equipment used to collect, record, and process imagery and electronic warfare data for operational forces.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds for the develonment of airborne equipment for such aircraft as the RF-4C and RC-135 and includes electronic, optical, laser, and infrared sensors, along with their associate data links and ground equipment. An example is the Tactical Electronic Reconnaissance System. Cost estimates for conduct of these projects are based on best engineering estimates by experienced personnel in the Aeronautical Systems Division and Electronic Systems Division of Air Force Systems Command.

Program Element: #64710F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Reconnaissance Equipment
Budget Activity: Tactical Programs, #4

(U) COMPARISION WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	14,900	13,300	19,900		Continuing	Not Applicable
Procurement (Other) (PE 27213F)	4,700					

(U) OTHER APPROPRIATION FUNDS:

Procurement (Aircraft) (PE 27213F)	20,034	490		1,889		104,862*
Procurement (Other) (PE 27213F)	4,752	6,114				10,366

* Includes $25.0M initiated by Congress in FY 1981 for buy of additional six Tactical Electronic Reconnaissance Sensor Systems.

Program Element: #64710F | Title: Reconnaissance Equipment
DOD Mission Area: TIARA for Tactical Air Warfare, #327 | Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Projects in this Program Element provide improvements to existing capabilities and provide new operational capabilities to collect, record, and process imagery and electronic warfare support measure data for operational forces. These projects are primarily responsive to the reconnaissance and electronic warfare support requirements of the Tactical Air Forces, Strategic Air Command, and the Electronic Security Command. Airborne equipment includes electronic, optical, laser, and infrared sensors and their associated data links. Ground equipment includes data processing and dissemination. While most systems developed under this Program Element become engineering prototypes for follow-on production, several projects develop unique intelligence gathering sensor systems to provide data required for design and development of new systems.

(U) RELATED ACTIVITIES: All projects in this Program Element are coordinated as appropriate with the Services and/or the National Security Agency groups involved in reconnaissance and electronic warfare activities. PE 63743F, Electro-Optical Warfare, and PE 63208F, Reconnaissance Sensors/Processing Technology, provide advanced development technology inputs to this Program Element. The Interim Tactical Electronic Intelligence Processor is being developed in coordination with the Army TENCAP Office. An electro-optical intelligence receiver for intelligence collection is being developed in conjunction with the Defense Intelligence Agency and the Defense Advanced Research Projects Agency. Procurement funds for aircraft modifications resulting from this program, such as the Tactical Electronic Reconnaissance (TEREC) System, are provided by PE 27213F, RF-4C Squadrons. Procurement funds for ground exploitation facilities, such as TEREC processing, are generally provided by PE 27431F, Tactical Air Intelligence Systems Activities and PE 27213F, RF-4C Squadrons. Planned new starts in sensor development will address requirements for sensor capabilities for advanced tactical air reconnaissance systems developed under PE 63239F.

(U) WORK PERFORMED BY: Responsible Air Force agencies of the Air Force Systems Command include the Aeronautical Systems Division, Wright-Patterson AFB, OH and the Electronic Systems Division, Hanscom AFB, MA. The major contractors are: Texas Instruments, Dallas, TX - ground processing; AMECOM Division of Litton Industries, College Park, MD - electronic reconnaissance sensor; and Vought Systems Division, Grand Prairie, TX - electro-optical systems.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Examples of accomplishment within this program element under completed projects include: an advanced aerial color film processor; a medium-altitude camera; an improved infrared sensor for the RF-4C; an airborne digital data set for film annotation; a special purpose airborne laser sensor; and the interface for a slewable sensor and laser designator on the RF-4C. Other accomplishments within currently existing projects are:

Electro-Optical Collection/Reconnaissance (Project 1155) - The development and initial deployment of a scientific and technical dual-band (visual and infrared) electro-optical sensor for the RC-135 and the development of an advanced
Design initiation of a high sensitivity, low-energy laser detection system for employment on

(U) Interim Tactical ELINT Processor (ITEP) (Project 2096) - The ITEP has been developed by the Army and Air Force as a transportable system that will receive, process, correlate, and disseminate Electronic Intelligence (ELINT) data from a variety of collection resources. The Air Force has fielded the system as a testbed for development of ELINT correlation.

Program Element: #64710F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Reconnaissance Equipment
Budget Activity: Tactical Programs, #4

The first system was delivered to the Army in September 1979. The Air Force unit was delivered in May 1980. User training is being provided for operations and maintenance of the facility; however, contractor support is required to maintain the best commercial practice hardware. Headquarters, Tactical Air Command has praised the ITEP performance and identified a need to upgrade the system from testbed status to operational status. This will require the addition of a tactical user's terminal.

(U) Electronic Warfare/Close Air Support (EW/CAS) Joint Test/Project 2533) - Phase I, the Tactical Communications Jamming (TCJ) phase, testing began October 1978 at Eglin AFB, FL. The first four tests of the TCJ phase will provide data on the efforts of jamming on specific communication links. The last two tests of this phase consisted of Electronic Warfare (EW) versus Close Air Support related Command, Control and Communications (C^3), EW versus combined Arm C^3, and a large scale EW versus combined arms C^3 and large scale EW vs tactical C^3 tests in conjunction with a Joint Exercise, Gallant Eagle 80. Phase I testing was completed in March 1980 and the test report published in December 1980. Phase II, the Air Support Operations (ASO) Phase, testing began Novemeber 1980 at Nellis AFB, NV. Phase II examined close air and attack helicopter support operations in a high-density EW/Air Defense environment for evaluation of C^3 and strike techniques; ground and air defense suppression coordination and procedures were also addressed.

(U) Tactical Electronic Reconnaissance (TEREC) Sensor (Project 2704) - Developed the prototype Tactical Electronic Reconnaissance sensor system for the RF-4C, and transitioned it to production. Initiated development of software necessary to integrate the Tactical Electronic Reconnaissance data link receivers with the ground processing equipment. Initiated development of software for the TEREC remote terminal (TRT).

2. (U) FY 1982 Program:

Electro-Optical Collection/Reconnaissance (project 1155) - The capability to collect data on electro-optical (E-O) associated threat systems will continue to be developed. Efforts will include redeployment of the dual-band sensor in a RC-135 aircraft; completion of testing of an advance] capability; and, completion of design and testing the high sensitivity, low energy laser detection system. A five year E-O investment strategy will be updated.

(U) Interim Tactical ELINT Processor (ITEP) (Project 2096) - Procure a Tactical User's Terminal (TUT) and continue software support.

(U) Advanced Reconnaissance Sensor (Project 2337) - Initiate engineering development of an advanced imaging system based on technology which has completed advanced reconnaissance sensor is in support of the Tactical Air Forces' requirement for a electro-optical system which provides wide field-of-view, high resolution, near-real-time coverage. Initiate generation of a data base for use in an Automatic Target Recongnizer.

(U) Electronic Warfare/Close Air Support (EW/CAS) Joint Test (Project 2533) - Complete Phase II testing and prepare reports and briefings.

Program Element: #64710F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Reconnaissance Equipment
Budget Activity: Tactical Programs, #4

Tactical Electronic Reconnaissance (TEREC) Sensor (Project 2704) - Complete the software necessary for integration of the TEREC data link receivers with processing equipment. Continue development of software for the TEREC Remote Terminal (TRT) and development of [redacted] capability. The sensor will be upgraded to accommodate the increasing capabilities and exotic signals of current and anticipated threats.

(U) Difference in total program is congressional deletion of funds for Project 2501.

3 (U) FY 1983 Planned Program:

) Electro-Optical Collection/Reconnaissance (Project 1155) - A new development will be initiated for an electro-optical system on [redacted] Data collection on [redacted] will be continued.

(U) Interim Tactical ELINT Processor (Project 2096) - Software improvements will continue in response to a changing threat and collection capability. Follow-on software integration concepts for applications of the Tactical Air Forces will be developed. This activity will be limited to studies of the feasibility of interfaces with other tactical collection platforms. The system will be deployed for Operational Demonstration and Evaluation in field exercises.

(U) Advanced Reconnaissance Sensor (Project 2337) - Engineering development of the Advanced Reconnaissance Sensor and development of a data base will be continued and test planning will be initiated.

(U) Tactical Electronic Reconnaissance (TEREC) Sensor (Project 2704) - Continue integration of TEREC and its associated ground processor, development of data link encryption capability and sensor update. Complete the software for the TEREC Remote Terminal (TRT).

(U) The difference in total program cost represents delay in planned initiation of Project 2660, deletion of funds for Projects 1156 and 2501 due to their transfer to the Tactical Cryptologic Program, and unprogrammed cuts to other projects during the budget formulation process.

4. (U) FY 1984 Planned Program:

Electro-Optical Collection/Reconnaissance (Project 1155) - Continue development of the electro-optical sensor system for a [redacted] and data collection on [redacted]

(U) Interim Tactical ELINT Processor (Project 2096) - Software improvements will continue in response to a changing threat and collection capability. Operational Demonstration and Evaluation of the software integration concepts will continue on the fielded system. Testbed system projected for update to operational status with initiation of procurement for a second system.

(U) Advanced Reconnaissance Sensor (Project 2337) - Engineering development of the Advanced Reconnaissance Sensor and data base generation will be continued.

Program Element: #64710F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Reconnaissance Equipment
Budget Activity: Tactical Programs, #4

(U) Electronic Warfare Support Measures (Project 2501) - This project will be moved to the Tactical Cryptologic Program.

(U) AAQ-X Infrared Sensor (Project 2660) - Initiate definition and development specifications for a small volume, low weight, steerable Forward Looking Infrared (FLIR) System for a near-real time passive sensor with a day/night capability. Systems to be based on infrared focal plane array technology and processing techniques now in development in Program Element 63208F, Reconnaissance Sensors/Processing Technology.

Tactical Electronic Reconnaissance (TEREC) Sensor (Project 2704) - Integration of the TEREC airborne and ground elements will be completed. Update of software to counter current threat emitters will be continued. [ ] will be tested.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64715F
DoD Mission Area: Air Warfare Support, #225

Title: DoD Physical Security Equipment-Exterior (Eng Dev)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	19,736	7,870	18,595	12,120	24,800	130,300

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the development of the Department of Defense Base and Installation Security System, a standardized set of components, interfaces, and methodology for creation of exterior physical security systems, by accomplishing full-scale development tasks in three functional areas: detection, command and control, and imaging. A Department of Defense need exists for a family of standardized modular equipment, integrable into system configurations to provide a level of security in consonance with the deployment mode, threat level, and sensitivity of the asset being protected.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds to complete engineering development of those system components intended for the Total Base and Installation Security System, to initiate engineering development of those system components which will complete advanced development during Fiscal Year 1982, and to continue engineering development of other items which were initiated in prior years. Primary emphasis will be placed on detection (sensor) subsystems and imaging subsystems. Cost estimate based on inputs from various government agencies performing these development efforts.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	19,900	8,000	19,400		23,900	130,100
Procurement (Other)(27596F)	17,950	12,203	39,429		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Procurement (Other)(27596F)	17,516	10,789	21,820	70,953	Continuing	Not Applicable

Program Element: #64715F
DoD Mission Area: Air Warfare Support, #225

Title: DoD Physical Security Equipment-Exterior (Eng Dev)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This program responds to Secretary of Defense direction contained in Department of Defense Directive 3224.3, 1 Dec 1976, which designates the Air Force as executive agency for the development of standardized exterior physical security equipment and systems for the protection of bases and installations. This program will provide pre-production equipment and subsystems, and through test and evaluation, production specifications for the Base and Installation Security System equipment for the four Services. The engineering development tasks consist of optimization of the overall system configuration through conduct of component, subsystem, and system testing, and preparation of production specifications. Under the Initial Base and Installation Security System efforts, production specifications were finalized for equipment which provides medium level security for small permanent locations and a partial system capability for selected resources deployed in a semipermanent mode. The Total Base and Installation Security System objectives are to provide a capability for high level security, against all threat levels, for resources in the three deployment modes: permanent, semipermanent, and mobile. The system will consist of four functional areas, each comprised of various modular components, capable of being integrated in various combinations and configurations to meet al Defense user requirements on a world-wide basis. Facilities and developments of other Services, government agencies, and commercial industries will be used to the maximum to insure that duplication of effort is avoided.

(U) RELATED ACTIVITIES: Advanced development tasks including equipment prototypes, development of technology base, and development testing are accomplished under Program Element 63714F, Department of Defense Physical Security Equipment-Exterior (Advanced Development). Procurement of physical security equipment is accomplished using Other Procurement-Air Force funding under Program Element 27596F, Air Base Defense System. The Base and Installation Security System equipment will be designed for interoperability with the Army interior security system (Facility Intrusion Detection System) and the Army tactical sensor system (Remotely Monitored Battlefield Sensor System). Management oversight of the physical security equipment programs is provided by the Department of Defense Physical Security Equipment Action Group with the Chairperson residing in the Office of the Under Secretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: This program is managed by the Physical Security Systems Directorate, Electronic Systems Division, Hanscom Air Force Base, MA. Department of Defense agencies performing development tasks are: Rome Air Development Center, Griffiss Air Force Base, NY; Army Mobility Equipment Research and Development Command and Army Night Vision Laboratory, Fort Belvoir, VA; Army Waterways Experimental Station, Vicksburg, MS; Naval Avionics Center, Indianapolis, IN; Naval Ocean Systems Center, San Diego, CA; and the Naval Coastal Systems Center, Panama City, FL. In addition to these Defense agencies, the Department of Energy/SANDIA Laboratories, Albuquerque, NM performs engineering development tasks and the Analytical Systems Engineering Corporation assists in the system engineering support and integration task.

Program Element #64715F
DoD Mission Area: Air Warfare Support, #225

Title: DoD Physical Security Equipment-Exterior (Eng Dev)
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: All of the items undergoing development for the Initial Base and Installation Security System capability have completed engineering development. These include a buried line sensor, perimeter fence sensor, closed aircraft shelter sensor, above ground barrier sensor, wide area sensor, boundary alarm assessment segment, and sensor data transmission and display segment.

2. (U) FY 1982 Program: The program provides for continued full-scale development of the following items: electromagnetic point sensor, mobile individual resource protection sensor, video frame storage element, and magnetic/seismic line sensor signal processor. Full-scale development has started on the ported coaxial cable line sensor. The permanent individual resource protection sensor is expected to complete full-scale development in Fiscal Year 1982.

3. (U) FY 1983 Planned Program: The program provides for continuation of full-scale development of the Total Base and Installation Security System components and subsystems. These include the mobile indivdual resource protection sensor, ported coaxial cable sensor, electromagnetic point sensor, and open shelter aircraft sensor. Initiation of engineering development is planned for the pyroelectric vidicon camera and infrared charge coupled device fence sensor. The decrease in the Fiscal Year 1983 procurement funding level is due to the delay in procurement of the ported coaxial cable sensor.

4. (U) FY 1984 Planned Program: The program provides for continuation of full-scale development of the Total Base and Installation Security System to include the electromagnetic point sensor, foliage penetration radar, infrared charge coupled device fence sensor, pyroelectric vidicon camera, and open shelter aircraft sensor. The mobile individual resource protection sensor and the ported coaxial cable sensor are expected to complete full-scale development in Fiscal Year 1984.

5. (U) Program to Completion: This program will provide type C (production) specifications for fully competitive production of a family of modular electronic equipment, capable of being integrated in various system configurations to meet Department of Defense and Service requirements for physical security. As requirements for exterior physical security are validated, development tasks will be assigned to the Air Force by the Under Secretary of Defense for Research and Engineering to satisfy the requirement.

6. (U) MILESTONES: Not Applicable

7. (U) RESOURCES: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64724F
DOD Mission Area: Escort, Stand-off and Counter C^3, #372

Title: Tactical C^3 Countermeasures
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual*	FY 1982 Estimate	FY 1983 Estimate	FY 84 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	20,271	10,455	18,976	27,957	Continuing	Not Applicable
2462	COMPASS CALL Development	20,271	5,800	4,600	3,900	Continuing	Not Applicable
2677	C^3CM Development		1,000	9,100	6,300	Continuing	Not Applicable
2726	Electromagnetic Combat Support		3,655	5,276	17,757	11,600	38,350

* $10,500 added by FY 1981 Supplemental Budget Request

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: To accomplish close air support, interdiction, and counter air mission, the Tactical Air Forces (TAF) require a command, control, and communications (C^3) countermeasures capability. The TAF] We must improve the TAF's capability to support and protect friendly forces. A key instrument to improve the TAF's capability is the ability to] This program provides for the engineering development of new C^3 countermeasures equipment for tactical electronic combat applications.

BASIS FOR FY 1983 RDT&E REQUEST: The Air Force completed a concept definition in FY 1979 for an EC-130H [ ] jamming aircraft as partial fulfillment of the mission need. The definition proposes a time-phased solution. This program includes all the efforts that require engineering development These efforts are to be added to a baseline capability installed on the EC-130H aircraft. The first baseline aircraft are being delivered in FY 1982. To complement the capability of the EC-130H aircraft, the Air Force identified a need for] Ground-based jamming and deception systems are also needed for defense of friendly assets from enemy air attacks. To protect friendly communications and complement our anti-jam communications fixes, the Air Force identified an urgent requirement for a] The FY 1983 request is based on Air Force Systems Command pricing models. For the EC-130H jammer program it includes continued development of the mission simulator, the [subsystem, and updates to exciters and transmitters; continued definition of improvements to signal acquisition and analysis subsystems; and initial development of a new [ ] subsystem. Development of a C^3 countermeasures mini-drone will begin in FY 1983 with competitive "fly-off" and quality assurance tests of the jamming system. Quick reaction capability (QRC)

Program Element: #64724F | Title: Tactical C^3 Countermeasures
DOD Mission Area: Escort, Stand-off and Counter C^3, #372 | Budget Activity: Tactical Programs, # 4

development of a mini-drone capability for [ ] will continue. The Air Force will also continue development of a ground-based jamming/deception system, an analysis system for evaluation of [ ] and a C^3 countermeasures operational support data base. Definition and engineering development of a C^3 countermeasures battle management data display system will begin.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	9,800	12,300	9,800		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	Procurement (Aircraft) (PE 27253F)*						
2462	COMPASS CALL Development	59,018	22,160	10,435	29,497	Continuing	Not Applicable

* Includes modifications and initial spares

Program Element: # 64724F Title: Tactical C^3 Countermeasures
DOD Mission Area: Escort, Stand-off and Counter C^3, #372 Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The Air Force C^3 countermeasures program includes both offensive capabilities to deny, disrupt, deceive, and exploit the enemy's C^3 network and defensive capabilities to protect friendly C^3 systems. The EC-130H[ ] jamming platform is an offensive system to counter the[ ] "Off-the-shelf" equipment and technology were used to modify C-130 aircraft to field a C^3 countermeasure capability in the near term. This program is responsible for engineering developments to counter new targets and keep the EC-130H a viable system throughout[ ] It also funds development of a mission simulator to help the mission crew train and maintain proficiency. To support air operations penetrating into enemy territory beyond the effective jamming range of the[ ]EC-130H, a new capability is required. Following informal evaluations of such systems as the EF-111, self-protection (internal or podded) jamming systems, and mini-drones, the Air Force decided to field a system in the near-term using low-risk technology. The mini-drone was identified as a particularly promising and cost effective candidate. A mini-drone capability is also being developed in this program for

] the Air Force has placed a high priority on this effort and will use quick reaction capability (QRC) procedures to field a system as soon as possible. The goal for an[ ] The same mini-drone platform will be used for both the C^3 countermeasures system and the[ ] The ground-based C^3 countermeasures systems developed in this program provide both offensive and defensive capabilities. These systems will[ ] counter friendly C^3 links to provide a realistic testing and training environment, analyze the[ ] provide a C^3 countermeasures operational support data base to support all C^3 countermeasures programs, and provide a battle management system for coordination and integration of all C^3 countermeasures efforts.

(U) RELATED ACTIVITIES: The Air Force production manager (Air Force Logistics Command) and development manager (Air Force Systems Command) for the EC-130H operate with a joint agreement for interface and configuration control to ensure that new equipment can be incorporated into operational use. Air Force Systems Command is responsible for production and development of both the mini-drone programs and the ground-based systems. This program will build upon technology demonstrated in PE 63718F, Electronic Warfare Technology. It will also draw upon technology developed in PE 63749F, C^3 Countermeasures Advanced Systems - a newly formed Program Element. Technology that satisfies similar requirements for other systems may be drawn upon, such as those in PE 62204F, Aerospace Avionics, PE 62715A, Expendable Jammers; and PE 63214N, Tactical C^3 Countermeasures. This program provides engineering development for PE 27253F, COMPASS CALL; PE 28021F, Electronic Combat Support; and PE 27246F, Expendable Drones.

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson AFB, OH - management of program to develop improvements to EC-130H and to develop and acquire mini-drone systems; Electronic Systems Division, Hanscom AFB, MA - management of program to develop and acquire ground-based systems; Air Force Wright Aeronautics Laboratory, Wright-Patterson AFB OH and Rome Air Development Center, Rome, NY - techniques developments for C^3 Countermeasures; and Air Force Logistics Command, Wright-Patterson AFB, OH - management of the EC-130H modification program.

Program Element: #64724F
DOD Mission Area: Escort, Stand-off and Counter C^3, #372

Title: Tactical C^3 Countermeasures
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments:

Compass Call Development (Project 2462) - In FY 1979 the Air Force completed the definition phase of the EC-103H, conducted a test and evaluation of an improved receiver-analyzer, and began development of a The Air Force continued development of this jammer and began development of a mission simulator to support mission aircrews in FY 1980. The FY 1981 Air Force program continued development of both the and the mission simulator and began development of a subsystem.

(U) C^3CM Development (Project 2677) - Not Applicable

(U) Electromagnetic Combat Support (Project 2726) - Not Applicable

2. (U) FY 1982 Program:

COMPASS CALL Development (Project 2462) - The will complete development and testing in FY 1982 as will the hardware and software design and system integration of the mission simulator. Development of the second phase of the subsystem will begin. Definition of improvements to signal acquisition and analysis subsystems and updates to exciters and transmitters will be started. The definition of a new jammer subsystem to counter another will also begin.

C^3CM Development (Project 2677) - Begin development using quick reaction capability (QRC) procedures of a mini-drone capability for The original authorization for this effort was in the Descriptive Summary for PE 64746F, Expendable Drones.

Electromagnetic Combat Support (Project 2726) - Definition and initial engineering development of ground-based jamming/deception system and an analysis system for evaluation of Engineering development of C^3 countermeasures operational support data base.

3. (U) FY 1983 Planned Program:

COMPASS CALL Development (Project 2462) - The mission simulator will be delivered to the field. The Air Force will continue development of the subsystem and updates to the exciters and transmitters as well as definition of signal acquisition and analysis subsystem improvements. Development of the new jammer subsystem will begin.

C^3CM Development (Project 2677) - Begin development of C^3 countermeasures mini-drone. Activities will include industrial survey of current capabilities followed by multiple contract awards for competitive "fly-off" and quality assurance tests of jammer system. Continue QRC development of a mini-drone capability for

Program Element: #64724F | DOD Mission Area: Escort, Stand-off and Counter C^3, #372

Title: Tactical C^3 Countermeasures | Budget Activity: Tactical Programs, #4

The same platform will be used for both these tasks. Begin definition of alternative methods to the mini-drone for

(U) Electromagnetic Combat Support (Project 2726) - Continue engineering development tasks begun in FY 1982. The Air Force will begin definition and engineering development of C^3 countermeasures battle management systems. The increase in FY 1983 funds from $9,800 to $17,291 reflects the results of the Air Force definition of requirements for ground-based C^3 countermeasures systems. This definition was completed in Spring 1981. The funding requirements, therefore, are only now being presented.

4. (U) FY 1984 Planned Program:

COMPASS CALL Development (Project 2462) - The Air Force will complete development of the subsystem and updates to the exciters and transmitters. New developments for the aircraft will be incorporated into the mission simulator. Development of the will continue and development of the improvements to the signal acquisition and analysis subsystems will begin.

C^3CM Development (Project 2677) - Continuation of competitive "fly off" and quality assurance tests of the jammer system. Completion of development of mini-drone capability for Continued definition of alternative means for

Electromagnetic Combat Support (Project 2726) - Continuation of all previously started engineering development tasks as well as initiation of development of an

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

Project: #2677
Program Element: #64724F
DOD Mission Area: Escort, Stand-off and Counter C^3, #372

Title: C^3CM Development
Title: Tactical C^3 Countermeasures
Budget Activity Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: In 1979 the Air Force identified a requirement for a C^3 countermeasures capability to support air operations

aircraft. While numerous possibilities, such as the EF-111, self-protection (internal or podded) jamming systems, and mini-drones, were explored to satisfy this requirement, a pragmatic approach was taken to field a system in the near-term using low-risk technology. The mini-drone was identified as a particularly promising and cost effective candidate. The mini-drone system will be targeted against such things as

This project will also evaluate the requirement for and fund the development and acqusition of a

capability for penetrating aircraft.

In 1982 the Air Force identified an urgent requirement for a capability to

We have thus far given the enemy

Following a review of currently available technology, the mini-drone was determined to be the only viable approach in the near term. Due to the urgency of obtaining this capability the Air Force will use quick reaction capability (QRC) procedures for this development to achieve an IOC in FY 1984. Concurrently, the Air Force will review alternatives to the mini-drone for mid and far term approaches to

RELATED ACTIVITIES: The efforts in this project will complement the capability of the EC-130H C^3 countermeasures aircraft by placing the mini-drone jamming system in

Due to the

Development and production of the mini-drone systems will be managed by Air Force Systems Command. Technology and "lessons-learned" from development of the EC-130H aircraft will be incorporated into this project. This project builds upon technology demonstrated in PE 63718F, Electronic Warfare Technology. It will also draw upon technology developed in PE 63749F, C^3 Countermeasures Advanced Systems - a newly formed Program Element. Technology that satisfies similar requirements for other systems may be drawn upon, such as those in PE 62204F, Aerospace Avionics; PE 62715A, Expendable Jammers; PE 63214N, Tactical C^3 Countermeasures; PE 63303N, Electromagnetic Radiation Source Elimination; and PE 63755A, Tactical Electronic Countermeasures Systems.

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson AFB, OH - management of development and production programs; Air Force Wright Aeronautics Laboratory, Wright-Patterson AFB, OH - technique development for C^3 Countermeasures.

Project: # 2677
Program Element: #64724F
DOD Mission Area: Escort, Stand-off and Counter C^3, #272

Title: C^3CM Development
Title: Tactical C^3 Countermeasures
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. FY 1982 Program: Begin QRC development of mini-drone for [ ] The orginal authorization for this effort was in the FY 1982 Descriptive Summary for PE 64746F, Expendable Drones.

3. FY 1983 Planned Program: Begin development of mini-drone C^3 countermeasures system. FY 1983 activities will include industry survey for "off-the-shelf" capabilities followed by multiple contract award for competitive "fly-off" and quality assurance tests of jammer system. Continue QRC development of mini-drone capability for] The same platform will be used for both these requirements. Begin definition of alternatives to the mini-drone for [ ]

4. FY 1984 Planned Program: Continuation of competitive "fly-off" test and quality assurance tests of jammer system. Completion of QRC development of mini-drone capability.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		1,000	9,100	6,300	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E			5,200		Continuing	Not Applicable

Project: #2726 Title: Electromagnetic Combat Support

Program Element: #64724F Title: Tactical C^3 Countermeasures

DOD Mission Area: Escort, Stand-off and Counter C^3, #372 Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The Air Force C^3 Countermeasures program includes requirements for both offensive actions against the enemy's C^3 links and nets and defensive actions to protect friendly C^3 systems. Project 2462 and 2677 in this program element (PE 64724F) provide offensive capabilities

This project funds ground-based systems to provide both offensive and defensive capabilities on the

Specific developments in this project include counters to

counters to friendly C^3 nets to provide a realistic testing and training environment; systems to analyze the

development of an operational C^3 countermeasures support data base to support all C^3 countermeasures programs; development of C^3 countermeasures battle management system; and development of

RELATED ACTIVITIES: Due to their nature and operating location, these ground-based C^3 countermeasures systems will support and complement both the EC-130H aircraft and mini-drones developed in other projects in the program element. Development and production of the ground-based systems will be by Air Force Systems Command. Electronic Security Command will operate and maintain the systems in support of the theater commander. This project builds upon technology demonstrated in PE 63718F, Electronic Warfare Technology. It will also draw upon technology developed in PE 63749F, C^3 Countermeasures Advanced Systems - a newly formed Program Element. Technology that satisfies similar requirements for other systems may be drawn upon, such as those in PE 62204F, Aerospace Avionics; PE 62715A, Expendable Jammers; and PE 63214H, Tactical C^3 Countermeasures. This project provides engineering development for PE 28021F, Electronic Combat Support, where procurement funds are programmed for FY 1985 and beyond.

(U) WORK PERFORMED BY: Electronic Systems Division, Hanscom AFB, MA - management of development and production programs; Air Force Avionics Lab, Wright-Patterson AFB, OH and Rome Air Development Center, Rome, NY - technique development for C^3 countermeasures.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable.

2. FY 1982 Program: Definition and initial engineering development of ground-based jamming/deception system and analysis system for evaluation of Engineering development of C^3 countermeasures operational support data base.

3. (U) FY 1983 Planned Program: The Air Force will continue the engineering development tasks begun in FY 1982 as well as begin definition and engineering development of the C^3 countermeasures battle management system.

4. FY 1984 Planned Program: Continuation of all previously started engineering development tasks for ground-based systems as well as initiation of development of an

Project: #2726
Program Element: #64724F
DOD Mission Area: Escort, Stand-off and Counter C^3, #372

Title: Electromagnetic Combat Support
Title: Tactical C^3 Countermeasures
Budget Activity: Tactical Programs, # 4

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Esitmate	Additional to Complete	Total Estimated Costs
RDT&E		3,655	5,276	17,757	11,600	38,350

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64725F
DOD Mission Area: Tactical Command and Control, #344

Title: Combat Identification Systems
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in Thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4,552	12,155	20,552	28,125	Continuing	Not Applicable
2463	Mark XII Identification Friend or Foe (IFF) Program	2,553	900		1,900	To Be Determined	To Be Determined
2597	Noncooperative Identification Subsystems		3,900	6,400	14,900	Continuing	Not Applicable
2598	Cooperative Identification Systems		400			Continuing	Not Applicable
2751	Indirect Identification Subsystems			1,700	1,800	Continuing	Not Applicable
2778	TAC Air Identification	1,999	6,955	12,452	9,325	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of this program element is to accomplish engineering development of systems that will provide reliable long-range identification of airborne targets in both all-weather and hostile electromagnetic countermeasures environments. This program is necessary because the numerical superiority of the projected threat demands that we be capable of engaging the enemy at long ranges with our beyond visual range weapons. The long range identification which is a prerequisite for such engagements

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds for a design study to determine the utility of integrating passive, radio frequency identification technology into existing tactical aircraft. Also continues support for tactical application of noncooperative target identification algorithms and the near-term demonstration of an improved indirect identification capability. Costing of these efforts was based on parametric and engineering estimates performed by the Combat Identification System Program Office at the Aeronautical System Division, Wright-Patterson Air Force Base, OH as of 12 November 1981.

Program Element: #64725F
DOD Mission Area: Tactical Command and Control, #344

Title: Combat Identification Systems
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	2,553	12,200	To be determined		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 81	FY 82 Estimate	FY 83 Estimate	FY 84 Estimate	Additional to Completion	Total Estimated Costs
Project 2597						
Procurement *(Aircraft) (Quantity - Dual Mode Recognizer Modifications) - 27130F				15,000 (60)	26,900 (244)	41,900 (304)
*includes initial spares						
Project 2778						
Procurement * (Aircraft) (Quantity) 27130F				3,900	130,000 (500)	133,900 (500)
*includes initial spares						
Operations and Modifications 72207F						16,400
Project 2463						
Procurement * (Aircraft) (Quantity - Mark XII Interrogator and/or Transponder Modifications)						
27130F			3,100 (1,110)	2,300 (280)		5,400 (1,320)
27131F				1,700 (480)	600 (220)	2,300 (700)

Program Element: #64725F
DOD Mission Area: Tactical Command and Control, #344

Title: Combat Identification Systems
Budget Activity: Tactical Programs, #4

Project 2463 (Con't)	FY 81	FY 82 Estimate	FY 83 Estimate	FY 84 Estimate	Additional to Completion	Total Estimated Costs
27133F					3,459 (1,000)	3,459 (1,000)
27128F				2,811 (650)	2,919 (906)	5,730 (1,556)

* includes initial spares

Operations and Maintenance

72207F				1,000	4,400	5,400
57112F					1 000	1,000
57115F					500	500

Program Element: #64725F Title: Combat Identification Systems
DOD Mission Area: Tactical Command and Control, #344 Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND DESCRIPTION: Current and planned weapons are lethal at extremely long ranges under varying weather conditions. Operations involving the defense or use of these high-performance weapons must be supported by positive target identification to allow our forces to limit their exposure to such enemy weapons while still taking full advantage of our own weapons' capabilities and also preventing fratricide. In view of the numerical superiority of the projected threat and the likely intensity of the air battle that is postulated for any future conflict in Central Europe, [ ] In March 1978, North Atlantic Treaty Organization (NATO) Long Term Defense Program Task Force Five on Air Defense [ ] Similarly, the need for improved identification capability has been documented by Tactical Air Forces Statements of Need 304-79 and 305-79 and more recently in a Joint Mission Element Need Statement approved by the Secretary of Defense on 30 October 1980.

[ ] The engineering development of these subsystems as well as the capability to integrate and correlate their outputs will be accomplished under this program element. All work will be a Tri-Service coordinated effort managed under the Combat Identification System Program, with the Air Force as lead service. Cooperation with NATO will be accomplished as appropriate. The work in this program element falls into four areas. Project 2463, Mark XII Identification Friend or Foe (IFF) Program is developing modifications for Mark XII IFF equipment to improve its resistance to electronic countermeasures. Project 2597, Noncooperative Identification Subsystems will support the transition of noncooperative, autonomous identification techniques to the F-15 and F-16 as well as to selected ground based sensors in support of Project 2751 through various engineering and test activities. Project 2598, Cooperative Identification System supports the engineering development of a miniaturized interrogator system for performing cooperative identification of airborne targets. Near-term application of such an interrogator could provide an air-to-air identification capability for the F-16 while the far-term application will support backward compatibility during transition from the aging Mark XII IFF system in use today to a replacement system in the 1990s. Project 2751, Indirect Identification Subsystems will develop and demonstrate the means for integrating and correlating identification data from multiple sources (e.g., sensors onboard aircraft as well as a variety of command and control elements). This is intended to raise the overall confidence and provide better management of the identification function during the weapons employment process.

(U) RELATED ACTIVITIES: Work accomplished under this program element is part of an integrated Tri-Service effort to improve United States identification capabilities worldwide. Related activities include: Program Element (PE) 63267N, NATO Future Identification System; PE 63515N, Advanced Identification Techniques; PE 63706A, IFF Developments; PE 63742F, Combat Identification Technology; PE 64211N, AIMS/ATCRBS/Mark XII; and PE 64709A, IFF Equipment. Coordination and integration of the various activities under these program elements is accomplished through the Tri-service Combat Identification System Program for which the Air Force is lead.

(U) WORK PERFORMED BY: The overall program is managed by the Combat Identification System Program Office at the Aeronautical Systems Division, Air Force Systems Command, Wright Patterson Air Force Base, [illegible] program office receives support from the Air Force Wright Aeronautical Laboratories/Avionics Labortory, Wright Patterson Air Force Base, OH and

Program Element: #64725F Title: Combat Identification Systems
DOD Mission Area: Tactical Command and Control #344 Budget Activity: Tactical Programs, #4

other offices within the Aeronautical Systems Division. Support is also provided by the Electronic Systems Division, Air Force Systems Command, Hanscom Air Force Base, MA; the MITRE Corporation, Bedford, MA and the Electromagnetic Compatibility Analysis Center, Annapolis, MD. Additionally, the following contractors are engaged in work under the Mark XII IFF Program: Bendix Communications Division, Baltimore, MD; Hazeltine Corporation, Greenlawn, NY; Quest Research Corporation, McLean, VA; Teledyne Electronics, Newburg Park, CA; and ARINC Research Corporation, Annapolis, MD.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Under the Mark XII IFF Program a detailed vulnerability assessment of existing Mark XII equipment was completed, various approaches for improving the electronic countermeasures performance were investigated and approaches with potential near-term application were selected for further development. Airborne data collection and analysis in support of developing the was completed. Also, work to adapt the identification algorithm for use on the was conducted. Additionally, engineering analysis of existing and planned command, control and communications elements was initiated to help define methods for integrating and correlating identification information from multiple sources. As part of the Mark XII IFF Program, contracts were awarded to develop modification kits to improve the electronic countermeasures performance of selected Mark XII equipment. Additionally, efforts to determine the military worth/cost benefit of modifying other Mark XII equipment were initiated. The initial versions of the noncooperative target identification algorithms were transitioned to the F-15 and F-16 Program Offices. A feasibility demonstration of the use of a passive, radio frequency sensor to perform airborne identification was initiated.

2. FY 1982 Program: Cost benefit analyses and tests of proposed electronic countermeasure improvement modifications for Mark XII IFF equipment will be completed and the decision on implementing the improvements will be made. Also engineering analysis of a miniaturized airborne interrogation system will begin. This analysis will investigate the use of The near-term application of such a system could provide an air-to-air identification capability for the F-16 while the far-term application will support backward compatibility during the transition from the aging Mark XII IFF system in use today to a replacement system in the 1990s. Additionally, a near-term in-theater demonstration of indirect identification techniques will be initiated. This near-term effort will exploit existing identification, intelligence, surveillance and communications resources. The FY 1982 effort will involve planning/coordination efforts for such a demonstration. The purpose of the demonstration is to show the value of fusing data from existing sensors and communication systems to improve the overall identification process. Further, efforts to emphasize the transition of noncooperative identification technology (anticipate incorporation into the F-15 and the F-16 will continue through various engineering and flight test activities. Noncooperative identification technology will also be applied to selected ground based sensors in support of the near-term indirect identification activities. Also, the feasibility demonstration of the use of a passive, radio frequency sensor to perform airborne identification will be completed.

Program Element: #64725F Title: Combat Identification Systems
DOD Mission Area: Tactical Command and Control, #344 Budget Activity: Tactical Programs, #4

3. FY 1983 Planned Program: Based on the results of the feasibility demonstration completed in FY 1982, a design study to determine the utility of passive, radio frequency identification technology for existing tactical aircraft will be initiated. Support will be provided to continue the development and refinement of the Additionally, technical assistance will be provided to investigate transitioning the radar identification algorithms to the E-3A aircraft. Also, continued support will be provided for the design, fabrication test and integration of noncooperative identification technology into future indirect identification efforts. In addition, efforts in support of an in-theater demonstration of improved indirect identification techniques using existing sensors and communication systems will continue. Planning for the transition of the multiple sensor integration work of Program Element 63742F to engineering development will also begin.

4. FY 1984 Planned Program: Continue design of passive, radio frequency identification techniques for onboard integration and demonstration. Continue development and refinement of Support the integration of identification data from multiple sensors onboard the F-15 aircraft. Conduct an in-theater demonstration of improved indirect identification techniques and support efforts to incorporate these techniques into the Tactical Air Control System.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

Project: #2597
Program Element: #64725F
DOD Mission Area: Tactical Command and Control #254

Title: Noncooperative Identification Systems
Title: Aircraft Identification Systems
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Beyond visual range identification of airborne targets is
In March 1978, North Atlantic Treaty (NATO) Long Term Defense Program Task Force Five on Air Defense

Similarly, the need for improved identification capability has been documented by Tactical Air Forces Statements of Need 304-79 and 305-79 and more recently in a Joint Mission Element Need Statement approved by the Secretary of Defense on 30 October 1980.

several complementary cooperative and noncooperative identification techniques as well as their integration are being developed under the Air Force led, Tri-Service Combat Identification System Program. This project accomplishes the engineering development of the most promising methods for noncooperative target identification. Primary emphasis is on techniques that can be applied to the F-15 and F-16 aircraft by the mid 1980s. Included in these techniques is the Dual Mode Recognition technique which

Another technique using radio frequency emissions from the target aircraft to perform long-range, adverse weather identification passively, is undergoing feasibility demonstration. This project will also develop the capability to integrate and correlate identification information from multiple sources onboard the weapon system. Also, noncooperative identification technology is being applied to support the near-term demonstration of improved indirect identification capabilities and future architecture implementation of the indirect capabilities into the Tactical Air Control System.

(U) RELATED ACTIVITIES: Work accomplished under this program element is part of an integrated Tri-Service effort to improve United States identification capabilities worldwide. Related activities include: Program Element (PE) 63267N, NATO Future Identification System; PE 63515N, Advanced Identification Techniques; PE 63706A, IFF Developments; PE 64211N AIMS/ATCRBS/Mark XII; PE 64709A, IFF Equipment; and PE 63742F, Combat Identification Technology. Coordination and integration of the various activities under these program elements is accomplished through the Combat Identification System Program for which the Air Force is lead service.

(U) WORK PERFORMED BY: The overall program is managed by the Combat Identification System Program Office at the Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson Air Force Base, OH. The Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright-Patterson Air Force Base, OH is assisting the Combat Identification System Program Office in the management of this project. Contractors supporting this effort include: Westinghouse Corp., Baltimore, MD; Hughes Aircraft Co., Culver City, CA; McDonnell Douglas Aircraft Corp., St. Louis, MO; and General Dynamics Corp., Fort Worth, TX.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. FY 1981 and Prior Accomplishments: This project began in FY 1980 but was not funded in FY 1981 because of Congressional concerns that the noncooperative identification technology was not transitioning to the field fast enough. To address these concerns and maintain program continuity, laboratory development and flight test activities supporting the transition of the Dual Mode Recognition (DMR) technique into were completed

Project: #2597
Program Element: #64725F
DOD Mission Area: Tactical Command and Control #344

Title: Noncooperative Identification Systems
Title: Combat Identification Systems
Budget Activity: Tactical Programs, #4

and initial versions of the DMR radar algorithm were transitioned to the F-15 and F-16 program offices. In addition, a feasibility demonstration, using an off-the-shelf radio frequency sensor, was initiated to investigate the detection, analysis and correlation of electronic emissions from target aircraft as a basis for performing noncooperative identification passively. Also, the initial planning and analysis in support of a near-term demonstration of improved indirect identification capabilities was conducted.

2. FY 1982 Program: The feasibility demonstration of off-the-shelf, radio frequency sensor technology to perform airborne target identification passively will be completed. Engineering development support will be provided to the F-16 program office for application of the Dual Mode Recognition (DMR) noncooperative identification algorithm. This involves the translation and integration of the DMR algorithm software into the radar/programmable signal processor architecture. Additionally, work in preparation for a near-term, in-theater demonstration of improved indirect identification capabilities will be conducted. Besides the development and planning in support of the actual demonstration, this involves the development and integration of noncooperative identification technology for use in the European demonstration at a Tactical Air Control System/Control and Reporting Center. The demonstration is expected to provide a basis for transitioning an improved identification capability to the command and control systems.

3. FY 1983 Planned Program: A design study will be initiated to determine the utility of integrating passive, radio frequency identification technology into existing tactical aircraft (e.g., F-16). Also, continued engineering support will be provided to the F-16 for application and refinement of the Dual Mode Recognition noncooperative identification algorithm. Additionally, the near-term, in-theater demonstration of improved indirect identification capabilities will be transitioned and continued under Project 2751. In addition, initial planning activities will begin in support of the expected transition to engineering development of onboard integration of identification data from multiple sources.

4. FY 1984 Planned Program: Based on the results of the FY 1983 design study, engineering development activity will begin to support the integration of passive, radio frequency identification technology into existing tactical aircraft (e.g., F-16 radar). Also engineering support and flight tests in support of the application of the Dual Mode Recognition algorithm will be completed. Additionally, an improved indirect identification capability will be demonstrated, and the architecture for improved indirect identification capabilities will begin to be integrated into the Tactical Air Control System. Also, engineering development of the onboard integration of identification of data from multiple sources will begin with initial emphasis on application to the F-15 aircraft.

5. Program to Completion: Engineering development activity in support of the integration of passive, radio frequency identification technology into existing tactical aircraft will continue. Also, other noncooperative target recognition techniques

Project: #2597 Title: Noncooperative Identification Systems
Program Element: #64725F Title: Combat Identification Systems
DOD Mission Area: Tactical Command and Control #344 Budget Activity: Tactical Programs, #4

will be selected for engineering development and/or enhancement as their utility is demonstrated through advanced development or other suitable means. In addition, the development and refinement of the onboard integration of identification data from multiple sources will continue. This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		3,900	6,700	15,500	Continuing	Not Applicable
8. (U) Comparison with FY 1982 Descriptive Summary:		3,900	To Be Determined		Continuing	Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64733F
DOD Mission Area: Defense Suppression, #224

Title Surface Defense Suppression
Budget Activity Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	8,605	9,564	4,740			186,711
2147	Imaging Infrared Seeker Integration		8,164	3,335			40,911
2195	Modular Guided Weapon System		1,400	1,[illegible]5			123,500
2225	Weapon System Integration						22,500
2226	JSOR Data Link*						

* This effort has been moved to PE64606F Conventional Standoff Weapon (CSW) to develop a jam-resistant data link for the CSW.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops the GBU-15 Modular Guided Weapon System. This weapon is a 2000 lb class guided glide bomb designed to destroy high value targets (interdiction) and enemy surface-to-air defenses (defense suppression). The in-production GBU-15 with television and data link (TV/DL) is optimized for low altitude launch allowing precise delivery while providing standoff range to the delivery aircraft. This combination of low altitude delivery and standoff reduces exposure of the delivery aircraft to enemy defenses. This program provides modular improvements to GBU-15 to extend its effectiveness against key targets. Key development areas address nighttime and limited weather capability.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The in-production GBU-15 with television/data link guidance provides a highly effective capability for precision, stand-off destruction of highly defended key targets during daytime conditions. The FY 1983 program will complete the integration and operational test of an imaging infrared seeker, based upon the sensor used for MAVERICK, to extend the GBU-15 capability into night operations. The infrared seeker will be a modular replacement for the television seeker; both will use the same data link. FY 1983 funding is required for the development of a depot technical repair center for the in-production television version of the GBU-15. In addition, the requested funding will develop support equipment and test procedures for the infrared seeker to ensure a readiness to support a FY 1983 production decision for the GBU-15 with infrared guidance. Budget estimates for project 2147 are based upon negotiated contract costs for contractor integration and test support and upon program office estimates for conduct and support of operational testing based upon considerable prior GBU-15 test experience. Estimates for projects 2195 are based on program office experience with related endeavors of similar scope.

Program Element: # 64733F
DOD Mission Area: Defense Suppression, #124

Title Surface Defense Suppression
Budget Activity Tactical Programs, #4

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
RDT&E	8,900	9,800	14,400		2,600	199,400
Other Procurement (PE #28030F)	20,724	51,250	51,310		TBD	TBD
Aircraft Procurement	10,200	16,400	10,200			42,600

OTHER APPROPRIATION FUNDS FY 1983:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Other Procurement (PE #28030F)						
(Quantity)						
Aircraft Procurement (3010)						
P-1900	10,000	8,475	9,600	0	0	33,875
P-1100	0	7,500	0	0	0	7,500
TOTAL 3010	10,000	15,975	9,600	0	0	41,375

Program Element: # 64733F
DOD Mission Area: Defense Suppression, #224

Title Surface Defense Suppression
Budget Activity Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Tactical Air Forces require a capability to destroy key surface targets with accurately delivered munitions without exposing the delivery aircraft to enemy defenses. This program develops the GBU-15 Modular Guided Weapon System to meet that requirement; and provides improvements in modular form. The GBU-15 is a cruciform wing weapon optimized for very low level, stand-off delivery of a unitary or cluster warhead in the 2000 lb range. The in-production configuration of GBU-15 utilizes a television seeker in the weapon nose to provide extremely accurate targeting information. Via data link, an operator in a standoff, controlling aircraft can "fly" the guided warhead to a specific target aimpoint providing high effectiveness against key interdiction (bridges, tunnels, power plants, etc), surface to air defense, and ship targets. To extend the capabilities of the GBU-15 into conditions of night and haze, an imaging infrared seeker highly common with the MAVERICK seeker is being integrated into GBU-15 under project 2147 of this program. The infrared seeker will be a direct modular replacement for the television seeker module; both seekers will utilize the same data link. Project 2195 has developed the basic weapon system and continues to develop modular improvements to extend the effectiveness of the GBU-15, and related support equipment. In addition to the GBU-15 a planar wing variant optimized for high altitude launch has been developed within Project 2195. Development of that version, designated the GBU-20, has been terminated due to fiscal constraints and problems encountered during testing.

(U) RELATED ACTIVITIES: Related and supporting efforts are pursued in Program Element (PE) 64606F, Conventional Standoff Weapon and PE 64608F, Close Air Support Weapon System. PE 64606F develops a conventional standoff weapon of greater capability than the GBU-15; PE 64608F develops an imaging infrared seeker to be used on the Air Force and Navy versions of the MAVERICK and GBU-15. PE 64606F also includes the development of a jam-resistant data link for the conventional standoff weapon; this data link may have application to the GBU-15, although this is not the focus of the effort.

(U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command (AFSC), Andrews AFB MD, and Armament Division (AD), Eglin AFB FL. Major contractors are Rockwell International, Columbus OH; Fairchild Camera Inst, Long Island NY; and Hughes Aircraft Co, Culver City/Canoga Park CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Both the Planar Wing GBU-20 and Cruciform Wing GBU-15 Weapons incorporate prior year development efforts which began in FY 1974. These include design and wind tunnel work, design of a data link, and development of a cluster warhead known as the Cluster Bomb Unit (CBU-75). Development and flight testing of the basic Cruciform Weapon was to be completed in FY 1976; however, due to the operational advantages of a weapon with data link, the flight test program was expanded to include data link testing which was completed in early FY 1978. Also, Distance Measuring Equipment (DME) equipped Cruciform and Planar Wing Weapons were flight tested. Additional testing of the GBU-15 was completed in March 1980 to satisfy Congressional concerns which arose during the FY 1979

Program Element: # 64733F   Title Surface Defense Suppression
DOD Mission Area: Defense Suppression, #224   Budget Activity Tactical Programs, #4

Appropriations hearing. Flight testing of the Planar Wing Weapon (GBU-20) with television and data link was conducted with the B-52D. Development of the Planar Wing GBU-20 has been terminated due to fiscal constraints and problems encountered during testing. The GBU-15 program was zero funded in FY 1980. It was continued through FY 1980 using FY 1979 funds. The GBU-15 (cruciform wing weapon) was recertified for production by the Department of Defense in April 80. Funding for initial USAF production of GBU-15 was provided by Congress in the FY 1980 Supplemental Appropriations Bill; the initial USAF production contract was awarded in September 80. Imaging infrared seeker and GBU-15 module integration was conducted, and environmental testing was conducted in 1981. Support equipment for the in-production GBU-15 with television/data link (TV/DL) was developed and updated to the production configuration.

2. (U) FY 1982 Program: Operational flight testing for the GBU-15 with infrared seeker will be initiated to demonstrate the capability of this system to accurately attack high-value targets during night and haze conditions. This seeker, as a modular replacement for the in-production television seeker, will provide the GBU-15 precision, standoff attack capability on a 24-hour basis. Development of the depot technical repair center for the in-production GBU-15 will be initiated. Support equipment and test procedures for the infrared seeker will be developed to ensure a readiness to support a FY 1983 production decision for GBU-15 with infrared guidance. Funding differences from that shown in the FY 1982 Descriptive Summary reflect the FY 1982 funding appropriated for this program element, the termination of the GBU-20 Planar Wing Weapon, the transfer of the jam-resistant data link to PE64606F, and the resultant restructuring of the imaging infrared seeker integration and test project.

3. (U) FY 1983 Planned Program: Testing will be completed and a production decision obtained for the GBU-15 with imaging infrared seeker. Development of depot technical repair center for the in-production GBU-15 will be completed. Support equipment for the infrared seeker will be updated to a production configuration.

4. (U) FY 1984 Planned Program: The production of the GBU-15 will continue: assuming a favorable production decision for the Imaging Infrared version, production will transition from the TV/DL version to the Imaging Infrared configuration.

5. (U) Program to Completion: Production will continue for the GBU-15, in the Imaging Infrared version, assuming a favorable production decision is made; otherwise, production will continue using the TV/DL configuration. Funding differences for total estimated program costs from those shown in the FY82 Descriptive Summary are mostly due to termination of the GBU-20 Planar Wing Weapon development and the transfer of the jam-resistant data link to PE64606F.

6. (U) Milestones:

A.	GBU-15/TV/DL Initial Production Contract Award		Sep 80
B.	GBU-15/TV/DL Initial Production Delivery		Jan 81
C.	Start GBU-15/Infrared/DL Operational Testing		Feb 82
D.	GBU-15/Infrared/DL Production Decision	*(Jul 83)	Sep 83

*Date presented in FY 82 Descriptive Summary

Budget Activity: Tactical Program, #4
Program Element: #64733F, Surface Defense Suppression

Test and Evaluation Data

1. (U) Development Test and Evaluation:

(U) The Glide Bomb Unit (GBU)-15(V)/B Modular Guided Weapon System is a family of guidance and control and airfoil modules which, when combined with either the MK-84 General Purpose Bomb or the Cluster Bomb Unit (CBU)-75A/B Cluster Warhead can be configured for various attack and target conditions. The GBU-15 utilizes a Cruciform Wing airfoil optimized for low level standoff delivery. Following completion of Congressionally directed testing in March 80 and recertification by the Deputy Secretary of Defense, the GBU-15(V) 1/B has been approved for production; a contract for the initial United States Air Force production with a follow-on option was awarded in September 80 to Rockwell International. This version employs a television/data link guidance to allow the standoff delivery of the MK-84 bomb against high value, heavily defended targets requiring precise hitting accuracy. Development effort is continuing to integrate and test an imaging infrared guidance based upon the Maverick seeker to provide attack capability during conditions of night and light haze. A Planar Wing Weapon variant developed under this program element has been re-designated as the GBU-20(V). Due to substandard test results of that weapon and fiscal constraints, further development and test of the GBU-20 has been suspended.

(U) The development contractor for the GBU-15 is Rockwell International Corp., Columbus, OH. Program management is provided by Headquarters, Air Force Systems Command, Andrews Air Force Base, MD, and its subordinate organization, Armament Division, Eglin Air Force Base, FL. The GBU-15 testing consisted of a development test and evaluation effort, conducted by Air Force System Command, and a combined development test and evaluation/initial operational test and evaluation conducted by Tactical Air Warfare Center, Eglin Air Force Base, Fl. A total of 44 GBU-15s have comprised the Development Test and Evaluation portion of the test program. Mass simulation vehicles were used to verify aircraft handling and safe jettison characteristics (six MK-84 and three CBU-75A/B on F-4 and eight MK-84 on F-111). Six weapons were preprogrammed MK-84 vehicles launched from an F-4 to verify weapon response to initial autopilot design. Seven were equipped with distance measuring equipment (two MK-84 and five CBU-75A/B). Six MK-84 weapons were launched from an F-4 using television guidance in the lock-on-before-launch profile. Eight weapons were equipped with data link guidance and MK-84 warhead; three launched from an F-4, two from a B-52, and three from an F-111. All flight tests were conducted at Eglin Air Force Base, Fl. with the exception of distance measuring equipment tests which were conducted at White Sands Missile Range, NM. and the F-111 integration tests conducted at China Lake, CA. Fuzing systems used were the FMU-124A/B for the MK-84 and the FMU-123/B for the CBU-75 warhead. Results of the FMU-124 reliability testing was .968 at the 90 percent confidence level (requirement is .95/90 percent). An extensive series of captive flight tests was also conducted at Eglin Air Force Base, FL. to evaluate airborne data link pod coverage and evaluate Electronic Counter Measures/Electro Magnetic Interference capability of both the GBU-15 and the AN/AXQ-14 data link pod. Ground tests included radar cross section testing and testing to determine the antenna pattern coverage of the AN/AXQ-14

Budget Activity: Tactical Program, #4
Program Element: #64733F, Surface Defense Suppression

data link pod on the F-4, F-111, and B-52. Major changes for Initial Operational Test and Evaluation weapons included improvements in the autopilot for low level launch capability. Required modifications as a result of the Development Test and Evaluation program were incorporated into the Initial Operational Test and Evaluation test hardware.

(U) Hardware reliability has been examined throughout the GBU-15 test program. The cumulative demonstration mean time between failure throughout the Phase I-Phase IV Initial Operational Test and Evaluation testing was 25.1 hours versus an established standard of 14.2 hours. The goal established for out of box reliability (initial checkout) for the development pre-production hardware used in the Phase III and IV Initial Operational Test and Evaluation was 92 percent at the 85 percent confidence level. The initial test pass rate for Phase III and IV was nine weapons checked, eight passed, for 89 percent. The use of hard tooling, circuit board redesign, full electronics "burn in" and decreased "touch labor" during manufacturing are expected to improve the out-of-box reliability of the production hardware. The out-of-box reliability specification for the production hardware is 95 percent and will be checked during the Follow-on Operational Test and Evaluation. The initial United States Air Force production contract for GBU-15 with Television guidance was awarded in September 80; initial production deliveries are scheduled to begin in December 81. With the exception of producibility changes, the Initial Operational Test and Evaluation hardware represents the form, fit, and function of the hardware being procured. Follow-on Operational Test and Evaluation using production GBU-15s is planned during April-September 82. The GBU-15 with Television guidance satisfactorily passed the environmental qualification tests as required by Military Standard 810B.

(U) The integration of the Maverick Imaging Infrared seeker into the GBU-15 will extend GBU-15 operation into conditions of night and light haze. Advanced development module testing was conducted during the period 1 August 1979-31 December 1979. This testing was designed to evaluate the functional aspects of hardware design and investigate some operational use concerns. Imaging infrared seekers and GBU-15 weapon modules will be acquired during 1981 to support Development Test and Evaluation/Initial Operational Test and Evaluation. Development Test and Evaluation is scheduled to begin in January 1982. Initial Operational Test and Evaluation is scheduled for August 1982-July 1983. The principal test site for Development Test and Evaluation/Initial Operational Test and Evaluation will be Eglin Air Force Base, FL. A Test and Evaluation Master Plan has been prepared identifying specific development, operational effectiveness, and operational suitability objectives. Specific measures of effectiveness will be developed for each objective and published in the Development Test and Evaluation and Initial Operational Test and Evaluation Test Plans.

Budget Activity: #4, Tactical Programs
Program Element: 64733F - Surface Defense Suppression

Test and Evaluation Data

2. (U) Operational Test and Evaluation Data:

a. (U) GBU-15/Cruciform Wing Weapon (CWW)/Television/Data Link.

(1) (U) The testing of this weapon was accomplished in four phases. Phases I and II were combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) conducted by the Armament Division and the Tactical Air Warfare Center (TAWC), October 1975-December 1977. The IOT&E Report was published in November 1978 (TAC Project 75C-003T, GBU-15 CWW IOT&E Phase III and IV, Secret). Both reports are available through the Defense Technical Information Center, Cameron Station, Alexandria, Virginia 22314.

(2) (U) For all four phases of the test program, the Air Force Test and Evaluation Center (AFTEC) approved the TAWC test plans, monitored the testing, and provided independent comments on the test results to the Chief of Staff, United States Air Force.

(3) (U) In addition to the GBU-15 IOT&E, four weapons were launched during other programs. Three weapons were launched during the F-111F PAVE TACK DT&E/IOT&E, and one weapon was launched during the Precision Guided Munitions Demonstration for the Secretary of Defense at White Sands Missile Range, NM, December 1978.

(4) (U) The following is a summary of test results:

(a) A total of 21 GBU-15 IOT&E launches were conducted: 17 from the F-4E and four from the F-111F.
One of the failures was hardware related; during launch of Phase IV, the weapon directional/vertical gyro failed to uncage. Two launch failures were operator induced, and one launch failure was weather related.

(b) Of the 21 launches, 12 weapons were launched at a release altitude below 500 feet above ground level. The gyro malfunction accounted for one of the failures; the other failure was due to operator error (weapon launched out of envelope).

(c)

Budget Activity: #4, Tactical Programs
Program Elements: 64733F - Surface Defense Suppression

(5) (U) A follow-on operational test and evaluation (FOT&E) of the GBU-15/TV weapon is being planned by the Tactical Fighter Weapons Center. The test, scheduled April to September 1982, will consist of 25 weapons launches from the F-4E PAVE TACK and F-111F PAVE TACK aircraft. Emphasis during FOT&E will be placed on the development of additional tactics to enhance GBU-15 employment and verification that deficiencies noted during IOT&E have been corrected.

b. (U) GBU-15 CWW/Infrared (IR)/Data Link.

(1) (U) The Air Force is currently planning for an IOT&E of the GBU-15 CWW/IR weapon in the August 1982 to July 1983 time period. AFTEC has been designated as the OT&E agency to conduct this IOT&E which will consist of all weapons launches from the F-4E PAVE TACK aircraft (seven weapons) and the F-111F PAVE TACK aircraft (four weapons). In addition, 65 captive-carry sorties, using both of the above aircraft, will be flown to generate approximately 300 passes from which data on target acquisition, acquisition ranges, and effects of weather can be obtained and evaluated.

(2) (U) The principal test sites will be Eglin AFB, Florida, and Naval Weapons Center, China Lake, California. Captive-carry missions will be flown off range against realistic targets in the southeastern and northwestern US. On-range targets for actual weapon launches will be selected for the degree to which they represent real world targets. Tactical Air Command aircrew and maintenance personnel will participate throughout the IOT&E.

c. (U) GBU-20 (formerly designated the GBU-15 Planar Wing Weapon)

(1) (U) Between April 1977 and August 1979, a combined DT&E/IOT&E of the GBU-20 was conducted to evaluate this weapon for employment by the B-52D. AFTEC was the OT&E agency for this test. The IOT&E Report, published in December 1979 under the title B-52D/GBU-15 PWW IOT&E, is available from the Defense Technical Information Center.

(2) Based upon test results,

(3)

The GBU-20 program was officially terminated by HQ USAF PMD, 26 May 1981.

Budget Activity: Tactical Program, #4
Program Element: #64733F, Surface Defense Suppression

3.

CRUCIFORM WING WEAPON/MK-84/TELEVISION/DATA LINK TECHNICAL CHARACTERISTICS

Characteristic	Objective	Threshold	Demonstrated[1]
Maximum Mach			
Maximum Altitude (feet)			
Minimum Altitude (feet)			
Range (Nautical Mile)			
Accuracy (feet) (Circular Error Probable)			
Reliability (weapon hardware inflight)	.95	.90[3]	.95[4]

1 Demonstration of parameter maximum was not necessarily a test objective.
2 Data not specified in technical specifications
3 Tactical Air Command goal for Initial Operational Test and Evaluation
4 Demonstrated during Development Test & Evaluation/Initial Operational Test and Evaluation Development Test and Evaluation/Initial Operational Test and Evaluation program conducted by Tactical Warfare Center.
5 Demonstrated during Development Test and Evaluation program conducted by Air Force Systems Command

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64737F
DOD Mission Area: Self Protection, #371

Title: Airborne Self Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	12,273	54,096	46,726	35,133	Continuing	Not Applicable
2712	ASPJ Common Development	6,700	29,900	15,400	14,000	11,513	88,713
2714	F-111/ASPJ Devlopment/ Integration					Continuing	Not Applicable
2715	ALQ-131/CPMS Development/ Integration	3,183	7,900	11,300	7,300	4,100	33,783
2719	F/16/ASPJ Development/ Integration	2,390	16,296	20,026	13,833	6,200	58,745

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Airborne Self Protection Jammer (ASPJ) designated as the ALQ-165 is a joint Air Force/Navy engineering development program for an internally mounted electronic countermeasures (ECM) system that will provide self protection and increase the probability of aircraft survivability when various tactical aircraft (F-16, F-14, F/A-18, A-6E, and EA-6B) are confronted by modern diversified radar controlled weapon systems. Development of associated support equipment, alternate technology and aircraft integration are included. Also included is development of a Comprehensive Power Management System (CPMS) for the USAF ALQ-131 ECM Pod to be carried by those aircraft not programmed for ASPJ. Major component, subsystem and system development will continue through the full scale production decision. Engineering Development Model systems will undergo effectiveness, qualification, and reliability testing. These systems will also be used to prototype aircraft installations.

(U) BASIS FOR FY 1983 REQUEST: This request includes funds for continuing Phase II (engineering development, fabrication, assembly and testing) for the full scale development of ASPJ, development and testing of associated ground support equipment and ASPJ integration with the F-16 aircraft. Also included in this request are funds to continue development of an advanced receiver/processor (R/P), known as the CPMS, for use with the ALQ-131 ECM pod. CPMS is a derivative of the basic ASPJ R/P. CPMS will increase the capability of the ALQ-131 ECM Pod for aircraft not programmed to be equipped with ASPJ. Cost estimates are based on data from previous ECM programs, engineering estimates and contractual data from ongoing programs.

Program Element: #64737F
DOD Mission Area: Self Protection, #371

Title: Airborne Self Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	12,300	55,600	21,800		17,000	110,900
Procurement (Aircraft) PE 27133F			46,500		TBD	TBD

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
Procurement (Aircraft) PE 27133F				22,900	Continuing	Not Applicable

Program Element: #64737F

DOD Mission Area: Self Protection, #371

Title: Airborne Self Protection Jammer (ASPJ)

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The Airborne Self Protection Jammer (ASPJ) designated the ALQ-165 is a joint Air Force/Navy engineering development program for an internally mounted electronic countermeasures (ECM) system that will provide self protection and increase the probability of aircraft survivability when various tactical aircraft (F-16, F-14, F/A-18, A-6E, and EA-6B) are confronted by modern diversified radar controlled weapon systems. ASPJ is necessary to counter present and projected threats

] The Comprehensive Power Management System (CPMS) (essentially the ASPJ receiver/processor) is being developed for the ALQ-131 ECM pod. These pods will be used on aircraft not scheduled to receive ASPJ (A-7D, A-10, and F/RF-4). The ASPJ program includes development of associated support equipment, alternate technology and aircraft integration. The program will complete major component and subsystem development and continue system development through the full scale production decision. Engineering Development Model systems will undergo effectiveness, qualification, and reliability testing and will be used in prototype aircraft installations for Development and Operational testing. Integrated logistics requirements/reliability, maintenance, and training will be incorporated. The ASPJ internal ECM system is intended for installation in the F-16A aircraft.

(U) RELATED ACTIVITIES: This program is structured as a joint Navy/Air Force effort with Navy funds provided under PE 64226N, Advanced Self Protection Systems. It is the intent of this program to attain 100% commonality of the ASPJ system design for internal application and to equally share the total Group B cost of engineering development between the two Services. The Air Force and Navy joint development efforts were initiated during FY 1979. Air Force funds were provided under PE 64738F, Protective Systems and PE 64739F, Tactical Protective Systems. In FY 1980 Air Force direction and funds for this effort were consolidated under PE 64737F, Airborne Self Protection Jammer. The F-16 internal ECM (IECM) efforts are directly related to PE '133F, F-16 Squadrons. The ALR-69 Radar Warning Receiver Update, funded under PE 64739F, is being interfaced with the ALQ-165 to insure operability.

(U) WORK PERFORMED BY: ASPJ is managed by a joint Navy/Air Force Program Office at the Naval Air Systems Command, Washington, D.C. The Navy is the lead Service. The Air Force unique portion of this program, integration of CPMS into the ALQ-131 and ASPJ into the F-16, is managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The ASPJ/CPMS Phase I effort was accomplished by two competitive contractor teams. One team was Northrop Corporation, Rolling Meadows, IL and Sanders Associates, Nashua, NH. The second team was ITT, Nutley, NJ and Westinghouse Corporation, Baltimore, MD. The ITT/Westinghouse team was selected during FY 1981 to proceed into Phase II (full scale engineering development).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In FY 1979, the ASPJ program successfully passed the Defense Systems Acquisition Review Council (DSARC) II milestone. As a result of the DSARC II decision, the Air Force was directed to fully participate with the Navy in the joint development of the ASPJ system. During FY 1979, Phase I of the ASPJ engineering development effort was initiated with the award of contracts to two competitive contractor teams. During Phase I, the program proceeded from engineering design to critical design review in FY 1981. During FY 1980, the Air Force decided to test ASPJ in the F-16 and agreed to equally share the ASPJ common development cost with the Navy. Design studies for an internal F-16 installation were initiated prior to the Air Force joining the ASPJ

Program Element: #64737F
DOD Mission Area: Self Protection, #371

Title: Airborne Self Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

program, the Navy developed dual-mode Traveling Wave Tubes, assembled an Advanced Development Model of the ALQ-165 and conducted simulator testing of the model. The ASPJ receiver/processor design criteria has been replaced for integration with the ALQ-131 Electronic Countermeasures (ECM) pod. As a result of the ASPJ Defense Systems Acquisition Review Council (DSARC) II Decision Memorandum direction, PE 64737F was established in the Air Force budget with four projects to permit better tracking of program tasks. The ASPJ Phase I engineering design was completed with the culmination of the critical design review. Phase II was initiated when one of the two competitive contractor teams was selected to proceed into Engineering Development Model fabrication, assembly and test. The aircraft manufacturer in concert with the ALQ-165 developers developed installation design specifications for the F-16A.

2. (U) FY 1982 Program: Phase II/Engineering Development Model fabrication, assembly and test of the ASPJ/ALQ-165 will continue. Early phases of Development Test and Evaluation of the ALQ-165 and CPMS will commence. Early phase of prototyping the F-16 aircraft will commence. Development and integration of the Comprehensive Power Management System (CPMS) will continue.

3. (U) FY 1983 Planned Program: Phase II of the ALQ-165 will continue and delivery of the Engineering Development Models will begin. These models will be used in the Test, Analyze and Fix Program and in development testing. Prototype aircraft installation will continue. Early testing of CPMS will commence. Qualification testing of ASPJ and CPMS will be completed. Prototyping aircraft will continue. The increased costs are attributed to the Air Force becoming a full participant in the ASPJ program, increasing the Air Force share from 37% to 50% and integrating ASPJ and CPMS into the F-16A and ALQ-131 ECM pod respectively.

4. (U) FY 1984 Planned Program: Complete development testing. Initiate operational testing.

5. (U) Program to Completion: Complete Development and Operational Testing. DSARC III will occur during FY 1985. The completion of Initial Operational Test and Evaluation, a successful DSARC III decision and subsequent test reports will conclude this engineering development program.

6. (U) Milestones: Not Applicable.

Project: 2712 Title: ASPJ Common Development

Program Element: #64737F Title: Airborne Self Protection Jammer (ASPJ)

DOD Mission Area: Self Protection, #371 Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND DESCRIPTION: The Airborne Self Protection Jammer (ASPJ), ALQ-165, is required to increase Air Force and Navy tactical aircraft survivability and provide an enhanced probability of mission success. The Research, Development, Test and Evaluation effort leading to the ALQ-165 is required to develop advanced Electronic Countermeasure techniques

Sixteen ASPJ Engineering Development Models will be used for system effectiveness evaluation, reliability testing, qualification testing and Initial Operational Test and Evaluation.

(U) RELATED ACTIVITIES: This project is structured as joint Navy/Air Force effort with Navy funds provided under PE 64226N, project W0629-TW. Development cost for this project is being shared equally between the Air Force and Navy. The F-16 internal ECM (IECM) efforts are directly related to PE 27133F, F-16 Squadrons.

(U) WORK PERFORMED BY: ASPJ Common Development is managed by a joint Navy/Air Force Program Office at the Naval Air Systems Command, Washington, D.C. The Navy is the lead Service. Air Force support for this effort is provided by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The ASPJ Phase I effort was accomplished by two competitive contractor teams. One team was Northrop Corporation, Rolling Meadows, IL and Sanders Associates, Nashua, NH. The second team was ITT, Nutley, NJ and Westinghouse Corporation, Baltimore, MD. The ITT/Westinghouse contractor team was selected to proceed into Phase II (Full Scale Engineering Development). Various Naval and Air Force organizations are supporting this effort through the joint program office

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In FY 1979, the ASPJ program successfully passed the Defense Systems Acquisition Review Council (DSARC) II milestone. As a result of the DSARC II decision, the Air Force was directed to fully participate with the Navy in the joint development of a common ASPJ system. During FY 1979, Phase I of the ASPJ engineering development was initiated with the award of contracts to two competitive contractor teams. Aircraft installation studies were conducted. As a result of the ASPJ DSARC II Decision Memorandum direction, ASPJ efforts formerly accomplished under PE 64738F and 64739F were consolidated under PE 64737F. The design phase was completed with a critical design review in FY 81, and Phase II, Engineering Development Model fabrication, assembly and test phase was initiated.

2. (U) FY 1982 Program: Phase II, Engineering Development Model fabrication, assembly and test, of the ALQ-165 development will continue. Early phases of Test, Analyze and Fix will commence.

Project: 2712
Program Element: #64737F
DOD Mission Area: Self Protection, #371

Title: ASPJ Common Development
Title: Airborne Self Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

3. (U) FY 1983 Planned Program: Phase II of ALQ-165 development will continue and delivery of the Engineering Development Models will commence. Development Test and Evaluation will continue.

4. (U) FY 1984 Planned Program: Development Test and Evaluation of the ALQ-165 in the F-16A will be completed; Operational Test and Evaluation will commence.

5. (U) Program to Completion: Complete Operational Testing. Obtain a production decision a Defense Systems Acquisition Review Council (DSARC) III. Commence production.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	6,700	29,900	15,400	14,000	11,513	88,713

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	6,700	27,700	13,500		14,300	62,200

(U) The cost increase is the result of the USAF becoming a full participant in the ASPJ program and the share ratio increased from 37% to 50%.

Project: 2715
Program Element: #64737F
DoD Mission Area: Self Protection #371

Title: ALQ-131/CPMS Development/Integration
Title: Airborne Self Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This project supports adapting the receiver/processor portion of the ALQ-165/ASPJ to provide an enhanced power management capability (Comprehensive Power Management System/CPMS) for the ALQ-131 electronic countermeasures (ECM) pod.

ALQ-131 ECM pods will be used on aircraft not scheduled to be equipped with the ASPJ internal ECM system, such as the A-7D, A-10, and F/RF-4.

(U) RELATED ACTIVITIES: The initial studies for the Comprehensive Power Mangement System (CPMS) were accomplished under Program Element (PE) 64739F. Modification of the ALQ-131 ECM pod to include new techniques that will take full advantage of the CPMS capability will be accomplished under PE 64739F.

(U) WORK PERFORMED BY: Development of the CPMS is managed by the joint Navy/Air Force Airborne Self Protection Jammer (ASPJ) Program Office at Naval Air Systems Command, Washington, D.C. Integration of CPMS into the ALQ-131 pod is managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The CPMS effort is being developed by a joint venture of two contractors composed of ITT, Nutley, NJ and Westinghouse Corporation, Baltimore MD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Studies were conducted to develop a design approach for integrating a Comprehensive Power Management System (CPMS) with the ALQ-131 pod, maximize commonality with ASPJ and how to meet performance requirements. A Memorandum of Agreement was signed in October 1978 with the Navy on CPMS development.

2. (U) FY 1982 Program: The design and critical item demonstration phase will be completed and Phase II, Engineering Development Model fabrication, assembly and testing will be initiated.

3. (U) FY 1983 Planned Program: Phase II, Engineering Development Model fabrication, assembly and test, of the CPMS development will continue. Delivery of engineering development models will commence early phases of Development Test and Evaluation.

4. (U) FY 1984 Planned Program: Phase II of CPMS development will continue. Development testing will be completed and operational testing will be initiated.

5. (U) Program to Completion: Complete Operational Testing. Obtain a Defense Systems Acquisition Review Council (DSARC III) production decision. Commence production.

Project: 2715
Program Element: #64737F
DoD Mission Area: Self Protection, #3/1

Title: ALQ-131/CPMS Development/Integration
Title: Airborne Self Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

6. (U) Milestones: Not Applicable

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	3,183	7,900	11,300	7,300	4,100	33,783

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	3,100	15,100	3,600		300	22,100

(U) FY 83 Funding increase is attributed to including all integration and test planning costs.

Project: 2719
Program Element: #64737F
DOD Mission Area: Self Protection, #371

Title: F-16/ASPJ Development/Integration
Title: Airborne Self Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This project supports the integration of the Airborne Self Protection Jammer (ASPJ) (ALQ-165) in the F-16 aircraft. The ALQ-165 is a joint Navy/Air Force program to develop an internal electronic countermeasures capability for self protection of tactical aircraft (F-16, F-14, F-18, A-6E and EA-6B) to enhance mission success and aircraft survivability when confronted by modern, diversified, radar controlled weapon systems.

(U) RELATED ACTIVITIES: Navy efforts for integrating ASPJ into Navy aircraft (F-14, F-18, A-6E and EA-6B) are funded under Program Element 64226N project W-1482.

(U) WORK EPRFORMED BY: The ASPJ Program is managed by a joint Navy/Air Force Program Office at Naval Air Systems Command, Washington, D.C. The Navy is the lead Service. The F-16 integration portion of this program is managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. General Dynamics, Fort Worth, TX is the aircraft contractor.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Preliminary aircraft installation studies were completed. Associate Contractor Agreements were signed with the prime aircraft manufacturer (General Dynamics) for preliminary installation investigations. Antenna measurements and aircraft radar cross section measurements were completed. Aircraft cooling requirements were studied. Support equipment requirements were identified.

2. (U) FY 1982 Program: Aircraft manufacturer complete installation design specification for the F-16. Commence prototype installation and check out in the F-16.

3. (U) FY 1983 Planned Program: Complete prototype installation in the F-16. Commence development testing.

4. (U) FY 1984 Planned Program: Complete development testing and initiate operational testing.

5. (U) Program to Completion: Complete operational testing in the F-16. Obtain production decision for the Airborne Self-Protection Jammer and commence production line installations in F-16 aircraft.

6. (U) Milestones: Not Applicable.

Project: 2719
Program Element: #64737F
DOD Mission Area: Self Protection, #371

Title: F-16/ASPJ Development/Integration
Title: Airborne Self Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	2,390	16,296	20,026	13,833	6,200	58,745

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	2,500	12,800	4,700		2,400	22,400

(U) FY 83 Funding increase is attributed to including all costs associated with integrating and interfacing ASPJ with other F-16 avionics.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64738F
DoD Mission Area: Self Protection #371

Title: Protective Systems
Budget Activity: Tactical Programs, #4

RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	62,787	108,491	110,234	53,148	Continuing	Not Applicable
1627	Simulation, Analyses and Evaluation	6,700	7,390	10,700	11,000	Continuing	Not Applicable
2114	Antenna Test Range	1,500	1,400	1,700	2,200	Continuing	Not Applicable
2683	Radar Countermeasures	26,400	40,350	17,900		Continuing	Not Applicable
3829	Infrared and Optical Countermeasures	500	2,450	6,500	6,648	Continuing	Not Applicable
5615	Strategic Protective Systems	19,687	45,430	63,134	24,000	Continuing	Not Applicable
5616	F/FB-111 Protective Systems	2,300	2,600	10,300	9,300	Continuing	Not Applicable
6510	Flight Test Simulators	5,700	8,871			Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides funds for: (1) engineering development of new or improved electronic countermeasures (ECM) equipment for strategic aircraft; (2) infrared countermeasures equipment for strategic, tactical and combat support aircraft; (3) an expedited effort to develop electronic countermeasures techniques against the new generation of highly ECM resistant and very capable [ ] radar threats; (4) development of Soviet radar replicas against which electronic warfare equipments are flight tested; (5) the evaluation and analysis of electronic warfare equipment; (6) development of an antenna test range to support both ground and airborne evaluation of new electronic warfare antennas and development of penetration aids for Air Launched Cruise Missiles.

BASIS FOR FY 1983 RDT&E REQUEST: The Soviets continue to develop, deploy, and provide their allies with sophisticated electronic and electro-optical surface-to-air and air-to-air weapon systems. Of particular concern is the deployment, in significant numbers, of both airborne and ground based [ ] threat radar systems against which current generation ECM systems have [ ] These circumstances make it imperative that Air Force aircraft

Program Element: #64738F | Title: Protective Systems
DoD Mission Area: Self Protection, #371 | Budget Activity: Tactical Programs, #4

carry effective electronic countermeasures (ECM) equipment which can provide protection against enemy air defenses and help ensure the successful accomplishment of assigned wartime missions without incurring unacceptable attrition. In order to ensure continued strategic bomber, cruise missile and cruise missile carrier effectiveness against Soviet defensive systems in the 1980s and 1990s, a significant investment in equipment development has been made to accelerate existing programs. The survivability enhancements derived from these developments will ensure continued effectiveness of strategic and tactical weapons systems affected through the 1980s and 1990s.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	62,894	108,900	79,700		Continuing	Not Applicable

FY 1983: The FY 1983 estimate is $34.3 million higher than estimated last year. The increases in requested funds for FY 83 are needed to: (1) Complete development of electronic countermeasures system for Air Launched Cruise Missiles to protect against Soviet and to develop necessary support equipment for that system, (2) accelerate countermeasures technique development, validation and integration into existing countermeasures systems, (3) emphasize development and flight testing of improved countermeasures capabilities for Cruise Missile Carrier Aircraft to protect it from the and (4) provide necessary updates to threat simulations/facilities and test range to permit required effectiveness and developmental testing.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #64738F | Title: Protective Systems
DoD Mission Area: Self Protection #371 | Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The purpose of this program element (PE) is to: (1) develop, test and evaluate electronic countermeasures (ECM) equipment for strategic aircraft; (2) develop infrared (IR) and optical countermeasures equipment for all combat aircraft; (3) develop new ECM systems, or techniques which can be integrated into existing aircraft ECM systems, that will be effective against the new generation of highly ECM resistive Soviet radar threat weapon systems; (4) upgrade existing, or develop new, simulations/replicas of radar controlled weapon systems against which electronic warfare (EW) equipments undergo both development, and flight testing; and (5) develop/upgrade the antenna test range which supports both ground and airborne evaluation of new electronic warfare antennas. The quality, quantity, diversity and continual improvement of command/control and weapon systems dictates an orderly developmental effort to improve existing and introduce new electronic warfare systems which provide adequate response/capability to counter these improved systems. Development efforts are in direct response to identified operational deficiencies where existing EW equipment will no longer provide adequate protection for aircraft performing assigned combat missions. Laboratory and flight test simulations of radars and defense systems are necessary to adequately evaluate the effectiveness of new equipment, EW techniques and tactics. The seven numbered projects with this program element fall into two functional area: (1) aircraft protective systems (Project 2683 - radar countermeasures; Project 5615 - Strategic Protective Systems, and Project 5616 - F/FB-111 Protective Systems); and (2) systems analysis and testing (Project 1627 - Simulation Analyses and Evaluation; Project 2114 - Aircraft antenna test range, and Project 6510 - Flight test simulators).

(U) RELATED ACTIVITIES: The efforts in this program build upon concepts and technology demonstrated in advanced development programs PE 63718F, Electronic Warfare Technology, and PE 63743F, Electro-Optical Warfare. They are closely coordinated with ECM engineering development projects in PE 64739F, Tactical Protective Systems.

WORK PERFORMED BY: The aircraft subsystems and laboratory simulation programs are managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The flight test simulation project is managed by the Armament Development and Test Center, Eglin AFB, FL. The antenna test range is managed by Rome Air Development Center, Griffis AFB, NY. The major contractors are: General Dynamics, Inc., Fort Worth, TX - threat simulation; Westinghouse Corp., Baltimore, MD - tail warning system for B-52 and F/FB-111; and ITT Avionics, Inc., Nutley, NJ - upgrade of ALQ-117 for the strategic bomber force and Cruise Missile Carrier Aircraft forces.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1 FY 1981 and Prior Accomplishments: Hardware development programs for strategic bomber and tactical fighter aircraft initiated in FY 1981 will continue. These include adaptation of the B-52/ALQ-153 Doppler Tail Warning Radar system for FB-111 application and ALQ-172 airborne interceptor jammer development including countermeasures and techniques/capabilities to defeat the threat to the B-52's role as Air Launched Cruise Missile Carrier. A very significant effort has been mounted to provide ECM protection for the Air Launched Cruise Missile against Soviet

Successful tests have been conducted. The level of effort simulation/replica development/update program continues. Development and test of countermeasures techniques to counter this radar technique continued.

Program Element: #64738F
DoD Mission Area: Self Protection, #371

Title: Protective Systems
Budget Activity: Tactical Programs, #4

2. FY 1982 Program: Major development emphasis will continue to be focused on improvements to B-52 Cruise Missile Carrier protective systems (ALQ-172); test and validation of countermeasures techniques for both strategic and tactical electronic warfare systems; and continued development and a production decision for ALCM countermeasures systems. Adaptation of the ALQ-153 tail warning radar system to the FB-111 and the full scale engineering development of a new flare have been scaled down to help fund higher priority projects. The level of effort for electronic warfare (EW) simulation facility upgrading, needed to test the effectiveness of new techniques, has been increased to develop simulations for testing of all EW hardware. Development of a countermeasures system to degrade the effectiveness will be initiated at an accelerated pace.

3. FY 1983 Planned Program: The ALQ-172 countermeasures system for the Air Launched Cruise Missile Carrier will undergo flight test and require a production decision. The ALQ-153 tail warning system will be installed in an FB-111 aircraft and begin flight test. Development on the Air Launched Cruise Missile ECM system flare full scale engineering development for tactical aircraft will begin while existing work for the B-52 version will progress toward an FY 84 flight test. Update to the F/FB-111 internal countermeasures system to protect it against the emerging threat will begin. countermeasures techniques, developed in previous years, will begin integration into the numerous ECM systems. Level of effort simulation improvement at the Air Force threat simulation facilities will continue. Studies will be initiated pertaining to countermeasures developments and application of detection systems. development will continue.

4. FY 1984 Planned Program: ALQ-172 development will be completed. Adaptation of the ALQ-153 to FB-111 aircraft will finish development and require a production decision. flare development for tactical aircraft will continue while strategic developments will be ready for production. F/FB-111 countermeasures system development will continue as will development of a capability for strategic and tactical aircraft. Threat simulation developments will continue. Development of a countermeasures capability for F/FB-111 aircraft and, if applicable, for Cruise Missile Carrier Aircraft will begin as will development for detection/countermeasures capability.

5. (U) Program to Completion: This is a continuing program.

Project: #1627
Program Element: #64738F
DoD Mission Area: Self Protection #371

Title: Simulation, Analyses and Evaluation
Title: Protective Systems
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This project provides for the development and fabrication of laboratory simulations of , radar systems and the analyses of potential candidate countermeasures systems and techniques. The availability of these realistic laboratory simulations of , radars permits effective definition, design, and evaluation of new/improved electronic countermeasures equipment against , surveillance radars, command and control networks, and controlled weapons.

RELATED ACTIVITIES: This project relies on many technical intelligence sources to define and assist in the design of functional electronic duplicates (simulations) of radar systems. These laboratory simulations are used by virtually all Air Force and many Army and Navy electronic warfare development programs during definition, design and/or evaluation. The analyses capability sponsored by this project supports Program Element (PE) 63718F, Electronic Warfare Technology; PE 63743F, Electro-Optical Warfare; PE 27252F, EF-111A; PE 64724F, Tactical C^3 Countermeasures; PE 64739F, Tactical Protective Systems and development efforts elsewhere in Protective Systems PE 64738F. These simulators are also used by Strategic and Tactical Air Commands to measure the change in effectiveness of operational ECM systems resulting from the use of new tactics or equipment settings against any specific threat radar.

(U) WORK PERFORMED BY: The laboratory simulation programs are managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The major contractors are: General Dynamics, Inc., Fort Worth, TX, - Air Force Electronic Warfare Evaluation Simulator (AFEWES); Calspan Corp., Buffalo, NY - Real Time Electromagnetic Digitally Controlled Analyzer and Processor (REDCAP) Simulator; and the Aeromedical Research Laboratory, Wright-Patterson AFB, OH - Strategic Avionics Crew Station Design Facility.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1 FY 1981 and Prior Accomplishments: Previously established simulation facilities are: the AFEWES, at General Dynamics, Fort Worth, TX; REDCAP Simulator at Calspan Corp., Buffalo, NY; and the B-52 Electronic Warfare Officer Crew Station for human factors engineering design evaluations at Wright-Patterson AFB OH. AFEWES consists primarily of five general classes of simulations of threat radar systems: (1) surface-to-air missile, (2) anti-aircraft-artillery, (3) airborne interceptor, (4) acquisition and (5) ground control intercept/height finder radars. This facility provides the Air Force and other Department of Defense agencies the capability to perform thorough assessments of electronic warfare techniques, equipment, and subsystems, as well as systematic in-depth evaluations of ECM system capabilities and weapon system survivability analyses. It is a valuable decision tool to supplement advanced development, engineering development, flight test and related analyses efforts. The unique feature of this facility is that actual ECM equipment is evaluated at its normal operating frequencies. REDCAP was established for evaluation of jamming equipment used against early warning radars and command and control network communications. The following simulator developments/upgrades continue in work: radar and associated missile simulation; radar simulation; command, control and communications (C^3) and data link systems simulation; upgrade of existing early warning (EW) and ground

Project: #1627
Program Element: #64738F
DoD Mission Area: Self Protection #371

Title: Simulation, Analyses and Evaluation
Title: Protective Systems
Budget Activity: Tactical Programs, #4

controlled intercept (GCI) radar simulations to bring them into compliance with current intelligence estimates; and the development of an Adaptable Radar Simulator which can be quickly assembled from available components and preliminary intelligence estimates to provide a rapid "first-look" at a potential new radar system.

2. FY 1982 Planned Program: Fabrication of radar simulations will continue. simulations and EW/GCI development will make them once again available for countermeasures testing with updated threat data incorporated. Of note is the installation (a first) of a model in the to provide it with a more realistic simulation of the actual problems encountered by such a radar when acquiring and tracking targets.

3. FY 1983 Planned Program: The FY 83 program will continue existing efforts to upgrade the various threat radar simulations to insure their compliance with the latest threat estimate. Fabricating of Radar will continue. Design and fabrication of a will begin as well as the design and fabrication of a reactive aircraft cockpit simulation.

4. FY 1984 Planned Program: The FY 84 program will build upon modernization and update efforts and development efforts continuing from 1982 and 1983, adding and updating capabilities as defined controlled weapon system threat data and funds availability permit.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	6,700	7,390	10,700	11,000	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
6,700	6,500	5,700		Continuing	Not Applicable

(S) FY 1983: The FY 83 estimate is $4.2M higher than estimated last year. The increase in requested funds for FY 83 is needed to accelerate and complete computer simulations of advanced radar systems and reactive cockpits and advanced Surface-to-Air Missile System (SAM) with simulations.

Project: #2683 Title: Radar Countermeasures

Program Element: #64738F Title: Protective Systems

DoD Area Mission: Self Protection #371 Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Most recent intelligence estimates confirm that air defense airborne interceptor, surface-to-air missile, and antiaircraft artillery radars now use radar target tracking techniques. technique which allows the threat system to obtain

This project is being constituted as a major development initiative to focus both resources and management attention on the urgent objective to find and integrate effective radar countermeasures into existing aircraft self-protection ECM systems.

RELATED ACTIVITIES: This new project draws heavily on concepts and technology demonstrated in advanced development Program Element (PE) 63718F, Electronic Warfare Technology. As techniques or new systems emerge successfully from engineering development, they may be input directly into hardware systems or channeled into selected program elements in which further integration into specific systems may be accomplished. The Air Force single manager radar countermeasures has already established direct liaison with Army and Navy electronic warfare development managers and is working to establish this program on a tri-service basis.

WORK PERFORMED BY: The Air Force manager is the Aeronautical Systems Division (ASD), Wright Patterson AFB, OH. Air Force has established a special management program office, nicknamed the "HAVE EXIT" Program Office, directly under the cognizance of the ASD Commander. The HAVE EXIT Program Office has management responsibility for all Air Force radar countermeasures development efforts. Major contractors are: ITT Avionics, Nutley, NJ; Sedco Systems Incorporated, Long Island, NY; Westinghouse Corporation, Baltimore, MD; Raytheon Corporation, Santa Barbara, CA; Tracor Sciences and Systems, Austin, TX; and General Electric Corporation, Utica, NY.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

a. FY 1981 and Prior Accomplishments: In this project, initiated in FY 1980, the Air Force began evaluation of preliminary systems concepts submitted by industry to counter the radar threat. Integration analyses and trade studies were accomplished to determine candidate systems approaches. The Air Force established as its first priority the attainment of effective radar countermeasures for strategic bombers and tactical fighters. Specific systems targeted for earlier countermeasures enhancement are the At the present time it appears that a combination of techniques will be required to provide the necessary survivability and mission effectiveness against the diverse threats. Selected techniques are being fabricated and integrated into the aforementioned ECM systems for testing against actual threat radars. In parallel with efforts to find immediate or near term solutions for these specific hardware systems, efforts will begin which will investigate other potential alternatives such as improved ( ) and techniques for specialized aircraft applications. The expedited development of an improved is planned. This effort could provide a highly cost effective complementary capability since it capitalizes on an existing on-the-shelf system which could be reinstalled in a short period of time at modest cost. The long term goal of finding a single or generic

Project: #2683 Title: Radar Countermeasures
Program Element: #64738F Title: Protective Systems
DoD Mission Area: Self Protection #371 Budget Activity: Tactical Program, #4

type solution will not be abandoned, and studies, analyses and some testing will be accomplished to further this objective.

2. FY 1982 Planned Program: Completion of fabrication of upgrades will occur. Comprehensive ground and flight testing of these upgrades will lead to the selection of those which are effective and warrant production for retrofit into these systems. Parallel efforts to design, fabricate, and test corresponding improvements for FB-111, F-15, F-16 and other Air Force aircraft ECM systems will continue. A continuing effort to solicit and evaluate new ideas will be maintained. Among those techniques already evaluated, two have shown excellent results in flight test against specific types/modes of radar operation. These include

3. FY 1983 Planned Program: The integration of selected countermeasures techniques into a wide range of aircraft ECM equipment will commence and be determined by the effectiveness of the specific techniques as validated in flight test, the effectiveness envelope of the technique (if limited) and the operational profile of the host aircraft. For example, would not be a candidate for F-15 because of the F-15 mission nor would an overly system be candidate for a small fighter. Actual integration efforts and flight test of the installed techniques will take place in the host ECM system development program element. This effort is planned to complete in FY 83.

4. (U) FY 1984 Planned Program: Program is planned to terminate in FY 83.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	26,400	40,350	17,900		Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	26,400	45,200	24,900		Continuing	Not Applicable

FY 1983: The FY 83 estimate is $6.2M less than estimated last year. The decrease in requested funds for FY 83 is a result of restructuring tasks contained within this project to concentrate efforts only on those which appear to provide the highest probability of success against the widest range of radar systems and be available for integration studies in FY 83. This project is scheduled to terminate activity in FY 83. Actual integration of these techniques into individual systems will be accomplished under other projects/program elements.

Project: #3829
Program Element: #64738F
DoD Mission Area: Self Protection #371

Title: Infrared and Optical Countermeasures
Title: Protective Systems
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This project provides for the development of infrared (IR) optical/electro-optical (EO) [countermeasures systems. The purpose will be to develop countermeasures capabilities to delete the growing arsenal of IR guided weapons in the] inventory and to develop counters for emerging optical, EO directed weapons. It is planned to take design candidates from laboratory development which are both responsive to existing requirements and technologically mature enough for full scale engineering development.

(U) RELATED ACTIVITIES: This project will rely on many technical intelligence sources to define the threat and assist in the definition and design of countermeasures system. Developments in the project will provide countermeasures capabilities for both strategic and tactical aircraft. Related activities take place in PE 64739F, Tactical Protective Systems.

(U) WORK PERFORMED BY: The Aeronautical Systems Division, Wright-Patterson AFB, OH.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 81 and Prior Accomplishments: This project was initiated in FY 1980. The initial task was to begin an analysis of the threat to US aircraft in the IR portion of the electromagnetic spectrum, determine the best solution, and support existing development programs aimed at transitioning mature capabilities into full scale engineering development. The primary near term aim is development of a flare [

] material capable of producing IR radiation closely matching that of a jet engine across the spectrum of interest has been chosen.

2. FY 1982 Program: In response to problems identified during 1981, the FY 1982 development program will concentrate on solving a [ ] phenomena and optimum dispenser packaging for strategic applications.

3. FY 1983 Planned Program: Full scale engineering development of the [ ] flare will be underway for strategic applications. Planning will begin for application to tactical aircraft dispensers. This program may include international development efforts. In addition, evaluations will be undertaken to determine the best method of [ ] weapon directing systems.

4. FY 1984 Planned Program: Full scale engineering development on the strategic [ ] flare will be completed. Full scale engineering development on a tactical derivative will continue as will studies into development of an [ ] detection capability.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

Project: #3829
Program Element: #64738F
DoD Mission Area: Self Protection #371

Title: Infrared and Optical Countermeasures
Title: Protective Systems
Budget Activity: Tactical Programs, #4

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	500	2,350	6,500	6,648	Continuing	N/A

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	500	2,500	7,000	-	Continuing	N/A

Project: #5615
Program Element: #64738F
DoD Mission Area: Self Protection #371

Title: Strategic Protective Systems
Title: Protective Systems
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This project provides for the development of new and improved electronic countermeasures (ECM) systems for strategic aircraft. The continued improvement in the quantity, quality and diversity of] air defense command/control and weapon systems establishes a corresponding need to provide improved self-protection countermeasures systems for strategic aircraft. For the immediate future the B-52 will continue to be the mainstay of strategic bomber aircraft offensive capability. The B-52 in its cruise missile carrying role will face a multitude of radar equipped airborne interceptor aircraft. Efforts in this project focus on optimizing existing B-52 ECM systems, and to provide the enhanced capability necessary to permit accomplishment in the new air-launched cruise missile carrier role and transfer of applicable technology to other systems for those techniques evaluated on the ALQ-172 by the HAVE EXIT countermeasures) SPO.

(U) RELATED ACTIVITIES: The efforts in this project draw heavily on concepts and technology demonstrated in advanced development Program Element (PE) 63718F, Electronic Warfare Technology, and PE 63743F, Electro-Optical Warfare. Technology from other projects within this PE and PE 64739F, Tactical Protective Systems, are utilized to the maximum extent possible.

WORK PERFORMED BY: The Air Force manager is the Aeronautical Systems Division, Wright-Patterson Air Force Base (AFB), OH. The major contractors are: ITT Avionics, Nutley, NJ - for update of ALQ-117 jammer, with Sedco Systems Incorporated, Long Island, NY as major subcontractor for ALQ-117 ECM antennas.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Completed efforts in prior years which are currently being installed in the B-52 as Class V modifications include: the ALQ-122 ECM system which jams the the ALQ-155 ECM power management system, which integrates ALT-28 jammers (covering the spectrum of early warning, surveillance, and terminal threat radars) with the ALR-46 radar warning receiver to provide rapid, accurate and prioritized jamming response to these threats; and the ALQ-1?3 doppler tail warning radar (which detects approaching air-to-air missiles and] Priority developments included: update of the ALQ-117 jammer (ALQ-172) to provide enhanced protection for the B-52 in its cruise missile carrier role and the development necessary to ensure penetration survivability. The Soviet [ ] missile system and modified fighter are now recognized as] threats to the cruise missile. Fortunately, ECM technology is available which can substantially reduce if not negate that threat. ECM hardware and airframe modifications to the air launched cruise missile to permit it to carry that hardware, continue in development in this project. The electronically steerable phased array jamming antenna system mentioned in previous descriptive summaries is being evaluated for cost effectiveness in comparison with smaller, less complex antenna installations and HAVE EXIT substitutions if any are applicable.

Project: #5615
Program Element: #64738F
DoD Mission Area: Self Protection #371

Title: Strategic Protective Systems
Title: Protective Systems
Budget Activity: Tactical Programs, #4

2. FY 1982 Planned Program: The ALQ-172 airborne interceptor jammer configuration will be determined and the system will complete system fabrication and begin an extensive program of both ground and flight testing. The air launched cruise missile (ALCM) ECM suite will complete fabrication, ground and flight test leading to a production decision for the buy of ALCMs. New initiatives include development of a non-lethal counter to the new

3. FY 1983 Planned Program: The ALQ-172 will complete a rigorous program of flight and qualification (reliability/maintainability/durability) testing leading to a production decision. development will continue. Development of a long range will be initiated.

4. FY 1984 Planned Program: ALQ-172 support equipment development will be continued. development should reach a production decision point. development will continue. Initiation of upgrades to the B-52 in any role at this time must necessarily undergo close scrutiny for force structure developments. However, rapid adaptation of capabilities to counter systems should be considered.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	19,687	45,430	63,134	24,000	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	19,794	43,200	23,100		Continuing	Not Applicable

FY 1983: The FY 83 estimate is $40.0M higher than estimated last year. In FY 81, this project was reduced significantly by Congressional direction. The increase in requested funds in FY 83 is necessary to complete initiatives delayed in FY 81, whose necessity is now clear since the role and service life of the B-52 has been clarified, and to initiate/continue new development efforts needed for effective completion of the B-52/Cruise Missile Carrier Mission. The increase is necessary (1) to complete development and flight of the (ALQ-172) countermeasures system necessary to counter (2) for addition of task to develop a countermeasures capability to negate the ability of the to detect and track US aircraft; and (3) to complete development of the countermeasures system for the Air Launched Cruise Missile and associated support equipment.

Project: #5616 — Title: F/FB-111 Protective Systems

Program Element: #64738F — Title: Protective Systems

DoD Mission Area: Self Protection #371 — Budget Activity: Tactical Programs,

DETAILED BACKGROUND AND DESCRIPTION: To increase the survivability of F-111 aircraft performing deep interdiction and FB-111 aircraft performing strategic strike missions, a combination of radar warning receiver, aft-looking missile warning receiver, internal radar jammer, and chaff/flare decoys is employed. This project provides for the development of improvements to the electronic warfare systems on the tactical F-111 and strategic FB-111 series aircraft. These improvements are necessitated by the continually improving surface-to-air and air-to-air defensive systems and the deployment of new or modified radar controlled weapons.

RELATED ACTIVITIES: The efforts in this program element (PE) are based on technology demonstrated in PE 63718F, Electronic Warfare Technology; PE 63743F, Electro-Optical Warfare; and in Project 5615 radar countermeasures) within this program element. Close coordination is maintained between efforts in this project and similar efforts in other projects within this PE, and PE 64739F, Tactical Protective Systems, to maximize commonality and avoid duplication of effort.

(U) WORK PERFORMED BY: The Air Force manager is the Aeronautical Systems Division, Wright-Patterson AFB, OH. The major contractors are: Sanders Associates, Nashua, NH - internal jammers; Dalmo-Victor Division of Textron, Belmont, CA - radar warning receiver; and Westinghouse Corporation, Baltimore, MD - pulse doppler tail warning systems; General Dynamic Corporation, Fort Worth, TX - F/FB-111 airframe; and Grumman Aircraft Company, Bethpage, NY - EF-111A airframe.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: In 1977, development and flight test of improvements to the F/FB-111 radar warning receiver (AN/ALR-62) and the FB-111A internal countermeasures system (AN/ALQ-137) were completed. Both systems were placed into production providing a major improvement over then installed systems which were designed and built in the early 60's with design of the F/FB-111. One major program initiated since then is the adaptation of the B-52 Doppler Tail Warning System to the F/FB-111 aircraft to provide highly reliable detection of missiles closing on the aft quadrant and plus crew warning.

2. FY 1982 Program: Higher priority and Quick Reaction Capability requirements have placed an increasing demand for funds available within PE 64738F. Consequently, the development efforts to adapt the tail warning system to FB-111 aircraft have been reduced in scope to only an installation/electro-magnetic interference study in an effort to improve the probability of a rapid successful/modification/flight test effort in FY 83. Also being evaluated this year is a program to expand Radar Warning Receiver and countermeasures system frequency coverage into the frequency band in response to identified systems which operate in that frequency band.

3. FY 1983 Planned Program: Begin modification of FB-111 aircraft to install and test ALQ-153 tail warning system. Adaptation of that system to F-15 aircraft may also begin. Studies will be completed which will lead to active development of a band countermeasures capability for F/FB-111 aircraft. Studies will be initiated

Project: #5616
Program Element: #64738F
DoD Mission Area: Self Protection #371

Title: F/FB-111 Protective Systems
Title: Protective Systems
Budget Activity: Tactical Programs, #4

to evaluate installation of Optical/Electro-optical and systems for F/FB-111 aircraft. Also studied will be an improvement to the chaff dispenser to permit capitalization of ongoing research.

4. FY 1984 Planned Program: Flight test the tail warning system on FB-111 aircraft and make a production decision. Begin development of a capability for radar warning receivers and countermeasures jammers. Complete studies on optical/electro-optical and system adaptation/installation on F/FB-111 aircraft. Begin update of chaff/flare dispenser to capitalize on chaff and flare development taking place elsewhere in this program element and increased effectiveness of the tail warning system.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	2,300	2,600	10,300	9,300	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	2,300	5,900	8,700		Continuing	Not Applicable

(U) In FY 1982, this project was reduced significantly to accommodate additional funding requirement in monopulse countermeasures development and for certain Quick Reaction Capability developments. In FY 1983, funding increases to regain momentum in development of the tail warning system, and initiation of new developments are necessary to insure the effectiveness of F/FB-111 aircraft against the developing Soviet threat.

Project: # 6510
Program Element: # 64733F
DoD Mission Area: Self Protection #371

Title: Flight Test Simulators
Title: Protective Systems
Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: There is a continuing and expanding need to flight test and evaluate new and/or modified electronic warfare (EW) equipment to counter new Soviet defensive systems prior to a production decision. These tests must be conducted in a simulated threat environment which requires many threat radars. In the past, the adaptability of airborne ECM systems was quite limited. However, new Radar Warning Receiver (RWR) and countermeasure system signal processing schemes are highly adaptive and make it extremely difficult to construct a test for such equipment without a large number of instrumented threat systems. This project is transferred to PE 64735F, Range Improvement, in FY 83 to consolidate threat simulator hardware developments.

(U) RELATED ACTIVITIES: Hardware developments under this project are coordinated with development programs conducted within PE 64739F, Tactical Protective Systems; PE 64738F, Protective Systems; and PE 64719F, Electronic Warfare Reprogramming Update. Developments are coordinated with PE 11897F, Training Offensive; and PE 27429F, Range Improvement Equipment.

(U) WORK PERFORMED BY: Tasks under this project are managed by the Armament Division, Eglin AFB, FL. The major contractors are General Dynamics, Fort Worth, TX; Mertric Systems, Fort Walton Beach, FL; RCA, Moorstown, NJ; and the Georgia Institute of Technology.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Development programs for replicas of surface to Air Missile (SAM) Systems have been undertaken as have continuing updates to these systems. In FY 81, development of the and a Modular Generic Radar were continued. Procurement of a radar was directed to provide a generic capability in those two important areas.

2. FY 1982 Program: Development of the and Modular Generic Radar continued along with minor updates to other simulations. Flycatcher procurement was cancelled. Initial development of an signal source was begun.

3. (U) FY 1983 Planned Program: Not Applicable.

4. (U) FY 1984 Planned Program: Not Applicable.

5. (U) Project to Completion: Not Applicable. This will be a continuing project under PE 64735F.

6. (U) Milestones: Not Applicable.

Project: # 6510
Program Element: # 64738F
DOD Mission Area: Self Protection #371

Title: Flight Test Simulators
Title: Protective Systems
Budget Activity: Tactical Program, #4

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,700	8,871	-0-	-0-	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,700	4,900	7,500			

(U) FY 1983: The FY 1983 estimate is $7.5M less than estimated last year. This project will transfer, in FY 83, to Program Element 64735F.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64739F
DOD Mission Area: Self-Protection, #371

Title: Tactical Protective Systems
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	25,359	23,711	28,093	26,959	Continuing	Not Applicable
2272	Active Countermeasures Systems	20,576	15,211	11,493	10,267	Continuing	Not Applicable
2273	Warning Systems	394	1,600	3,200	3,692	Continuing	Not Applicable
2274	Dispensers and Expendables	397	900	100		Continuing	Not Applicable
2879	EW Reprogramming Update			7,100	7,000	7,800	21,900
5618	F-15 Protective Systems	3,992	6,000	6,200	6,000	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the engineering development of new and improved self-protection electronic warfare (EW) equipment to include rapid EW reprogramming update capability for tactical strike, air superiority, and reconnaissance aircraft.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds for development of various self-protection EW systems for tactical strike, air superiority, and reconnaissance aircraft to allow them to accomplish their assigned missions without incurring an unacceptable attrition rate and the required rapid response software reprogramming system. Self-protection EW equipment includes internally mounted countermeasures systems, electronic countermeasures pods, radar warning receivers, chaff/flare dispensers and expendables and the F-15 Tactical Electronic Warfare System. Cost estimates are based on engineering estimates, statistical data from previous programs and specific contractual data from ongoing development programs.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	24,600	24,300	22,300		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #64739F
DOD Mission Area: Self-Protection, #371

Title: Tactical Protective Systems
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The purpose of this program element (PE) is to develop, test, and evaluate electronic warfare (EW) systems for tactical strike, air superiority, and reconnaissance aircraft. Through fiscal year (FY) 1976, this program was limited to the design, development, qualification and evaluation of the ALQ-131 advanced modular electronic countermeasures (ECM) pod. The ALQ-131 can be configured with up to five transmitter modules and a receiver/processor (R/P) module. Increased frequency coverage, power management, and software threat programming provide a greatly enhanced self-protection capability. Production of the [ ] which counters [ ] was started in FY 1976. In FY 1978, this PE was expanded to include the engineering development of improvements to the F-15 Tactical Electronic Warfare System (TEWS). The efforts associated with the F-15 TEWS are intended to expand the capabilities of the existing warning receivers, jammers and dispensers to counter new or improved Soviet threats. The PE currently includes programs to develop new technology self-protection systems against [ ] and to improve the capability of inventory radar warning receivers, ECM pods, internal ECM systems and chaff and flare expendables and associated dispensers. In FY 1983, automation of the EW software reprogramming capability for SAC, TAC, and AFLC will be implemented.

(U) RELATED ACTIVITIES: The efforts in this program draw from technology developed in various other program elements (PE), such as PE 64738F, Protective Systems; PE 63718F, Electronic Warfare Technology; and PE 63743F, Electro-Optical Warfare. The F-15 Tactical Electronic Warfare System (TEWS) efforts are directly related to PE 27130F, F-15 Squadrons.

(U) WORK PERFORMED BY: This program element is managed at the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. The prime contractor for the ALQ-131 Advanced Tactical Countermeasures Pod is Westinghouse Electric Corporation, Baltimore, MD. The subcontractor for the improved R/P module for the pod is Loral Electronics Systems, Yonkers, NY. The major contractors for the F-15 TEWS are: Northrop Corporation, Rolling Meadows, IL - Internal Countermeasures Set; Loral Electronic Systems, Yonkers, NY - Radar Warning Receiver; Magnavox Company, Ft Wayne, IN - Electronic Warfare Warning Set; and McDonnell Douglas Aircraft Corporation, St. Louis, MO - aircraft integration and Countermeasures Dispenser.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The [ ] of the ALQ-131 ECM pod completed all development efforts except for the receiver/processor (R/P) and entered production in July 1976. New threat data revealed that a [ ] capability would be required for effective power management. In FY 1979 an Improved R/P development effort was initiated. Development was initiated of ALQ-131 [ ] modules designed to [ ] in order to degrade th[ ] Development was completed and flight testing initiated of a [ ] designed to match the [ ] F-15 aircraft. Development continued of an ALE-40 dual-chaff cartridge containing two separate elements, each having a countermeasure capability equivalent to one existing chaff unit. This is a cooperative development effort with the Royal Netherlands Air Force. Development of the F-15 Tactical Electronic Warfare System (TEWS) was completed in FY 1976. A radar warning receiver (RWR)

Program Element: #64739F Title: Tactical Protective Systems
DOD Mission Area: Self-Protection, #371 Budget Activity: Tactical Programs, #4

update was completed in 1977. capability for the radar warning receiver (RWR) was completed in FY 1980. Development of the F-15 countermeasures dispenser (ALE-45) system was initiated in FY 1979. An F-15 RWR enhancement effort to develop appropriate detection capabilities of the of threats was initiated in FY 1980. In FY 1981 the ALQ-131 module effort was terminated based on the results of a military worth evaluation. In FY 1980 Upgrade programs to provide the ALQ-131 electronic countermeasures (ECM) pod with a capability to counter systems began.

2. FY 1982 Program: Development of the Improved Receiver/Processor (R/P) module for the ALQ-131 will be completed. Development will be completed of a cartridge designed to match the of the F-15 aircraft. Development will complete on the ALE-40 dual-chaff cartridge. Planning for the development of an capability will begin. Development of a capability for integration into inventory RWRs will be initiated. Initiate a task to determine whether available is best suited for A-10 application. Initiate an program for slow-moving large aircraft to protect them from attack. The efforts to upgrade the F-15 Tactical Electronic Warfare System (TEWS) will be continued. The F-15 radar warning receiver (RWR) enhancement program will continue. The F-15 ALE-45 development program will be completed.

3. FY 1983 Planned Program: The development efforts initiated in FY 1982 and prior years, for electronic countermeasures (ECM) systems, radar warning receivers (RWR) and chaff/flare dispenser systems will be continued. The F-15 TEWS upgrade effort will be continued. Engineering development of the New Threat Warning System will begin. Begin engineering development of an to detect and target operating in the Initiate an Electronic Warfare (EW) Reprogramming Update program to provide SAC, TAC, and AFLC with an automated system to allow rapid software updates to inventory systems The funding increase in FY 1983 is the result of revised inflation factors and addition of the EW Reprogramming Update program.

4. FY 1984 Planned Program: The development efforts initiated in FY 1983 and prior years for electronic countermeasures systems, radar warning receiver systems and chaff/flare dispensers and EW reprogramming will be continued. The F-15 RWR enhancement will be completed.

5. Program to Completion: This is a continuing program to develop new systems or to update existing electronic countermeasures capabilities to counter weapon systems.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

Project: #2272
Program Element: #64739F
DOD Mission Area: Self-Protection, #371

Title: Active Countermeasures Systems
Title: Tactical Protective Systems
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This project provides for the development of improved electronic countermeasures (ECM) capability for inventory ALQ-131 ECM pods and for the development of new ECM capabilities, to include and infrared systems for tactical strike, reconnaissance aircraft and slow-moving aircraft. Updates to existing systems are required to eliminate deficiencies such as quality, and diversity of The continued improvement in the quantity, systems creates a continuing need to improve the self-protection countermeasures capability for tactical strike and reconnaissance aircraft.

(U) RELATED ACTIVITIES: The efforts in this project build upon feasibility concepts and techniques demonstrated in Program Element (PE) 63718F, Electronic Warfare Technology and PE 63743F, Electro-Optical Warfare. Techniques and technology from PE 64738F, Protective Systems, that satisfy similar requirements for other aircraft will be utilized.

(U) WORK PERFORMED BY: The Air Force manager is the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. The prime contractor for the ALQ-131 Advanced Tactical Countermeasures Pod is Westinghouse Electric Corporation, Baltimore, MD. The subcontractor for the Improved Receiver/Processor (R/P) module for the ALQ-131 ECM pod is Loral Electronics Systems, Yonkers, NY. The competing contractors for the ALQ-131 Surveillance Radar Jammer (SRJ) modules were Sperry Microwave, Clearwater FL, and American Electronic Laboratories, Landale, PA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The configuration of the ALQ-131 electronic countermeasures (ECM) pod completed development and production started in FY 1976. Development testing of the original receiver/processor (R/P) module to provide power and resource management for the ALQ-131 ECM pod was completed in FY 1978. However, additional analysis of the threat data revealed that a capability was required to counter the latest Soviet radar threats. In FY 1979 an Improved R/P program was initiated to incorporate this capability. Competitive development of ALQ-131 modules designed to jam to degrade the was initiated in FY 1980. was terminated in FY 81 based upon the results of the military worth evaluation. In FY 1980 an ECM improvement program was initiated to address reliability and maintainability of the ALQ-131 ECM pod and to provide it with a capability against

2. FY 1982 Program: The ALQ-131 Improved R/P will complete flight testing and a production decision will be made. Improvement programs to provide the ALQ-131 ECM Pod with a capability against will be continued to increase pod effectiveness against operationally deployed and postulated Soviet threat radars. Begin planning for the full scale engineering development of an Initiate evaluation of a development program to provide selected large aircraft (C-141, C-5, C-130, E-3A, etc.) and certain helicopters with an

Project: #2272 Title: Active Countermeasures Systems
Program Element: #64739F Title: Tactical Protective Systems
DOD Mission Area: Self-Protection, #371 Budget Activity: Tactical Programs, #4

3. FY 1983 Planned Program: The ECM improvement programs initiated in FY 1982 and prior years will be continued. Begin full scale engineering development of for large aircraft. ALQ-131 electronic countermeasures (ECM) pod improvement/enhancement programs will continue with the goal of incorporating, incrementally, new capabilities into the pod production line to expedite the fielding of a more effective self-protection pod for the tactical forces. Continue full scale engineering development of the to detect and target

4. FY 1984 Planned Program: The ECM development efforts initiated in FY 1982 and prior years will be continued. Flight testing of the will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	20,576	15,211	11,493	10,267	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	19,600	13,600	11,500		Continuing	Not Applicable

Project: #2879
Program: #64739F
DOD Mission Area: Self-Protection #371

Title: EW Reprogramming Update
Title: Tactical Protective Systems
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: AFR 55-90, "Electronic Warfare Policy," directs implementation of the Electronic Warfare (EW) Integrated Reprogramming Concept to rapidly
to reprogram the software in computer driven airborne electronic warfare systems. The intent is to achieve rapid response to technological surprise on the battlefield. TAF SON 304-80, dated 7 May 1980, establishes the requirement for updating the existing manual reprogramming system. The EW Reprogramming Update program provides SAC, TAC, and AFLC automated tools to permit rapid analysis, assessment and trade-off decision making during the EW software reprogramming process. This process includes assessing the impact of on operational EW systems, establishing and selecting realistic reprogramming options for the EW system software, creating and documenting the change to the software program and keeping track of which software programs are installed in specific EW systems. This program updates the existing manual system to achieve a more rapid and accurate response while using less highly skilled personnel in the decision making process.

(U) RELATED ACTIVITIES: EW Reprogramming Upgrade capability is an integral part of rapid reprogramming and is fed by activities from the Electronic Warfare Support Data Base, a principal project in PE 35887F, Electronic Combat Intelligence Support and PE 31335F, Computer Aided Electronic Warfare Information System. The EW Reprogramming Update Capability directly supports activities of the EW Avionics Integrated Support Facility, PE 71111F and the other projects associated with PE 64739F. In addition, this activity directly supports all digitally reprogrammable Avionic EW systems and is also targeted to support new EW systems like the Advanced Self Protection Jammer (ASPJ), the New Threat Warning System (NTWS) and the B-1 Defensive Avionics Suite (ALQ-161).

(U) WORK PERFORMED BY: The work will be done by the EW System Program Office, ASD/RWW, Wright-Patterson AFB, OH, the EW System Manager, WRALC/MMR, Robins AFB, GA, and contractors to be identified.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A study was initiated in January 1979 under PE 64710F, "Reconnaissance and Electronic Warfare" to determine the feasibility of upgrading the present manual reprogramming system. This study produced a requirements analysis, overall system specifications and programmatic data.

2. (U) FY 1982 Program: FY 1982 efforts will develop software functional specifications, hardware specifications, and interface requirements.

3. (U) FY 1983 Planned Program: Initiate development of the Threat Impact Assessment Software (TIAS), the Data Change of Verification Software (DCAVS) and the Mission Data Management Software (MDMS). Procure two hardware systems.

4. (U) FY 1984 Planned Program: Complete development of the TIAS, DCAVS and MDMS software and initiate software verification and validation (V&V). Procure initial hardware systems for USAFE.

Project: #2879
Program: #64739F
DOD Mission Area: Self-Protection, #371

Title: EW Reprogramming Update
Title: Tactical Protective Systems
Budget Activity: Tactical Programs, #4

5. (U) Program to Completion: Complete software V&V, Conduct Development Test and Evaluation/Initial Operational Test and Evaluation.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E			7,100	7,000	7,800	21,900

8. (U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable

Project: #5618
Program Element: #64739F
DOD Mission Area: Self-Protection, #371

Title: F-15 Protective Systems
Title: Tactical Protective Systems
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for development of electronic warfare (EW) equipment for the F-15 aircraft. The F-15, in its counter-air role, will be required to operate in the presence of hostile ground controlled fighter interceptors, surface-to-air missiles and antiaircraft artillery. The F-15 pilot must be alerted to the presence of the enemy aircraft so that he can achieve a favorable attack position, and with respect to enemy air defenses must be sufficiently protected to escort friendly ground attack forces into enemy held territory and pursue enemy fighters into and over their own defended territory. A combination of warning devices, jammers, and decoys have been selected to degrade the capabilities of the enemy electronic defense systems. This project accomplishes the necessary engineering development to expand the capabilities of the existing warning receivers and jammers to counter new or improved threats. Also included is the development of a chaff/flare dispenser to provide improved capability to counter threats. The current configuration consists of a Radar Warning Receiver (RWR), Electronic Warfare Warning Set (EWWS) and an Internal Countermeasures Set (ICS). A Countermeasures Dispenser (CMD) set will be added to this configuration. Collectively, these four subsystems are known as the F-15 Tactical Electronic Warfare System (TEWS). A previous Project (2073) for development of the new subsystem was folded into this project, to provide for more effective Air Force management.

(U) RELATED ACTIVITIES: The work under this project is directly related to program element (PE) 27130F, F-15 Squadrons, which provides for procurement of the F-15 TEWS as part of the F-15 Weapons System. Technology developed in PE 63718F, Electronic Warfare (EW) Technology, and PE 63743F, Electro-Optical Warfare, provides the basis for improvements to counter new threats. Close coordination occurs between this project and other aircraft EW programs within this program element and programs in PE 63738F, Protective Systems. For example, the CMD will use identical chaff and a variation of the flares and the dispenser developed in this PE for other tactical aircraft.

(U) WORK PERFORMED BY: The Air Force manager is the Aeronautical Systems Division, Wright-Patterson, AFB, OH. Major contractors are: Defense Systems Division of the Northrop Corporation, Rolling Meadows, IL - ICS; Loral Electronics Systems, Yonkers, NY - RWR; Magnavox Company, Fort Wayne, IN - EWWS; and McDonnell-Douglas Aircraft Corporation, St. Louis, MO - Aircraft Integration and the CMD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Development of the Radar Warning Receiver (RWR), Electronic Warfare Warning Set (EWWS) and Internal Countermeasures Set (ICS) was completed in FY 1976. An RWR threat related improvement was completed in FY 1977. Development of a capability for the RWR to improve location of was completed during FY 1980. During 1977 a major update to the F-15 TEWS was started. This development program increased the and This program was terminated at the end of FY 1980 after completion of integration and simulator testing. Development of the Countermeasures Dispenser Set (CMD) was initiated in FY 1979. A modular Operational Flight Program for the RWR was completed in FY 1981. In FY 1981 an RWR Enhancement effort was initiated to provide a capability to detect threats. The fleetwide retrofit of the New Threats RWR hardware began in FY 1981. The RWR memory expansion from began in FY 1981.

Project: #5618
Program Element: #64739F
DOD Mission Area: Self-Protection, #371

Title: F-15 Protective Systems
Title: Tactical Protective Systems
Budget Activity: Tactical Programs, #4

2. (U) FY 1982 Program: The flight test of the Countermeasures Dispenser (CMD) enhancements will be completed. The Radar Warning Receiver (RWR) memory expansion will be tested, to include flight testing. The RWR Enhancement development and the New Threat retrofit will continue.

3. FY 1983 Planned Program: The RWR Enhancement program will undergo simulator and flight testing. Planning will be initiated for the retrofit of the CMD, and the Enhanced RWR programs.

4. (U) FY 1984 Planned Program: The Enhanced RWR program will complete flight testing and a production decision will be made.

5. Program to Completion: New or improved will be monitored and improved capability efforts initiated to the F-15 Tactical Electronic Warfare System (TEWS) as required, to avoid obsolescence. New systems or radars may be deployed, requiring corresponding improvements to the F-15 TEWS.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	3,992	6,000	6,200	6,000	Continuing	Not Applicable

8. (U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

RDT&E	4,[illegible]	6,000	6,200		Continuing	Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64740F　　Title: Computer Resource Management Technology
DOD Mission Area: Air Warfare Surveillance & Reconnaissance, #227　　Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4,455	4,882	4,993	7,209	Continuing	Not Applicable
2239	Computer Security Technology	1,509	1,944	2,027	1,696	Continuing	Not Applicable
2522	Requirements Analysis	452	459	588	1,294	Continuing	Not Applicable
2523	Management Control Technology	319	248	293	398	Continuing	Not Applicable
2524	Policy and Procedure Guidance	823	1,193	1,304	1,396	Continuing	Not Applicable
2526	Software Engineering Tools and Methods	1,201	798	485	1,627	Continuing	Not Applicable
2652	Computer Architecture Standards	151	240	296	798	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF THE ELEMENT AND MISSION NEED: Air Force and Department of Defense studies have shown that the rapidly increasing cost of computer software diverts resources from other vital mission requirements. Increasing threat complexity has forced an increase in mission complexity and increased proliferation of digital computers and software. Current Department of Defense computer software costs (over $4 billion per year) are growing rapidly; this growth must be controlled. The goal of this program is to apply technology in the system acquisition and support process to reduce software life cycle cost and to improve the quality of weapon system software. This program is part of a joint service effort coordinated under the Office of the Secretary of Defense Management Steering Committee for Embedded Computer Resources and, as such, is responsive to Department of Defense wide deficiencies.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This program is part of a coordinated joint Defense and tri-service System Software Research and Technology Program to overcome deficiencies in the development, acquisition, operation, and support of embedded computer resources. FY 1983 requested funds will support thrusts in six areas: (1) computer security technology, (2) requirements analysis, (3) management control technology, (4) policy and procedure guidance, (5) software engineering tools and methods (6) computer architecture standards. Specific FY 1983 objectives are: (1) apply advanced developments in computer engineering and associated management procedures, (2) develop and apply techniques to reduce cost and increase performance of complex systems, (3) provide for active Air Force use, tools and techniques which improve acquisition practices for developers, maintainers, and users, (4) provide management techniques which improve visibility and control of computer system development.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,470	6,000	7,000		Continuing	Not Applicable

Program Element: #64740F
DOD Mission Area: Air Warfare Surveillance & Reconnaissance, #227

Title: Computer Resources Management Technology
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Computer technology is central to the Air Force's ability to perform its mission. Management of this vital resource and its associated costs presents a major challenge to the Air Force. The computer Resource Management Technology program is an Air Force-wide computer engineering development effort. It was established to apply technically advanced solutions to problems in managing compter resources used in Defense systems. The program seeks to improve the performance/cost ratio of Air Force computer resources. Consisting of some 40 different tasks, the program exploits the results of advanced development programs; develops and applies techniques to reduce cost and increase reliability in complex automated Defense systems; and provides users and system designers with improved computer equipment programming techniques, and information processing tools to specify, design, test and support automated Defense systems. This program addresses identified deficiencies in the use and control of high order languages, in management and engineering approaches to computer software development, in the use of requirement and cost analyses, and in the application of comprehensive acquisition management procedures. The program is also the research and development arm of the Air Force multi-level computer security initiative. Current projects are described below.

(U) Computer Security Technology (Project 2239): Provides a technology transfer program; fosters widespread availability multi-level computer security technology and validation techniques to industry and for Air Force and Department of Defense systems. The work responds to the Department of Defense Computeer Security Initiative Task in four areas: (1) Department of Defense Computer Security Consortium Support; (2) ad hoc program office support; (3) "trusted" (provable) system development and demonstrations; and (4) verification procedures. This work has wide-spread application. Among Air Force program offices with computer security requirements are Strategic Air Command Digital Infomation Network (SACDIN), Operational Application of Special Intelligence Systems (OASIS), Automatic Digital Information Network II (AUTODIN II), Space Defense Operation Center (SPADOC), SEEK SCORE, IASA, EIFEL II, and MX. This project addresses requirements specified in SAC ROC 1-74, MAC ROC 6-75, HQ USAF Data Project Directive HAF-P81-1, and findings in the Air Force Audit Agency directed Computer Fraud Study which resulted from OMB-A/71 and recommendations of the Department of Defense Oversight Committee. This critically important effort represents a continuing commitment to research and development of trusted computer systems as an integral part of military security.

(U) Requirements Analysis (Project 2522): Develops and applies tools that provide the system developer rapid insight into the technical implications of stated system requirements on computer resources. These tools are used to identify costs and risk areas, and to explore implementation alternatives before making schedule and financial commitments for computer resources. Work has been successfully accomplished with the Computer Aided Design and Specification Analysis Tool in the E-3A and SACDIN Program Offices. An estimated $700,000 savings was attributed to the use of Computer Aided Design and Specification Analysis Tool in the E-3A Program Office alone. A new initiative, the Automated Interactive Simulation Model, represents the latest effort to focus on an "easy to learn, simple to use" approach. Using a menu of parameters, the system engineer builds a "model" of his system configuration, process, and performance to aid in design/tradeoff analyses, and to explore optimum system design in terms of cost and perfomance. The automated tools and procedures developed under this project are improving the requirements definition/analysis phase of military system acquisitions.

(U) Finally, work will begin to improve total system performance, developing design guidelines to specify the interface between man and computer. These User System Interface (USI) guidelines will address data entry, data display, sequence control, user guidance, and data transmission.

Program Element: #64740F   Title: Computer Resources Management Technology
DOD Mission Area: Air Warfare Surveillance & Reconnaissance, #227   Budget Activity: Tactical Programs, #4

Management Control Technology (Project 2523): Develops and applies information system tools and techniques to improve the planning and controlling of system acquisitions with embedded computer resources. This project develops and evaluates ways to estimate computer system timing and sizing. These techniques have been used in the SEEK SCORE, Air Weather Distribution System (AWDS), Joint Tactical Information Distribution System (JTIDS), Battlefield Exploitation and Target Acquisition (BETA), Base and Installation Security System (BISS), Automated Technical Control (ATEC), and System Test and Exercise Module (STEM) Programs. This project also applies software quality metrics, an approach to quantify software quality in defense systems. A recent effort examines eleven (11) software quality factors developed by a major defense contractor and applies them to an actual system acquisition. Management control and visibility will be enhanced through these quality "yardsticks". This project also responds to a Joint Logistics Commanders' request to reduce the confusion resulting from diverse standards for software acquisition, and is producing a tri-service MIL-STD on software engineering. This single standard will provide one approach to developing a better software product. Lastly, in an effort to collect and analyze data on software development costs, the Software Acquisition Resource Expenditure (SARE) collection system will be piloted in the Tactical Communication Control Facility Program.

Policy and Procedure Guidance (Project 2524): Develops comprehensive, specific standards and procedures to guide the acquisition and support of computer resources. This project develops guidebooks, training media, and the Training and Performance Support System (TPSS) to train USAF people in software management. During FY 1981, the Air Force spent over $1.6 billion to acquire software. Over 60% of the officers managing these acquisitions are second lieutenants. To reduce our estimated 30% shortfall in skilled computer system acquisition managers, the TPSS effort develops courses materials, techniques and programs to provide the latest training in software acquisition. Already, over 120 people have been trained at the prototype TPSS and are making positive contributions in their acquisition management duties. Products developed for the TPSS will be incrementally transferred to AFSC Product Divisions and AFLC Air Logistics Centers as they become available.

Software Engineering Tools and Methods (Project 2526): Develops and applies a comprehensive, integrated set of engineering tools to improve the software development and acquisition processes. Special emphasis is on configuration management, documentation, training, and support to transfer the new tools to program offices. This project supports the J73 Language Control Facility, the National Software Works, and Ada, the new DOD standard High Order Language system. The J73 Language Control Facility validates languages for systems which have made a commitment to the J73 High Order Languages CX, Advanced Tactical Fighter, Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN), Digital Integrating Subsystem (DIS), Advanced Medium-Range Air-to-Air Missile (AMRAAM), and MX. The National Software Works demonstrates the internetting of computers and tools to support developers, maintainers, and users of computer systems. Tools on the National Software Works will support a programming demonstration at a selected AFLC Air Logistics Center. Ada system support will involve rehosting and retargeting of the Ada compiler and programming support environment for Air Force specific systems and standard architectures.

Computer Architecture Standards (Project 2652): Supports development of tactical command, control and communication and space systems by stabilizing the software deve... ment environment, using high order languages, and facilitating interoperability. Work initially centered on defining Air Force requirements for the MIL-STD-1862 (NEBULA) 32-bit Computer

Program Element: #64740F Title: Computer Resources Management Technology
DOD Mission Area: Air Warfare Surveillance & Reconnaissance, #227 Budget Activity: Tactical Programs, #4

Instruction Set Architecture developed by the Army. Specifically, command, control, communication and intelligence and ground based space system requirements will be identified and recommended to the Joint NEBULA Control Board. This project also provides educational materials and briefings on DOD and Air Force standardization efforts and examines Air Force support software tools needed for these standards. The work is in concert with recent DOD initiatives on standardization within the military to reduce the proliferation of computer architectures, improve supportability, and reduce costs.

(U) RELATED ACTIVITIES: This program supports and is responsive to the DOD Defense Computer Resource Technology Plan and the DOD Ada Joint Program Office (PE63226F, DOD Common Programming Language (Ada)). It is related to other programs which constitute the DOD Software Science and Technology Program: 62701A, Communications Electronics; 62725A, Computer and Information Sciences; 63723A, Automatic Data Processing Equipment Development, 62721N, Command and Control Technology; 63526N, Advanced Computer Technology; 62708E, Distributed Information Systems; 62702F, Command, Control and Communication 62204F, Aerospace Avionics; and 63728F, Advanced Computer Technology. Air Force thrusts generally transition into this program from 63728F and are coordinated through technical reviews at the staff and engineering levels. Coordination with other Services is done in the Research and Development Technology Panel of the Management Steering Comittee for Embedded Computer Resources, in The DOD Computer Security Consortium, and in annual DOD apportionment reviews.

(U) WORK PERFORMED BY: The Electronics Systems Division (ESD) Hanscom AFB, MA has management responsibilities for the program. Contractors include the System Development Corporation, Santa Monica, CA; TRW, Redondo Beach, CA; Boeing Computer Services, Seattle, WA; Logicon Inc., Bedford, MA; Doty Associates, Inc., Rockville, MD; Denver Research Institute Denver, CO; System Architecture Inc., Randolph, MA; Softech Inc., Dayton, OH; ITT Research Institute, Rome, NY; SRI International, Menlo Park, CA; Martin Marietta Aerospace, Denver, CO; Hughes Aircraft Company, Fullerton, CA; Systems & Applied Science Corporation, Riverdale, MD; Aerospace Corporation, Los Angeles, CA; DigiComp Research, Ithaca, NY; Dynamics Research, Wilmington, MA. System engineering support is being provided by MITRE Corporation, Bedford, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Major achievements of this program include: (1) developed and demonstrated a multi-level computer security operating system, the Kernelized Virtual Machine/370 (2) supported the Korean Air Intelligence System Program, specifying and developing a "security interface" for command post operations; (3) refined and improved tools and mathematical languages used to verify multi-level security in computer systems; (4) selection of PE64740F as the R&D arm of the USAF ADP Security Program; (5) applied the Computer Aided Design and Specification Analysis Tool (CADSAT), an automated requirements analysis tool, on the E-3A and SACDIN programs; (6) successfully piloted a general purpose modeling tool, the Automated Interactive Simulation Model (AISIM) on the Base and Installation Security System. AISIM helps program engineers assess cost and performance alternatives in system design; (7) published a procedures handbook for estimating computer sizing and timing: these procedures are helping USAF program offices define computer system requirements and evaluate contractor proposals; (8) first application of software quality measurements in a USAF program, the Radar Prediction System: this "real-world" experience will be included in a handbook for program offices; (9) published guidebooks on computer system acquisition management for both the

Program Element: 64740F
DOD Mission Area: Air Warfare Surveillance & Reconnaissance, #227

Title: Computer Resources Management Technology
Budget Activity: Tactical Programs, #4

Electronic Systems Division and the Aeronautical Systems Division; (10) awarded a contract to develop a computer-aided, computer managed instructional system, the Training and Performance Support System (TPSS); (11) transitioned the JOVIAL High Order Language Control Facility into use Air Force-wide; (12) procured and installed hardware for three Air Logistics Centers participating in the National Software Works technology demonstration; (13) surveyed program offices at the Electronic Systems Division or their requirements for 16- and 32- bit standard instruction set architecture (MIL-STDs-1750A and 1862); (14) published a guidebook on specifying computer resource requirements in the System Specification ("A Spec").

2. (U) FY82 Program: With the PE64740F funding reduction, ten of the twenty-five tasks planned for FY82 were unfunded. These tasks will be reinstated, rescoped, or postponed contingent upon FY83 funding. The FY82 restructured program will (1) enhance the Kernelized Virtual Machine/370 multi-level secure operating system, concentrating on special security requirements and independent proof analysis, demonstrate the KVM/370 system at an operational site, and certify and document the system; (2) improve verification procedures and mathematical languages used to validate DOD multi-level computer security systems; (3) provide computer security technical support to the Korean Air Intelligence System (security interface), Military Airlift Command (secure data base management systems), the Air Force Computer Security Program Office (automated risk analysis , and Air Force Audit Agency/Air Force Accounting and Finance Center policy verification) (4) rehost the automated general-purpose modeling capability (AISIM) on a government owned computer and distribute the AISIM tool to USAF program offices for assessing risk, cost-effectiveness, and alternatives in designing defense systems; (5) develop standard guidelines for the design of the user-system interface (USI) in automated systems. This development will lead to a USI evaluation tool, a USAF Design Handbook supplement, and a military standard for USI design of computer software; (6) complete the handbook and training materials for applying quality metrics to computer software developments in weapon systems, and train selected program office engineers in their use; (7) support the Joint Logistics Commanders: produce MIL-STD-XXX on Software Engineering for tri-service use and complete updates to MIL-STD-483, 490, and 1521A; (8) develop and incrementally transfer training courses and materials for the computer-aided, computer-managed Training and Performance Support System (TPSS), an automated system to teach USAF people computer system acquisition management; (9) produce a handbook for engineers to use in specifying computer requirement for avionic systems; (10) complete the National Software Works (NSW) demonstration at the Warner-Robins, Oklahoma City, and Sacramento Air Logistics Centers and transfer the hardware and software to AFLC; (11) define Air Force support software requirements for the Army's 32-bit computer instruction set architecture MIL-STD-1862A, for C^3I and ground-based space systems and recommend requirements to the Army-Air Force Nebula Control Board; and (12) develop a briefing and educational materials to inform USAF program offices of status and plans for MIL-STD-1750A (16-bit instruction set architecture), MIL-STD-1862A (32-bit instruction set architecture), MIL-STD-1589B (JOVIAL J73 High Order Language) and MIL-STD-1815 (Ada High Programming Language).

3. (U) FY 1983 Planned Program: Continue to support the DOD Computer Security Initiative Task and Air Force programs with computer security requirements. Support the Korean Air Intelligence System "Security Interface". Analyze and document the Military Airlift Command requirements for multi-level secure data bases. Assist the Air Force Computer Security Program Office, procuring automated tools and procedures to analyze computer security risks in specific ADP systems. Exercise the tools and mathematical languages used to verify multi-level secure systems against a common prob-

lem to demonstrate the relative capabilities of each. Transfer the general purpose modeling tool, AISIM, to Air Force program offices through interactive terminals. Introduce two new requirements tools, DOCWRITER and the Automated Requirements Development System (ARDS), to program offices to generate and maintain acquisition documents. The computer-based training system, TPSS, will be operational. AFSC product divisions and AFLC Air Logistic Centers wil use courses and materials to train people in computer system acquisition management and will be able to provide specific computer resource training "on demand" to meet time-sensitive training requirements. Consolidate and update the Computer System Acquisition Management guidebooks into AFSC guidebooks. Continue the cost and monitoring system (SARE) for software development in the Tactical Command and Control Facility program. Complete the Joint Logistics Comanders' task with a handbook showing DOD users how to apply the MIL-STD-XXX on Software Engineering. Test User System Interface guidelines for software in a program office, and publish a USI Evaluation Guide. Complete the final report on the National Software Works, and transfer the NSW Information Center to AFLC. Begin efforts to identify the most promising Air Force program candidates for high payoff introduction of Ada and begin development of training and educational materials on Ada. Continue the computer architecture standards project, emphasising an orderly transition to the Air Force and Army instruction set architectures for C^3I and ground-based space systems. Define and develop tools for both standards.

4. (U) FY 1984 Planned Program: Continue multi-level computer security work. Implement improvements resulting from the analysis of Military Airlift Command secure data base management system requirements. Start a new task to address multi-level security on local computer networks. Begin work on computer security verification methods for Ada. Complete an Air Force Computer Security Program Office Guide to define ADP security. Support Air Force organizations with special security requirements, specifically the Air Force Audit Agency and the Air Force Accounting and Finance Center. Enhance the Automated Interactive Simulation Modeling tool, AISIM, for use on dissimilar computer systems. Transfer proven requirements analysis tools and their training materials to an Air Force support facility. Complete an AFSC Design Handbook Supplement for the User System Interface (USI) Guidelines. Begin developing a MIL-STD for the USI Guidelines. Complete the Software Acquisition Resource Expenditure (SARE) task. Assuming successful results, implement SARE AFSC-wide. Apply PE 63728F's software quality metrics work in actual USAF program offices; validate and refine the quality metrics and methods. Continue updating the AFSC Software Acquisition Management Guidebooks: Add new titles for software quality assurance, independent verification & validation, microprocessing technology, and software quality measurements. Intensify efforts to support Air Force program offices using Ada. Complete planning and select an Air Force system for rehosting the Ada compiler and programming support environment (APSE). Continue to develop training and educational materials on Ada. Continue the Computer Architecture Standards project with emphasis on Air Force interests in DOD standard instruction set architectures. Update USAF directives and guidance on computer architectures. Pursue an Air Force Ada application on the 32-bit architecture.

5. (U) Program to Completion: While specific tasks will conclude, the level of effort will continue as new technology initiatives are started.

6. (U) Milestones: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64742F
DOD Mission Area: Multimission, Technology & Support, #374

Title: Precision Location Strike Systems
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECTED LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	62,780	87,795	98,859	80,379	CONT	N/A
1190	Precision Location Strike System (PLSS)	62,700	87,195[1]	98,259	80,379	105,142	584,775 [2]
1947	Emitter Location System (ELS)	0	0	0[3]	0	0	6,200
1949	Advanced Location Strike System (ALSS)	80	600	600	0	0	39,200
2589	Joint Service Weapon Data Link (JSWDL)	0	0	0[3]	0	0	3,700

1/ Design and integration funds previously planned for GBU-15 interface will be used to support Conventional Standoff Weapon (CSW) program. Includes $6.9 million reprogrammed to specifically support CSW development.
2/ Includes $0.4M for Coherent Emitter Location Testbed (CELT).
3/ Continue required development as part of PLSS, Project 1190.

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this Program Element is to develop and test a tactical strike system designed primarily to suppress enemy air defenses. This system is the Precision Location Strike System (PLSS). A triad of TR-1 aircraft equipped with PLSS equipment will real time collect hostile

Following the selection of air defense targets, a hardened PLSS ground station will direct the attack force to the targets by jam resistant data link commands relayed through the TR-1s. The strike element can be aircraft, standoff guided weapons, or Army artillery. The system provides 24 hour theater wide suppression of enemy air defenses in any weather and will thereby lower aircraft losses and increase sortie effectiveness. This capability, is rated by the and the highest priority system in terms of cost versus payoff.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Design of the Precision Location Strike System hardware and software will be finalized through the Critical Design Review process. In addition, subsystem element hardware fabrication will continue. Coding, debugging and testing of system software and development of peculiar support equipment (PSE) will continue. Advanced Location Strike System (ALSS) will support the Research, Development, Test and Evaluation (RDT&E) efforts for Precision Location Strike System (PLSS) risk reduction and tactical demonstrations/exercises. Elements of ALSS will be used to support Assault Breaker/Pave Mover test and demonstration. Cost estimates are based on negotiated contract prices and changes and on system program office estimates.

Program Element: #64742F
DOD Mission Area: Multimission, Technology & Support, #374

Title: Precision Location Strike Systems
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: 3/

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	14,850	83,100	77,700	-	102,700	478,750
Procurement (Other) (PE 27244F)			2,100	-	5,600	7,800

(U) OTHER APPROPRIATION FUNDS: 4/($ in thousands)

Aircraft Procurement (PE 27244F)	0	1,700	1,800	6,400	176,100	186,000
Procurement (Other) (PE 27244F)	0	0	0	0	76,500	76,500
Operations and Maintenance (PE 27244F)	20	100	300	1,200	Continuing	Not Applicable

3/ Reflects data from FY 1982 Descriptive Summary dated January 1981. Does not consider effect of RDT&E funding adjustments in FY 1981 Supplemental Budget (+$48.0M in FY 1981) and FY 1982 Amended Budget (-$1.9M in FY 1982).

4/ Funds shown here for reference will be in Program Element 27244F, Location Strike System and will be for augmentation and upgrade of the development system to an operational status. One complete PLSS system for the U.S. ...ces in Europe, with two ground stations, plus an additional ground station, CONUS based, for training and

Program Element: #64747F | Title: Precision Location Strike Systems
DOD Mission Area: Multimission, Technology & Support, #374 | Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Soviet/Warsaw Pact tactical doctrine emphasizes a 24-hour a day capability with a strong emphasis on protection of ground forces using air defense systems to reduce the effectiveness of airpower. Defense Intelligence Agency document, "Precision Location Strike System (PLSS) Electronics Warfare Threat Through 1990," June 1977, projects trends of

Current and projected Air Force and Army systems will threat. All weather operations are constrained by accurate weapons with capability while all weather weapons systems are constrained by Delivery of weapons is primarily from within the lethal range of the enemy air defense systems. Current reconnaissance systems lack the ability to provide The development of the Precision Location Strike System (PLSS) will substantially alleviate any of the critical deficiencies in our all-weather tactical defense suppression close air support interdiction attack capabilities and will enhance our reconnaissance capabilities. The Advanced Location Strike System (ALSS) is the predecessor system which supports continued development of operational concepts for a PLSS system by the Tactical Air Command and serves as a Research, Development, Test and Evaluation (RDT&E) testbed for PLSS risk reduction efforts.

(U) The PLSS project is a major program development effort. PLSS will provide targeting-accuracy, integrated location and strike of hostile air defenses continuously in near real time and all weather over a theater-wide area. As such, PLSS will be the centerpiece to efficient and effective conduct of lethal defense suppression to reduce attrition to acceptable levels, especially, in the critical first few days of conflict. Additionally, PLSS can provide up to the minute Electronic Order of Battle information enabling the commander to assess the immediate threat to his strike force.

(U) Full Scale Engineering Development of the PLSS was initiated in September 1977 after review by the Defense System Acquisition Review Council and approval by the Deputy Secretary of Defense.

The Emitter Location System (ELS), Project 1947, was being developed to accurately locate for attack accuracy

The addition of the full ELS capability as an integrated subsystem of PLSS would give the Air Force the total capability for accurate location and all-weather attack of the full range of enemy radar air defense systems. The ELS approach uses and has been pursued as a separate effort. The technology has rapidly advanced and the ELS capability can be integrated into PLSS through a phased approach to achieve location The ELS technology has been validated and demonstrated in the Coherent Emitter Location

Testbed (CELT). Other than the capability to locate which has been incorporated in the PLSS, ELS has been deferred due to lack of funds.

The Advanced Location Strike System (ALSS), Project 1949, is the predecessor system to PLSS. The ALSS was designed to quickly deploy to Southeast Asia (SEA) in 1972 to locate and destroy sites. Those hostilities ceased before ALSS was deployed; however, it was deployed to Europe for operational test and evaluation. The documented limitations (limited frequency coverage and weapons control, vulnerabilities to countermeasures, etc.,) precluded introduction of ALSS into the operational inventory. Studies concluded that it was not cost effective to modify ALSS to meet the PLSS requirement. ALSS is being used by Air Force Systems Command as a Research, Development, Test and Evaluation testbed.

(U) The development of the Joint Service Weapon Data Link (JSWDL), Project 2589, was to provide a jam-resistant data link for tactical guided weapons by merging elements of the Air Force PLSS and Army Modular Integrated Communication Navigation System (MICNS). JSWDL has been discontinued.

RELATED ACTIVITIES: The Conventional Standoff Weapon (CSW) to be developed in PE 64606F, Conventional Standoff Weapon, provides funds for a powered, guided missile capable of carrying a lethal payload to a range of from a medium or high altitude launch. With antimaterial submunitions as payload this missile will provide an effective long range standoff weapon. An emitter identification effort has Army and Navy participation through sharing of technology equipment and test information. Demonstration of the Emitter Location System (ELS) capability was a joint Air Force/Army/Defense Advanced Research Project Agency (DARPA) effort associated with Battlefield Exploitation and Target Acquisition (BETA) under PE 27431F, Tactical Air Intelligence Systems. The airborne relay vehicles (TR-1) will be procured under PE 27215F, TR-1 Squadron. F-16 aircraft will be produced capable of carrying and employing the PLSS guidance equipment under PE 27133F, F-16.

(U) WORK PERFORMED BY: Overall management of all projects in this program element is by Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson AFB, OH. The Precision Location Strike System (PLSS) prime contractor is Lockheed Missiles and Space Company (LMSC), Sunnyvale, CA. SofTech Corporation, Dayton, Ohio, provides independent validation and verification of the LMSC developed PLSS software. MIT Lincoln Laboratory, Lexington, MA and Aerospace Corporation, California perform studies and provide consultive services. Technical cognizance of the Emitter Location System is performed by the Rome Air Development Center (RADC), Rome, NY with International Business Machines (IBM), Owego, NY, as the development contractor.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The Precision Location Strike (PLSS) contractor, Lockheed Missiles and Space Company, was selected in June 1977. The Defense System Acquisition Review Council II (Development Readiness) review was held in July 1977 and the Deputy Secretary of Defense approved PLSS full scale development on 1 September 1977.

Program Element: #64742F Title: Precision Location Strike Systems
DOD Mission Area: Multimission, Technology & Support, #374 Budget Activity: Tactical Programs, #4

System Requirements Review was held in January 1978. System Design Review was held in May 1978. Subcontractor Preliminary Design Reviews (PDRs) began in July 1978 to support subsystem PDRs beginning in November 1978. The system PDR was conducted satisfactorily in October 1979. Brassboard fabrication and testing aimed at risk reduction were also initiated. The first of four increments of the software Critical Design Review was completed in October 1980. An independent contractor for software validation and verification, SoftTech Corporation, was selected and began efforts to support the program. Discussions were conducted with North Atlantic Treaty Organization (NATO) allies on the combat potential of PLSS in NATO. Discussions on operational integration of PLSS into the NATO structure were also initiated.

(U) An emitter identification effort was initiated in 1973 with initial emphasis on feasibility demonstration of the technique. A large enough data base of emitters to give confidence in the technique under limited conditions was established in 1973-74. Three Advanced Identification signal processors were built in 1974 and became the brassboards for the Air Force testing of the technique. From 1975 to 1977 a large data base was collected to demonstrate feasibility under a wider range of conditions. This effort culminated in a flight test conducted during September 1978.

Since 1975, the Advanced Location Strike System (ALSS) has been utilized as a testbed to help define the PLSS baseline configuration, and in developing, evaluating, and refining operational concepts for a PLSS. Distance measuring equipment (DME) guidance for both guided and unguided ordnance delivery was demonstrated using a Pod Relay Subsystem on tactical aircraft. The Air Force and Army jointly succeeded in integrating the capabilities

ALSS was utilized in the Red Flag and Blue Flag operational exercises and in successful demonstrations of DME guided GBU-15 Cruciform Wing and Planar Wing Weapons, with the latter demonstration completed in July 1979.

Project 1947, Emitter Location System (ELS) study efforts and follow-on demonstration programs show the ELS technique to be viable for precise location. The technique for Phase I of ELS and proven by a Defense Advanced Research Projects Agency (DARPA) sponsored program, was integrated into the PLSS baseline design. Following completion of the ELS demonstrations in March 1978, ELS funds and equipment were applied to support the joint AF/Army/DARPA Coherent Emitter Location Testbed (CELT) development. CELT was transported to Europe in 1980 and participated in the REFORGER 1980 exercises during September and October 1980.

(U) Project 2106, Photogrammetric Target System (PTS), was initiated in 1974 with initial emphasis on a manual system for use with the Advanced Location Strike System, to be followed by a more automated system of greater capacity to be used throughout the Tactical Air Forces. Development of the manual system was cancelled in April 1975 with the Air Force procurement of the Army Analytical Point Positioning System. A service test model (STM) was procured for development of optical exploitation techniques and software for a PTS. A study of Tactical Air Force requirements began in September 1977 to resolve issues involving point positioning requirements.

(U) In July 1977, the Precision Location Strike System (PLSS) Defense Systems Acquisition Review Council (DSARC) II directed the Air Force to incorporate the Joint Service Weapon Data Link (JSWDL) into the PLSS development program. A JSWDL system analysis was initiated under the PLSS contract in September 1977 and completed in December 1977.

A JSWDL development plan was approved in April 1978. The Air Force also incorporated JSWDL requirements into the Army's Modular Integrated Communication Navigation System (MICNS) program. When the standoff missile for PLSS was changed from the GBU-15 to the Conventional Standoff Weapon, the JSWDL development was discontinued.

2. (U) FY 1982 Program: Design efforts and engineering tests will intensify, culminating in completed drawings and specifications for the system Critical Design Review. Precision Location Strike System (PLSS) subsystems will be fabricated. Qualification and acceptance testing of completed subunits will continue. Integration tasks relating to test and checkout of subsystems will also be continued. Software development is to be continued. Design and integration funds previously planned for GBU-15 interface will be used to support Conventional Standoff Weapon (CSW) program. Funds reprogrammed into PLSS for CSW will be used to develop standoff weapon compatible with PLSS. Work previously deferred on peculiar support equipment development will be initiated. Advanced Location Strike System (ALSS) will continue to support development testing associated with PLSS risk reduction as well as increasing knowledge of distance measuring equipment (DME) and time of arrival (TOA) techniques. ALSS will participate in joint Air Force/Army demonstrations of Assault Breaker/PAVE MOVER advanced development equipment.

3. (U) FY 1983 Planned Program: During this period the Critical Design Review (CDR) will be conducted. PLSS subsystem fabrication will continue. Qualification and acceptance of completed units will occur. Software development will be completed. Independent software validation and verification will continue. Precision Location Strike System (PLSS) subcontractor unit fabrication and delivery will be completed for system integration, testing and checkout. Test aircraft modification will occur. Integration of the full PLSS system will occur and system level testing will start. Advanced Location Strike System (ALSS) will continue to support development testing primarily in development of baseline data for PLSS test with potential use as range instrumentation during initial phases of PLSS Development Test and Evaluation (DT&E). The FY 1982 estimate of FY 1983 requirements for the Program Element (PE) was $77,700 thousand. The FY 1983 request of $98,859 thousand increased the PE by $21,159 thousand in order to develop the PLSS guidance equipment for the F-16, to make software changes to accommodate the conventional standoff weapon, to purchase deferred hardware buys and to include deferred peculiar support equipment development. The increase was associated with the FY 1980 reduction and late receipt of FY 1981 full funding and requires major schedule adjustments in the PLSS project. Funding requirement for FY 1983 through completion are based on that reduction and delay. Development of the Photogrammetric Target System, Project 2106, has been deferred until a statement of need is submitted and validated. Development of the Emitter Location System, Project 1947, is being carried as part of the PLSS, Project 1190, funds. Development of the Joint Service Weapon Data Link, Project 2589, has been discontinued.

4. (U) FY 1984 Planned Program: Procurement of Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) items will be completed. Contractor test of system will occur and Air Force DT&E will begin. An Air Force Systems Acquisition Review Council review for long lead, production procurement will be accomplished.

5. (U) Program to Completion: The combined DT&E/IOT&E for the PLSS will be completed followed by an Air Force System Acquisition Review Council review for full production. A positive production decision will be followed by initial delivery beginning in late FY 1985.

Program Element: #64742F

DOD Mission Area: Multimission, Technology & Support, #374

Title: Precision Location Strike Systems

Budget Activity: Tactical Programs, #4

6. **Milestones:**

	Milestones		Date
A.	Area Coordinating Paper Number 4		Mar 1972
B.	Tactical Air Forces Required Operational Capability (TAF ROC) 314-74 Validated		Nov 1974
C.	ALSS - Deployment to Europe		May 1975
D.	PLSS Defense System Acquisition Review Council (DSARC) II/Milestone II		Jul 1977
E.	ELS Feasibility Demonstration Complete		Mar 1978
F.	Photogrammetric Targeting System (PTS) Studies Complete		Oct 1978
G.	CELT European Demonstration		Sep-Oct 1980
H.	Initiate PLSS DT&E/IOT&E	(Sep 1983)*	May 1984
I.	Complete DT&E/IOT&E - PLSS	(Sep 1984)*	May 1985
J.	PLSS AFSARC III		FY 1984/1985**
K.	PLSS Initial Operational Capability (1st production unit, 1st Unit Equipment squadron)		

* Data presented in FY 1982 Descriptive Summary.

** PLSS has been designated a non-major program. AFSARCs for long lead procurement and full production will occur in FY1984 and FY1985 respectively.

(U) EXPLANATION OF MILESTONE CHANGES

FY 1981 funds were constrained and delayed. The final $46.0 million of the planned total $62.6 million was not available to the contractor until June of 1981.

Project: #1130
Program Element: #64742F
DoD Mission Area: Multimission, Technology & Support #374

Title: Precision Location Strike System (PLSS)
Title: Precision Location Strike Systems
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Soviet/Warsaw Pact tactical doctrine emphasizes a 24-hour a day capability with a strong emphasis on protection of ground forces using air defense systems to reduce the effectiveness of airpower. Defense Intelligence Agency document, "Precision Location Strike System (PLSS) Electronics Warfare Threat Through 1996," June 1977, projects trends of of Soviet systems.

Current and projected Air Force and Army systems will threat. All weather operations are constrained by accurate weapons with capability while all weather weapons systems are constrained by Delivery of weapons is primarily from within the lethal range of the enemy air defense systems. Current reconnaissance systems The development of the Precision Location Strike System (PLSS) will substantially alleviate any of the critical deficiencies in our all-weather tactical defense suppression close air support interdiction attack capabilities and will increase our reconnaissance capabilities. The Advanced Location Strike System (ALSS), as the predecessor system, serves as a Research, Development, Test and Evaluation (RDT&E) testbed for PLSS risk reduction efforts.

(U) The PLSS project is the major development effort in this Program Element. PLSS will provide targeting-accuracy, integrated location and strike of hostile air defenses continuously in near real time and all weather over a theater-wide area. As such, PLSS will be the centerpiece to efficient and effective conduct of lethal defense suppression to reduce attrition to acceptable levels, especially, in the critical first few days of conflict. Additionally, PLSS can provide up to the minute Electronic Order of Battle information enabling the commander to assess the immediate threat to his strike force.

The PLSS will provide a location accuracy against air defense radar systems and a The PLSS can update about Once processed and identified, the system relays target information to the appropriate Air Force or Army battlefield commander Emitter target location is accomplished by using time-difference-of-arrival and direction-of-arrival techniques.

Project: #1190 Title: Precision Location Strike System (PLSS)
Program Element: # 64742F Title: Precision Location Strike Systems
DoD Mission Area: Multimission, Technology & Support, #374 Budget Activity: Tactical Programs, #4

Identification of emitter type is accomplished from comparison with known parameters. New signals are used to update the electronic order of battle data. Further identification to is being developed as a part of the Precision Location Strike System (PLSS). The PLSS will be capable of operating in the dense emitter signal environment projected for Europe through 1990.

Attacks on radiating and nonradiating targets will be with F-16/ordnance or standoff guided weapons using the PLSS Distance Measuring Equipment (DME) precision guidance. Use of DME guided standoff weapons significantly reduces the attrition of attacking forces from surface-to-air missile/antiaircraft artillery (SAM/AAA) defenses. The PLSS will allow a guidance accuracy giving a total guided missile system accuracy (location/strike) of less than a Using DME units on attacking aircraft will also reduce attrition through increased probability of target kill on the first pass. The PLSS can direct unguided ordnance delivery within an of the target location. The DME guidance data link being developed will provide PLSS with very high jam resistant protection to counter the Defense Intelligence Agency (DIA) projected threat environment.

(U) Full Scale Engineering Development (FSED) of the PLSS was initiated in September 1977 after review by the Defense System Acquisition Review Council and approval by the Deputy Secretary of Defense.

RELATED ACTIVITIES: The Conventional Standoff Weapon (CSW) to be developed in PE 64606F, Conventional Standoff Weapon, provides funds for a powered, guided missile capable of carrying a lethal payload to a range of from a medium or high altitude launch. With anti-material submunitions as payload this missile will provide an effective long range standoff weapon. An emitter identification effort has Army and Navy participation through sharing of technology equipment and test information. The airborne relay vehicles (TR-1) will be procured under PE 27215F, TR-1 Squadron. F-16 aircraft will be produced capable of carrying and employing the PLSS guidance equipment under PE 27133F, F-16.

(U) WORK PERFORMED BY: Development of Precision Location Strike System (PLSS) is managed by the Air Force Systems Command, Aeronautical System Division, Wright-Patterson AFB, OH. The prime contractor is the Lockheed Missiles and Space Company, Sunnyvale, CA. Major subcontractors are: E-System, Garland, TX (intercept equipment and aircraft modification); Sperry Univac, Salt Lake City, UT (data link equipment); IBM, Owego, NY (strike and jammer location software and equipment); Collins, Dallas, TX (ground communications subsystems); Control Data Corporation, Minneapolis, MN (UYK-25 computers); Brunswick, Marion, VA (shelters); Harris Corporation, Melbourne, FL (navigation and strike data link), and Motorola Corporation, Phoenix, AZ (displays). MIT Lincoln Laboratory and Aerospace Corporation perform studies, analyses and related efforts in support of PLSS. SofTech Corporation performs independent software verification and validation.

Project: #1190
Program Element: # 64742F
DoD Mission Area: Multimission, Technology & Support, #374

Title: Precision Location Strike System (PLSS)
Title: Precision Location Strike Systems
Budget Activity: Tactical Programs, #4

(U) PROGRAMS ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The contractor, Lockheed Missiles and Space Company, was selected in June 1977. The Defense System Acquisition Review Council Milestone II (Development Readiness) review was held in July 1977 and the Deputy Secretary of Defense approved PLSS Full Scale Development on 1 September 1977. System Requirements Review was held in January 1978. System Design Review was held in May 1978. Subcontractor Preliminary Design Reviews (PDR) began in July 1978 in preparation for subsystem PDRs beginning in October 1978. Subsystem PDRs supported the system PDR held in October 1979. The first of four increments of the software Critical Design Review was completed in October 1980. Brassboard fabrication and testing for risk reduction was also initiated. An independent contractor for software validation and verification, SofTech Corporation, was selected and began efforts to support the program. Discussions were conducted with North Atlantic Treaty Organization (NATO) allies on the combat potential of PLSS in NATO and on the operational integration of PLSS into the NATO structure. The Task Force 7, Electronic Warfare report as a part of the NATO Long Term Defense Program

2. (U) FY 1982 Program: PLSS contractors will continue design efforts, engineering tests, and documentation culminating in completed drawings and specifications for the system Critical Design Reviews (CDR). Software development will continue. Qualification and acceptance testing of completed subunits will continue. Integration tasks relating to test and checkout of subsystems will continue. Design and integration funds previously planned for GBU-15 will be used to support the Conventional Standoff Weapon (CSW) program. Funds reprogrammed into PLSS for CSW will be used to develop standoff weapon compatible with PLSS. Work previously deferred on peculiar support equipment development will be initiated.

3. (U) FY 1983 Planned Program: During this period, the system CDR will be conducted. Subsystem elements fabrication will continue. Qualification and acceptance testing of completed units will continue. Integration tasks relating to test and checkout at the subsystem level will also continue. Precision Location Strike System subcontractor unit fabrication and delivery will be completed for system integration, testing and checkout. Independent software validation and verification will continue. Software development will be completed. Test aircraft modification will occur. Integration of the full PLSS system will occur and system level testing will start.

4. (U) FY 1984 Planned Program: Procurement of Development Testing and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) items will be completed. Contractor test of system will occur and Air Force DT&E will begin. An Air Force Systems Acquisition Review Council review for long lead, production procurement will be accomplished.

5. (U) Program to Completion: Combined DT&E/IOT&E will be completed in May 1985 followed by a Milestone III (production) review. A positive production decision will be followed by initial deliveries begining in late FY 1985.

6. Milestones

	Milestones	Date
A.	TAF ROC 314-74 Validated	Nov 1974
B.	Defense System Acquisition Review Council (DSARC) II/Milestone II	Jul 1977

Project: #1190
Program Element: # 64742F
DoD Mission Area: Multimission, Technology & Support #374

Title: Precision Location Strike System (PLSS)
Title: Precision Location Strike Systems
Budget Activity: Tactical Programs, #4

C.	Full Scale Development Contract		Sep 1977
D.	Airborne Relay Vehicle Decision		Oct 1978
E.	Preliminary Design Review		Oct 1979
F.	Critical Design Review	*(Dec 1981)	Mar 1983
G.	Initiate DT&E/IOT&E	*(Sep 1983)	May 1984
H.	Complete DT&E/IOT&E	*(Sep 1984)	May 1985
I.	AFSARC III		**FY 1984/1985
J.	PLSS Initial Operational Capability (first production unit, first Unit Equipment Squadron)		

* Date presented in FY 1982 Descriptive Summary.
** PLSS has been designated a non-major program. AFSARCs for long lead, production procurement and full production will occur in FY 1984 and FY 1985 respectively.

(U) EXPLANATION OF MILESTONE CHANGES: See Section 8.

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimate Costs
RDT&E	62,700	87,195 1/	96,259	80,379	105,142	584,775 2/
Aircraft Procurement (PE 27244F)	0	1,700	1,800	6,400	176,100	186,000
Other Procurement (PE 27244F)	0	0	0	0	76,500	76,500

1/ Design and integration funds previously planned for GBU-15 interface will be used to support Conventional Standoff Weapon (CSW) program. Include $6.9 million reprogrammed to specifically support CSW development.
2/ Includes $0.4M for Coherent Emitter Location Testbed (CELT)

8. (U) Comparision with FY 1982 Descriptive Summary: 3/

RDT&E	14,750	82,500	77,100	-	102,700	428,150
Other Procurement			2,000		5,600	7,000

The FY 1982 estimate for the FY 1983 project requirement was $77,100 thousand. The FY 1983 request of $98,259 thousand is an increase of $21,159 thousand due in part to rephasing and restructuring the program as a result of FY 1980 fiscal constraints and delay in getting additional funding in FY 1981. In addition, the increase will be to develop the PLSS guidance equipment for the F-16, to make software changes to accommodate the Conventional Standoff Weapon (CSW) and to include deferred peculiar support equipment development. Total estimated cost of the project increased by $156,625 thousand to $584,775 thousand as a result of the previously mentioned development changes, the schedule changes associated

Project: #1190 Title: Precision Location Strike System (PLSS)
Program Element: # 64742F Title: Precision Location Strike Systems
DoD Mission Area: Multimission, Technology & Support, #374 Budget Activity: Tactical Programs, #4

with the FY 1980 and 1981 funding perturbations, and the fact that the FY 1982 Descriptive Summary did not consider the effect of funding adjustments in the FY 1981 Supplemental Budget nor FY 1982 reprogramming actions. Funding requirements for FY 1983 through completion are based on negotiated contract prices and changes and system program office estimates. The FY 1982 estimate of the procurement requirement only reflected initial spares costs. The FY 1982 Amended Budget added Aircraft Procurement funds to provide for TR-1 wideband data link equipment. The FY 1983 estimate presents the total Aircraft and Other Procurement requirements for the operational PLSS hardware.

3/ Reflects data from FY 1982 Descriptive Summary dated January 1981. Does not consider effect of RDT&E funding adjustments in FY 1981 Suppplemental Budget (+48.0M in FY 1981) and FY 1982 Amended Budget (-$1.9M in FY 1982). Does not consider the Aircraft Procurement funding adjustment in the FY 1982 Amended Budget (+$1.7M in FY 1982 and TBD in outyears).

Budget Activity: Tactical Programs, #4
Program Element: #64742F Precision Location Strike System (PLSS)

Test and Evaluation Data

1. (U) Development Test and Evaluation: Tactical Air Forces Required Operational Capability No. 314-74, Location Strike System, 1 May 74, outlined the requirement for detection, identification, location, and strike of pulsed and nonpulsed emitters. It also stated the requirement for a capability to strike radiating and non-radiating targets in all weather conditions.

Precision Location Strike System mission and description: The Precision Location Strike System will provide the tactical forces with an all-weather, standoff precision strike system capable of attacks against tactical targets (such as headquarters, command and control facilities, airfields, and bridges) located by other systems, while providing near-real-time integrated detection, location and destruction of the enemy's defense system in a dense emitter and jammer environment. The Precision Location Strike System will be able to locate and destroy enemy _ _ in the PLSS frequeny coverage and to operate in conjunction with other signal intelligence and reconnaissance systems to provide cueing and direct strikes for those systems. Electromagnetic emitter information collected by a triad of aircraft will be data linked to a ground Central Processing Subsystem for processing and evaluation. Potential target information will be forwarded to appropriate combat control elements which will direct tactical strike aircraft to the target area. The Central Processing System will provide steering and weapon release commands to the strike aircraft and, after weapon release, will control guided ordnance to the target. Unguided ordnance will be released so that the weapons' trajectory will carry them to the target. Possible follow-on applications include distance measuring equipment guidance of cruise weapons and the acquisition of targeting data for Army surface-to-surface missiles and artillery.

(U) Two contractors were reviewed through source selection process from September 1976 to June 1977 for Full Scale Development. The contract was awarded to Lockheed Missiles and Space Company, Incorporated. A Defense System Acquisition Review Council II review, held on 26 July 1977, resulted in Deputy Secretary of Defense approval for Full Scale Development on 1 September 1977. Go ahead for Full Scale Development was given to Lockheed Missile and Space Corporation on 2 September 1977. Decision Coordinating Paper #129 schedule thresholds are as follows: (1) Preliminary Design Review complete, January 1979; (2) Critical Design Review complete, December 1979; (3) Start Development Test and Evaluation (Field Tests), June 1981; and (4) Complete Initial Operational Test and Evaluation, August 1982. The Preliminary Design Review and Critical Design Review thresholds have been breached and the others will be breached because of program stretches caused by funding reductions from the planned development program.

(U) Development Test and Evalution accomplished to date consists of "breadboard" tests conducted by the prime contractor or his subcontractors to reduce the technical risks of developing Full Scale Development hardware.

Budget Activity: Tactical Programs, #4
Program Element: #64742F Precision Location Strike System (PLSS)

2. (U) Operational Test and Evaluation: The PLSS combined development test and evaluation/initial operational test and evaluation (DT&E/IOT&E), scheduled to begin in September 1983 and be completed in September 1984, will be conducted from either the Air Force Flight Test Center (AFFTC), Edwards AFB CA or from the USAF Tactical Fighter Weapon Center (TFWC), Nellis AFB NV. Final test site selection will be determined by February 1982. Either of these test sites will allow use of the emitter environment on the Nellis and Naval Weapons Center (NWC), China Lake CA, ranges. Consideration is being given to conducting a portion of the IOT&E in Europe. The full-scale development equipment to be evaluated is not expected to differ significantly from the production equipment.

(U) The Air Force Test and Evaluation Center (AFTEC) will direct the IOT&E portion of the combined DT&E/IOT&E using a team of fully-trained Air Force operations and maintenance personnel and resources from Air Force Systems Command (AFSC), Tactical Air Command (TAC), Air Force Logistics Command (AFLC), Strategic Air Command (SAC), Electronic Security Command (ESC), and Air Training Command (ATC).

(U) The purpose of the IOT&E will be to determine the operational effectiveness and suitability of the PLSS when employed in its operational configuration. IOT&E results will be used as inputs to the Air Force System Acquisition Review Council (AFSARC) III decision scheduled for the second quarter of FY85.

(U) Operational scenarios will be established to evaluate the ability of the system to locate and identify emitters; direct attack aircraft for the delivery of unguided ordnance; guide extended range powered munitions; interface with command, control, communication and intelligence (C^3I) nets; and operate in a chemical/biological warfare environment. A significant portion of the C^3I interoperability evaluation is planned during the European portion of the IOT&E or the follow-on test and evaluation (FOT&E). The capability of the PLSS to accurately track and control multiple weapons delivery will be assessed. The survivability of the airborne relay vehicles (ARVs), strike aircraft, and PLSS ground components will be assessed.

(U) An assessment of interoperability with other defense suppression systems, to include degradation from friendly electromagnetic interference, will be conducted. Degradation of location and strike accuracy, resulting from electronic countermeasures, will be evaluated. Evaluations of system reliability, maintainability, availability, and logistics supportability will also be conducted.

(U) Even though complete PLSS support equipment (SE) will not be available until FY84/85, an acceptable evaluation of maintainability can still be completed. Approximately one-half of the line replaceable units (LRUs) will be supportable by the SE available during IOT&E. The remaining SE will be evaluated during follow-on test and evaluation (FOT&E).

3. System Characteristics: The following are goals for critical parameters to be evaluated during Development Test and Evaluation/Initial Operational Test and Evaluation.

Budget Activity: Tactical Programs, #4
Program Element: #64742F Precision Location Strike System (PLSS)

Parameter	Objectives	Demonstrated Performance
Probability of:		
Location (1)		
Identification (2)		
Frequency Coverage		
Range (3)		
Accuracy (R/D=1) (4)		
Strike		
Location		
System		
Mission Reliability (5)		
Mission Completion		
Success Probability		

1. Probability of location refers to the capability to locate emitters within the area of interest which radiate for a minimum time. Minimum times by class are: Testing to be conducted in a benign electronic countermeasures environment.

2. (U) Probability of identification refers to the correct identification of those emitters located by the Precision Location Strike System.

3. (U) Range for operation of data link and distance measuring equipment is defined as the line-of-sight distance between Precision Location Strike System terminals; i.e , Central Processing Subsystem to Airborne Relay Vehicles, Airborne Relay Vehicle to Site Navigation Subsystems, and Airborne Relay Vehicle to Vehicle Navigation Subsystems and Weapon Navigation Subsystems.

4. Range (R) is defined, for this parameter, as the distance on the perpendicular bisector of the Airborne Relay Vehicle baseline measured from the baseline (D) to the emitter/target of interest. For test purposes, these accuracy goals/thresholds are specified for a geometry of

5. (U) Mission reliability is the probability of mission success as defined in the Reliability Annex (Annex C to the Decision Coordinating Paper).

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64750F | Title: Intelligence Equipment
DOD Mission Area: TIARA for Tactical Air Warfare, #327 | Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	15,607	14,744	18,469	16,894	Continuing	Not Applicable
1174	Intelligence Security Equipment	816	2,900	2,600	1,000	Continuing	Not Applicable
1955	Air Force Support to DOD Indications & Warning	8,077	6,546	6,379	7,167	Continuing	Not Applicable
2053	Foreign Technology Division Intelligence Processes	4,461	3,400	3,890	4,792	Continuing	Not Applicable
2165	COMPASS PREVIEW	980	700				19,900
2323	Radar Prediction System (RAPS)	973	100				5,[illegible]00
2631	Computer Assisted Mission Planning System (CAMPS)	300	1,100	5,600	3,935	5,265	16,200

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element supports United States Air Force operating commands by performing the engineering development of ground equipment used to process, integrate, display and distribute intelligence data. This equipment will reduce the time required for the exploitation of intelligence data to meet the needs of Air Force agencies producing strategic, tactical, and scientific and technical intelligence. The equipment will also improve the efficiency of those units producing air target materials. Equipment and techniques are also developed to counter the foreign intelligence threat to the USAF mission, to support the collection of human intelligence, and to support the USAF escape and evasion mission.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The funds are requested to continue development efforts to improve the timeliness and accuracy of intelligence products provided to the operational commanders, the research and development planners and the National Command Authorities. FY 1983 funds will improve capabilities to: (1) produce a warning of foreign threats, (2) evaluate foreign weapon systems, and (3) perform tactical unit mission planning. Funds will also be used to develop

Program Element: #64750F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Intelligence Equipment
Budget Activity: Tactical Programs, #4

equipment to assist in countering the foreign surveillance threat and improve the collection of foreign intelligence using human resources and to support prisoner of war escape and evasion. The cost estimates for this program were developed by the Air Force Systems Command program offices based on experience with similar development programs.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: (PE level only)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	15,646	14,800	14,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: None

Program Element: #64750F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Intelligence Equipment
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The objectives are to develop hardware and software, for the exploitation of data and the production of intelligence and target materials and to improve the existing capabilities presently being employed by various operating commands. Also, equipment and techniques will be developed to support units involved in countering the enemy surveillance threat to the Air Force mission, to assist in the collection of foreign intelligence through us of human resources, and to support intelligence aspects of prisoner of war escape and evasion. The program objectives are accomplished through the following projects:

(U) Intelligence Security Equipment (1174) - Develops equipment and techniques to counter foreign surveillance threats. The project also develops unique equipment and techniques to support the Air Force mission for collection of foreign intelligence through the use of human resources and to support the intelligence aspects of prisoner of war escape and evasion.

Air Force Support to DOD Indications and Warning (1195) - Improves the existing capability by modernizing the Air Force Indications and Warning Centers at Strategic Air Command, Aerospace Defense Command, Military Airlift Command, and Alaskan Air Command to provide compatibility with the National Military Intelligence Center modernization effort. Provides a capability to rapidly correlate available all-source intelligence data, and develop indications and warning of threats to assist the National Command Authorities and military commanders in managing a crisis situation.

(U) Foreign Technology Division Intelligence Processes (2533) - Improves the Foreign Technology Division capability to acquire, evaluate, analyze, and report on foreign scientific and technical information and material. These improvements will assist in responding to intelligence requirements vital to the operational commanders, research and development planners, and national level agencies.

(U) COMPASS PREVIEW (2165) - Develops a test-bed digital imagery exploitation device for Air Force softcopy conceptual validation testing.

(U) Radar Prediction System (2323) - Develops and implements an automated system that will produce a prediction of a radar scope display of specific geographic areas. This radar prediction is generated from a digital data base and primarily supports the aircraft crew members in mission planning for strike and reconnaissance (F-16, B-52, F-111, F/RF-4), or air drop delivery (C-130).

(U) Computer Assisted Mission Planning System (2631) - Develop a capability to provide timely aircrew mission planning. This project will develop an automated capability to assist in route planning, compute required fuel loads, perform penetration analysis to best avoid enemy defenses, and accomplish weapons planning.

Program Element: #64750F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Intelligence Equipment
Budget Activity: Tactical Programs, #4

RELATED ACTIVITIES: Intelligence program activities of joint service interest such as the Indications and Warning efforts are coordinated with the Defense Intelligence Agency. Exploratory and advanced development activities related to this program are conducted under Program Element 62702F, Command Control and Communications and 63789F, Command Control, and Communications Advanced Development. Other related Air Force Activities include Program Elements 31011(G), Cryptologic Activities: 31328F, Strategic Air Command; 31310F, Foreign Technology Division; 31334F, Air Force Other Commands; 31335F, Air Force Automated Data Processing Support to General Defense Intelligence Program; 31318F, HUMINT (Contolled); 31321F, HUMINT (Overt); 35127F, Foreign Counterintelligence; 35128F, Security and Investigative Activities; and 27431, Tactical Air Intelligence System Activities.

(U) WORK PERFORMED BY: The Air Force manager for Project 2631, Computer Assisted Mission Planning System (CAMPS) is Electronic Systems Division, Hanscom AFB, MA. The Air Force manager for the remaining projects is the Rome Air Development Center, Griffiss AFB, NY. Major contractors are Planning Research Corporation, McLean, VA; BETAC Corporation, Burlington, MA; General Electric Company, Daytona Beach, FL; Northrop Corporation, Hawthorne, CA; Computer Science Corporation, Falls Church, VA; GTE Sylvania, Mountain View, CA; International Computing Company, Bethesda, MD; Pattern Analysis and Recognition Corporation, Rome, NY; and Booz-Allen and Hamilton, Bethesda, MD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments:

Intelligence Security Equipment (Project 1174) - This project normally has 10-12 independent tasks ongoing simultaneously. Examples of Fiscal Year 1981 and prior accomplishments are: design and fabrication of for field testing, development of a secure data/speech recording system, development of a processor to automatically enhance audio recordings degraded by noise, development of a covert mobile communications antenna, evaluation of techniques for improving and automating the processes invloved in preparation of development of a chemical marking system, and design a miniature addressable transceiver system.

(U) Air Force Support to DOD Indication and Warning (Project 1955) - The development activities through Fiscal Year 1981 have centered on major improvements at Strategic Air Command and Aerospace Defense Command. However, initial efforts to upgrade the indications and warning capabilities of the Military Airlift Command and the Alaskan Air Command began in Fiscal Year 1981. The major thrust of the initial efforts at Strategic Air Command and Aerospace Defense Command was to provide a capability to manage intelligence information internal to the commands' indications and warning function. In Fiscal Year 1981 at the Strategic Air Command effort began to provide for analyst access to external national level files.

(U) Foreign Technology Division Intelligence Processes (Project 2053) - This project has completed development of electronic warfare and command, control, and communications threat analysis systems, development of several tasks to

Program Element: #64750F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Intelligence Equipment
Budget Activity: Tactical Programs, #4

improve forecasting methodology for projecting intercontinental ballistic missile developments, including installation of software to improve analysis of biconic reentry vehicles, development of a solid rocket simulation model to distinguish different propellant configuratic :, and development of analysis tools to determine reentry vehicle orientation from radio frequency polarization data, completed a computer model of a particle beam accelerator, initiated effort to develop a computer performance measures capability to improve management of all internal Foreign Technology Division data processing resources, and began duplication of a Special Command, Control, and Communications antenna for analysis.

(U) COMPASS PREVIEW (Project 2165) - Detailed system specifications were developed in Fiscal Year 1975. Between Fiscal Years 1976 and 1980 a COMPASS PREVIEW test bed was fabricated. The system was installed at Headquarters Strategic Air Command between June 1980 and January 1981. Operational/developmental test and evaluation of COMPASS PREVIEW began in May 1981, using imagery interpreters from Strategic Air Command, Tactical Air Command, United States Air Forces in Europe, Pacific Air Forces and Foreign Technology Division.

(U) Radar Prediction Systems (RAPS) (Project 2323) - Full scale prototype development of the Radar Prediction System, begun in Fiscal Year 1979, was completed in Fiscal Year 1981.

(U) Computer Assisted Mission Planning System (CAMPS) (Project 2631) - Initiated development of prototype computer assisted mission planning system for tactical units.

2. (U) FY 1982 Program:

Intelligence Security Equipment (Project 1174) - Complete development of a small two-color infrared imaging system and a range-gated television system for surveillance under adverse light and weather conditions. Initiate full scale development of a miniature addressable transceiver system, an automated special printing system for and a portable narrow-band surveillance receiver for the detection, identification and location of unauthorized emissions.

(U) Air Force Support to DOD Indications and Warning (Project 1955) - At the Strategic Air Command, implemention of Operational Intelligence Support System graphic and trend analysis capability will be completed. At Aerospace Defense Command complete implementation of an improved integrated space and missile history data base. Alaskan Air Command will begin operation of an initial small-scale, stand-alone analysis capability. Military Airlift Command will begin initial operation of a limited data base and an expanded information dissemination capabilities using software previously developed for Strategic Air Command.

(U) Foreign Technology Division Intelligence Processes (Project 2053) - Complete computer performance measures development, integration of the electro-optical data base with the electronic warfare analysis system. Continue work on various tasks associated with improving missile and reentry vehicle analysis capability and missile system forecasting. Initiate new efforts to refine and analyze requirements and provide specifications supporting the mid - 1980s total upgrade of the Foreign Technology Division's data processing environment, to provide a capability to analyze reentry vehicle data from the Real-Time Optical System, to develop a standard query language, to develop methodologies to perform space system forecasting and analysis of ballistic missile guidance and guidance related errors.

(U) COMPASS PREVIEW (Project 2165) - Complete testing.

(U) Radar Prediction System (RAPS) (Project 2323) - A decision has been made not to procure the Radar Prediction System. Because of the cost of contractor support required for the Operational Test and Evaluation a decision was made to terminate the contract and incorporate the prototype system into the Rome Air Development Center Intelligence Test Bed.

(U) Computer Assisted Mission Planning System (CAMPS) (Project 2631) - Continue development of specifications and Request for Proposal for prototype systems.

3. (U) FY 1983 Planned Program:

Intelligence Security Equipment (Project 1174) - Continue development of miniature addressable transceiver system and portable narrow-band surveillance receiver, complete automated special printing system, and begin the design and fabrication of a __ and the design and fabrication of a portable wide-band antenna system for use with countermeasures receivers.

(U) Air Force Support to DOD Indications and Warning (Project 1955) - At Strategic Air Command, implement advanced indicator analysis capability. At Aerospace Defense Command, implement space threat correlation capability. At Alaskan Air Command, install the current intelligence analysis system on prototype hardware. At Military Airlift Command, implement mission folder development and route threat assessment capability.

(U) Foreign Technology Division Intelligence Process (Project 2053) - Complete space and missile system forecasting. Continue missile and reentry vehicle analysis tasks, development of standard query language, Real-Time Optical System analysis capability, guidance error analysis capability, requirements definitions for the Foreign Technology Division's data processing environment, and operation/analysis of command, control and communications antenna. Initiate an effort to develop a capability to analyze satellite configurations based only on external signature data.

(U) Computer Assisted Mission Planning System (CAMPS) (Project 2631) - Award contract and begin full scale engineering development of prototype systems.

(U) The increase in FY 1983 total program cost from the FY 1982 Descriptive Summary represents the inclusion of funds to develop Computer Assisted Mission Planning System prototype systems.

Program Element: #64750F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Intelligence Equipment
Budget Activity: Tactical Programs, #4

4. (U) FY 1984 Planned Program:

Intelligence Security Equipment (Project 1174) - Complete development of miniature addressable transceiver system, surveillance receiver and wide-band antenna system. Initiate a program to develop a portable wide-band recorder and a capability to obtain foreign material for exploitation.

(U) Air Force Support to DOD Indications and Warning (Project 1955) - At Strategic Air Command, develop analyst oriented software correlation techniques on the Operation Intelligence Support System. At Aerospace Defense Command, implement foreign launch assessment capability. At Alaskan Air Command, implement capability to query the Defense Intelligence Agency data base. At Military Airlift Command, implement a capability to manage collection of intelligence information. In addition, initiate the Air Force subset of the Worldwide Indicator Monitoring System (WWIMS) at Strategic Air Command and Aerospace Defense Command.

(U) Foreign Technology Division Intelligence Processes (Project 2053) - Complete and implement missile and reentry vehicle analysis capability, standard query language, and missile guidance error analysis capability. Complete operation and analysis of command, control and communications antenna and finalize requirements to upgrade the Foreign Technology Division's data processing environment. Continue Real-Time Optical System analysis effort and satellite externals program. Initiate effort to develop a missile/payload threat analysis system and a capability to forecast weapon systems, other than missile and space systems.

(U) Computer Assisted Mission Planning System (CAMPS) (Project 2631) - Accept delivery of first prototype system. Conduct Development/Operational Test and Evaluation

5. (U) Program to Completion:

(U) Intelligence Security Equipment (Project 1174) - This is a continuing project.

(U) Air Force Support to DOD Indications and Warning (Project 1955) - This is a continuing project.

(U) Foreign Technology Division Intelligence Processes (Project 2053) - This is a continuing project.

(U) Computer Assisted Mission Planning System (CAMPS) (Project 2631) - Production decision in Fiscal Year 1985 with procurement in that and following years. Incremental improvement to capabilities through software and hardware additions through Fiscal Year 1987.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

Project: #1955 Title: Air Force Support to DOD Indications and Warning
Program Element: #64750F Title: Intelligence Equipment
DOD Mission Area: TIARA for Tactical Air Warfare, #327 Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the implementation of improved indications and warning capabilities at Air Force Indications and Warning Centers/Facilities. Improvements are directly related to the Defense Intelligence Agency modernization program for the National Military Intelligence Center. Improvements are necessary to allow internetting of computers between the Air Force Indications and Warning Centers/Facilities and the National Military Intelligence Center. The objectives of this project are to: provide for the rapid and reliable analysis of indications and warning intelligence, provide assessments of the indications and warning intelligence and the resulting implications concerning nation interest, and provide the National Command Authorities and military commanders with timely and accurate assessments to assist in determining a national course of action. New technologies have evolved that permit rapid analysis of multi-source data and remote access to other intelligence data bases to assure the use of all available information to postulate an indication of future events. These technologies will be incorporated into Indications and Warning Centers/Facilities to permit rapid assessment and reporting.

(U) RELATED ACTIVITIES: Intelligence program activities of joint service interest are coordinated with the Defense Intelligence Agency. Implementation activity is conducted under Program Elements 31328F, Strategic Air Command; 31334F, Air Force Other Commands; and 31335F Air Force Automated Data Processing Support to General Defense Intelligence Program. Exploratory development activities related to this project are conducted under Program Element 62702F, Command, Control and Communications.

(U) WORK PERFORMED BY: The Air Force manager is Rome Air Development Center, Griffiss AFB, NY. Major contractors are Planning Research Corporation, McLean, VA; INCO Incorporated, McLean, VA; BETAC Corporation, Burlington, MA, Pattern Analysis and Recognition Corporation, Rome, NY; and Booz-Allen and Hamiltion, Bethesda, MD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The development activities through Fiscal Year 1981 have centered primarily on major improvements at Strategic Air Command and Aerospace Defense Command. However, initial efforts to upgrade the intelligence analysis and indications and warning capabilities of the Military Airlift Command and Alaskan Air Command began in Fiscal Year 1981. The major thrust of these efforts was to provide a capability to manage intelligence information internal to the command's indications and warning function. Efforts supporting the Strategic Air Command Operational Intelligence Support System provide automated intelligence information dissemination, analyst information exchange, and intelligence product generation. In Fiscal Year 1981 efforts began to expand this system to provide external analyst access to nation level files. This includes data at the Defense Intelligence Agency and National Security Agency to improve signals intelligence and electronic intelligence exploitation for trend analysis. The Aerospace Defense Command development has focused on existing sensor system exploitation and long-range space defense intelligence functions by implementation of some software enhancements and creating specifications for the total hardware and software system required for the space defense indications and warning function. The initial efforts at Alaskan Air Command and Military Airlift Command was to determine currently existing capabilities and requirements.

Project: #1955
Program Element: #64750F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Air Force Support to DOD Indications and Warning
Title: Intelligence Equipment
Budget Activity: Tactical Programs, #4

2. (U) FY 1982 Program: The Strategic Air Command Operational Intelligence Support System graphics and trend analysis capability will become operational. Data base requirements and indicator requirements at Strategic Air Command will be addressed. The Aerospace Defense Command effort includes implementation of an improved space history and missile data base along with unique space and missile indicators. The Alaskan Air Command effort includes an initial stand-alone correlation and analysis capability. The Military Airlift Command effort will expand the information dissemination capabilities transferred from Strategic Air Command to provide data base and unique indicator support.

3. (U) FY 1983 Planned Program: The Strategic Air Command Operational Intelligence Support System advanced indicator analysis capability will become operational. The Aerospace Defense Command effort includes implementation of a space threat correlation capability. The Alaskan Air Command effort includes installation of the current manual analysis system on prototype hardware. The Military Airlift Command effort includes provision of a capability to prepare mission folders and develop airlift mission route threat assessment base on political and military factors.

4. (U) FY 1984 Planned Program: The Strategic Air Command effort includes development of analyst oriented software correlation techniques on the Operations Intelligence Support System. The Aerospace Defense Command foreign launch assessment capability will become operational. The Alaskan Air Command effort will include implementation of the Intelligence Data Handling System II communications capability to the Defense Intelligence Agency data base system which will allow analyst to directly query that data base. The Military Airlift Command effort will include implementation of a capability to manage collection of intelligence information directly related to their peacetime and wartime worldwide airlift mission. In addition to the other efforts at the Strategic Air Command and the Aerospace Defense Command, begin development of the Air Force subset of the Department of Defense Worldwide Indicator Monitoring System (WWIMS).

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: ($ in thousands).

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	8,077	6,544	6,379	7,167	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	7,800	6,700	7,300		Continuing	Not Applicable

(U) Decrease in FY 1983 project cost from FY 1982 Descriptive Summary represents unprogrammed cuts during budget formulation process.

Project: #2631 Title: Computer Assisted Mission Planning System (CAMPS)
Program Element: #64750F Title: Intelligence Equipment
DOD Mission Area: TIARA for Tactical Air Warfare, #327 Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Mission planning activities at the tactical wing and squadron level apply intelligence data to tasking received from higher levels of the Tactical Air Control System, along with terrain, aircraft performance, weapons, and weather data, to validate tasking and produce appropriate mission plans. Tactical units currently employ manual means of information handling and mission planning. This current labor-intensive method degrades unit responsiveness to operational mission tasking and endangers the safety of flight crews because of inadequate penetration analysis. The Computer Assisted Mission Planning System project will develop an automated system to be used at tactical wing and squadron level to handle incoming message traffic, perform route planning, compute required fuel loads, accomplish weapons planning, and perform penetration analysis to best avoid enemy defenses. The planned engineering approach provides for the early acquisition of an initial capability to perform these basic mission planning functions. During production, incremental upgrades, primarily software additions to the initial capability, will allow the system to evolve into the final required operational capability.

(U) RELATED ACTIVITIES: Four testbeds were developed, fielded, and tested under Program Element 63789F, Command, Control, and Communications Advanced Development, Project 2315, Experimental Penetration Analysis Support System. Results from this testing will be used to develop the specification for the Computer Assisted Mission Planning System.

(U) WORK PERFORMED BY: The Air Force manager is Electronic Systems Division, Hanscom AFB, MA. A contractor for the prototype development has not been selected.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Program was initiated in Fiscal Year 1981. Preliminary efforts were to develop functional description, based on field experience with Experimental Penetration Analysis System testbeds that were modified to include mission planning functions.

2. (U) FY 1982 Program: Continue development of specifications and release Request for Proposal to contractors for competitive bid on production of prototype systems. Continue operation of testbeds at operational units.

3. (U) FY 1983 Planned Program: Award contract and begin full scale engineering development of both software and hardware for the prototype systems with initial capabilities.

4. (U) FY 1984 Planned Program: Accept delivery of first prototype system. Perform developmental and operational test and evaluation of systems.

5. (U) Program to Completion: Production decision in Fiscal year 1985, with incremental procurement of sufficient

Project: #2631 Title: Computer Assisted Mission Planning System (CAMPS)
Program Element: #64750F Title: Intelligence Equipment
DOD Mission Area: TIARA for Tactical Air Warfare, #327 Budget Activity: Tactical Programs, #4

systems to support Tactical Air Forces wings and squadrons worldwide. Continue improvement to capabilities through parallel development of new software and hardware through Fiscal Year 1987.

6. (U) Milestones: Not Applicable.

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	300	1,100	5,600	3,935	5,265	16,200

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	300	1,100	600		Continuing	Not Applicable

(U) The increase in FY 1983 cost from the FY 1982 Descriptive Summary represents funding of full-scale pre-production prototypes of the CAMPS.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64753F
DOD Mission Area: Air Warfare Support, #225
Title: Combat Helicopter Modernization
Budget Activity: Tactical Programs, #4

(U) RESOURCES ($ in thousands):

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		18,829	32,347	17,977	20,913	90,066

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Modernization of the Aerospace Rescue and Recovery Service and the Special Operations Force must begin at once to replace obsolescent, hard-to-maintain equipment and to upgrade helicopter capabilities to cope with increasing threats. The objective of this program is to develop a derivative of the Army UH-60A Black Hawk helicopter to meet Air Force combat rescue and special operations mission requirements.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 RDT&E request includes funds to continue engineering design, to continue modification of the two prototype aircraft, and to begin test and evaluation. Aeronautical Systems Division cost estimates were derived from Army historical data and from hardware price lists whenever available. Systems development and integration cost estimates were based on data from similar programs.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		19,300	33,900		29,400	82,600
Procurement (Aircraft)	To be determined					

(U) OTHER APPROPRIATION FUNDS:

	FY 1984	Additional to Completion
Procurement (Aircraft)		
Program Element # 35113F *	62,100	To be determined
(Quantity)	(4)	
Program Element # 27241F	1,400	To be determined

*Includes Initial Spares

Program Element: #64753F
DOD Mission Area: Air Warfare Support, #225

Title: Combat Helicopter Modernization
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION:

(U) The current Air Force combat rescue/special operations force is limited in numbers and capabilities, and some of the systems in the inventory are reaching the end of their useful service lives. In particular, the H-3 -which represents about half the current combat rescue/special operations helicopter inventory -- is an obsolescent, marginally capable system, and it must be replaced beginning in the mid-1980s. In the Southeast Asia conflict, normal search and rescue missions required that the H-3 be operated above design gross weight, which prevented normal hovering takeoffs and often required that fuel be dumped prior to recovery operations. The H-3 force has become increasingly inefficient to operate and difficult to maintain. Replacing H-3s with H-53s is not an affordable solution and will not provide the reliability and maintainability needed for dispersed, forward area combat rescue/specialized mission operations.

(U) The objective of this program is to develop and procure a derivative of the Army UH-60A Black Hawk helicopter to meet Air Force combat rescue/special operations mission requirements. Development, production, and support costs will be limited by maintaining commonality with the UH-60A and using Navy SH-60B Seahawk components to the maximum extent consistent with Air Force operational requirements and concepts. Improved avionics, auxiliary fuel tanks, air refueling capability, and necessary mission equipment will be integrated into the H-60, a helicopter with proven reliability, maintability, and survivability. The suite of state-of-the-art avionics gear will significantly improve mission responsiveness and force survivability by providing a capability for low level flight at night or in adverse weather. System architecture will permit addition of new capabilities as parallel Army/Navy development efforts mature.

(U) This will be an Air Force Designated Acquisition Program. Sikorsky Aircraft will build the basic airframe. The Air Force will conduct competition in as many other areas of the program as practical. As a minimum, competition will be conducted to select a systems integration contractor.

(U) RELATED ACTIVITIES: The following programs will produce systems/subsystems that are likely candidates for incorporation into the Air Force version of the H-60:

(U) Army.

(U) Infrared engine exhaust suppression. The Army plans to develop a full-range UH-60A infrared engine exhaust suppressor. First production items should be available in 1985.

(U) UH-60A external stores support system. The Air Force will adapt this support for an external auxiliary fuel tank. Commonality of the fuselage attachment structure with the Army system will be retained.

Program Element: #64753F Title: Combat Helicopter Modernization
DOD Mission Area: Air Warfare Support, #225 Budget Activity: Tactical Programs, #4

(U) Navy:

(U) SH-60B engines. T700-GE-401 engines will be used to provide the added performance needed due to the increased air vehicle weight and the more demanding Air Force missions.

(U) SH-60B transmission. The SH-60B main gear box will be used since it includes an integrally mounted rotor brake.

(U) SH-60B automatic flight control system. Flight controls will retain standard UH-60A system with the addition of hover coupling. The SH-60B approach and hover coupler will be incorporated.

(U) SH-60B rescue hoist. The SH-60B external rescue hoist will also be included.

(U) Air Force: Survival Avionics System. The aircraft portion of this system will be incorporated into the Air Force version of the H-60.

(U) WORK PERFORMED BY: A System Program Office has been established by the Air Force Systems Command at its Aeronautical Systems Division located at Wright-Patterson Air Force Base, OH. Contractor for the basic airframe will be Sikorsky Aircraft. The Air Force will conduct competition in as many other areas of the program as practical. Bidders for the systems integration contract are expected to include IBM, Sikorsky/Norden/Collins, E-Systems, Astronautics and Electrospace.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

(U) FY 1981 and Prior Accomplishments: Not applicable.

(U) FY 1982 Planned Program: Contract award. Start engineering design, order two test sets of avionics equipment, and initiate software program development. Begin modification to test and evaluation configuration of two production Black Hawk airframes to be borrowed from the Army -- the first for aerodynamic, mechanical, and fuel system tests, the second for avionics and automatic flight control systems tests.

(U) FY 1983 Planned Program: Complete engineering design of aircraft modifications and continue engineering design of avionics hardware, software, and integration. Procure additional avionics hardware and air vehicle equipment. Begin hot bench avionics testing. Complete airframe modification of the first prototype aircraft and begin aerodynamic, mechanical and fuel system flight test program.

(U) FY 1984 Planned Program: Complete modification of second prototype aircraft and retrofit first prototype with avionics. Begin avionics and flight control system flight tests.

Program Element: #64753F
DOD Mission Area: Air Warfare Support, #225

Title: Combat Helicopter Modernization
Budget Activity: Tactical Programs, #4

5. (U) Program to Completion: Complete developmental and initial operational testing. Attain Initial Operational Capability (IOC) in FY 1986. Develop, integrate and test multi-mode radar if a suitable off-the-shelf or in-development radar (such as LANTIRN) is not available sooner. Increased total estimated RDT&E cost in this summary reflects development, if required, of a multi-mode radar in FY 1986.

6. (U) Milestones:

			Date
A.	MAC/TAF requirements validation		September 1979
B.	AFMENS approval		November 1980
C.	Full-scale development/Initial production decision (AFSARC II)		FY 1982
D.	Begin flight test		FY 1983
E.	Initial production begins		FY 1984
F.	Major production decision (AFSARC III)	*(FY 1984)	FY 1985
G.	Initial operational capability (IOC)		FY 1986

* Date presented in Fiscal Year 1982 Descriptive Summaries

(U) Explanation of Milestone Changes: In order to allow sufficient time for aircraft testing prior to AFSARC III and yet achieve the required FY 1986 IOC, a limited production decision for 20 aircraft in FY 1984/FY 1985 is planned at AFSARC II. The major production decision (AFSARC III) has been moved from FY 1984 to FY 1985.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1981 Budget Data: Not applicable.

Budget Activity: Tactical Programs, #4
Program Element: 64753F, HH-60D Program

Test and Evaluation Data

1. (U) Developmental Test and Evaluation:

(U) Combined Developmental Test and Evaluation (DT&F) and Initial Operational Test and Evaluation (IOT&E) will be conducted by a combined task force as described in the 3 August 1981 HH-60D Test and Evaluation Master Plan. DT&E/IOT&E will be conducted on two modified UH-60A helicopters. The first aircraft will initially have only airframe modifications and will be used primarily for aerodynamics, mechanics, and fuel system testing. The second aircraft will include both airframe and avionics modifications and will be used for avionics and flight control system testing. Once airframe testing on the first aircraft is completed, it will be modified with the full avionics suite and will participate with the second aircraft in avionics testing. Due to lead times involved, the refueling probe may not be the final design and external fuel tanks may not be as crashworthy or ballistic resistant as production versions will be. Once production probes and tanks are available, they will be tested both individually and with the system. In all other aspects the DT&E/IOT&E and production aircraft will be similarly configured.

(U) The primary objectives of DT&E are to assist in the engineering design and development process, to verify accomplishment of specification requirements, to characterize the performance of the system, and to ensure that critical issues have been sufficiently resolved to permit a major production decision at Milestone III.

(U) The US Army Aviation Research and Development Command (AVRADCOM) has accomplished a significant amount of DT&E on the UH-60A airframe. The US Naval Air Systems Command has accomplished extensive DT&E on a derivative of the UH-60A (the SH-60B Seahawk) which will provide the engines, transmission, automatic flight control system and rescue hoist planned for the HH-60D. Data from those tests applicable to the HH-60D airframe and systems will be used to the greatest extent practical to reduce HH-60D testing requirements.

(U) Contractor DT&E will be conducted at the Sikorsky Aircraft Company and at the selected avionics contractor facility beginning in the Spring of 1983. The first flight is scheduled for the Summer of 1983. As soon as practical, the test aircraft will be transferred first to Edwards Air Force Base California and finally to a designated operational site for the combined Air Force DT&E/IOT&E which will continue until the planned major production decision in the summer of 1985 Air Force DT&E will be conducted by the Air Force Flight Test Center. The service program manager is Lt Col Dick Kalishek.

(U) Data on Reliability, Maintainability, Availability and Logistics Supportability will be collected during flight testing using the Air Force Flight Test Center System Effectiveness Data System. Aircraft maintenance will initially be performed by contractor personnel with Air Force personnel participating through over-the-shoulder or realistic on-the-job training. Complete Air Force maintenance will be planned for the earliest possible date.

Budget Activity: Tactical Programs, #4
Program Element: #64753F, HH-60D Program

2. (U) Operational Test and Evaluation:

(U) The Air Force Test and Evaluation Center (AFTEC) will manage the operational test and evaluation. The IOT&E test team will consist of personnel from AFTEC, Military Airlift Command, Tactical Air Command, Air Force Logistics Command and Air Training Command.

(U) Air Force IOT&E planning has identified the following operational evaluation areas:

(U) The capability of the HH-60D system (aircraft and avionics) to meet the combat rescue and special operations requirements in a hostile, night/adverse weather environment.

(U) The capability of the HH-60D to be operated by the defined crew complement to accomplish the mission.

(U) The operational availability and mission reliability of the system.

(U) The maintainability of the system (including avionics and support software) with representative operational personnel in realistic operating environments.

3. (U) Systems Characteristics:

Characteristics*	Objectives	Demonstrated
Hover capability	Mid-mission hover out of ground effect at 4000 ft, 95°F	To be determined
Cruise speed	125 knots minimum at max continuous power	To be determined
Dash speed	160 knots minimum	To be determined
Unrefueled mission radius	250 nautical miles minimum	To be determined
Terrain following/Terrain Avoidance performance	Safe and effective flight at altitudes as low as 100 feet above the terrain	To be determined

* Reliability and maintainability characteristics remain to be finalized and will be specified in the Full Scale Development contract in the Summer of 1982.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64754F Title: Joint Tactical Information Distribution System (JTIDS)
DOD Mission Area: Tactical Communications, #343 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	57,029	68,378	52,513	37,957	334,800	733,877

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is to develop a highly jam resistant, secure digital information distribution system for use in a tactical combat environment. The Joint Tactical Information Distribution System (JTIDS) is a joint development employing time division multiple access and spread spectrum techniques. The system will provide sufficient interconnectivity and capacity to permit rapid and secure exchange of the necessary command, control and status information among all equipped elements in the tactical theater.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds for the development of depot support equipment for the E-3A/ground terminal. Also includes funds for the continued full scale development of a fighter terminal and flight tests in F-15 fighter aircraft (in 1984) prior to commitment of funds to develop a production aircraft-integration capability. Funding has been rephased to reflect a revised program schedule. The request is based on the January 1981 DSARC II milestone estimates and a fixed-price terminal development contract.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	59,400	87,600	52,439		311,100	731,900

(U) OTHER APPROPRIATION FUNDS: ($000)	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
Aircraft Procurement:						
E-3A*	12,600	6,900	16,300	19,800	32,500	88,100
F-15 and F-16					TBD	TBD
Other Procurement:						
Ground Terminal (PE 27434F)		26,484	26,218	22,528	50,177	125,407

*Includes installation labor & spares

Program Element: #64754F Title: Joint Tactical Information Distribution System (JTIDS)
DOD Mission Area: Tactical Communications, #343 Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: There is currently no system in operation which provides the necessary, real-time information about the dynamic combat environment. Currently, information upon which to base critical operational decisions normally exists somewhere within a combat area, but may not always be available to the force element needing the data. The decision-maker, therefore, must base decisions on an incomplete knowledge of the current combat situation. Consequently, there is an urgent requirement for a system that will distribute essential information to all elements of the force. The system must secure the message traffic, work in a sophisticated jamming environment, and prevent hostile forces from intercepting and using the transmitted information. The Joint Tactical Information Distribution System (JTIDS) satisfies these requirements.

(U) The system will be structured to operate as an information distribution network into which tactical users transmit command and control, surveillance, position and status, or other significant combat information at specific time intervals. All of this information is immediately available to each net participant who may select for display or storage that portion of the information in which he is interested. The system will interconnect the E-3A aircraft; ground and shipboard command, control and surveillance centers; and combat and support aircraft.

(U) The program provides for the development, fabrication, and test of prototype terminal equipment for various applications and the demonstration of the readiness of the system for production. Also included in the program is the design, prototype fabrication, and test of the necessary interface equipment to permit the incorporation of terminals into first line fighter aircraft.

(U) RELATED ACTIVITIES: The Joint Tactical Information Distribution System development is managed by a jointly manned program office. Development, prototype fabrication, and test of terminal equipments for various applications of the services will be funded under this program element and will be conducted in conjunction with the other programs with which the equipments will ultimately be integrated.

(U) WORK PERFORMED BY: The Joint Program Office is located at the Electronic Systems Division, Hanscom AFB, MA. Work is also being done at the Aeronautical Systems Division, Wright Patterson AFB, OH; and the Electromagnetic Compatibility Analysis Center, Annapolis, MD. Initial system design and fabrication of prototype terminals for the E-3A were under contract to Hughes Aircraft Company, Fullerton, CA, under a subcontract to the E-3A contractor, the Boeing Company, Seattle, WA. A letter contract for the initial low-rate production of the Class I terminal for the E-3A and the surface interface terminal was let to Hughes in July 1980. A firm fixed-price contract was let to Singer-Kearfott, Little Falls, NJ, for full scale engineering development of the Class 2 terminal (Rockwell-Collins, Cedar Rapids, IA, is the second contractor in the leader-follower concept being pursued in this contract.). Other major contractors include: MITRE Corp, Bedford, MA, system engineering support; Singer-Kearfott, Little Falls, NJ, Advanced Development Model fighter class terminal; International Business Machines (IBM), Owego, NY, surface terminal; International Telephone and Telegraph Corp (ITT), Nutley, NY, advanced capability terminals; McDonnell Douglas Aircraft Corp, St Louis, MO, and General Dynamics Corp, Fort Worth, TX, fighter cockpit integration studies; and ARINC Research Corp, Annapolis, MD, design-to-cost studies.

Program Element: #64754F
DoD Mission Area: Tactical Communications, #343

TITLE: Joint Tactical Information Distribution System (JTIDS)
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Advanced development of the basic time division multiple access technique was completed under Program Element (PE) 63706F, Advanced Command and Control Capability, and PE 63727F, Advanced Communication Technology. The operational feasibility, flexibility, and potential of the system was demonstrated in Europe in conjunction with the E-3A Airborne Warning and Control System breadboard operational test in April 1973. The development of prototype JTIDS terminals for E-3A aircraft was completed. Development of JTIDS terminals for ground, ships, and fighter aircraft was initiated. A Joint Program Office was established to manage the program. A flight and bench test program was conducted with the Federal Aviation Administration to demonstrate the compatibility with other systems in the same frequency band. A limited frequency clearance has been approved. Fighter aircraft integration studies and concept definition studies for manpack terminal application were conducted. Fighter terminal prototypes completed initial operational testing. Development of a pod configuration of the fighter terminal was completed in preparation for further operational testing. Developmental and initial operational testing of the ground interface equipment was completed. A full scale development contract for the fighter terminal was awarded in January 1981. Development of fail-safe provisions to assure continued electromagnetic compatibility with air traffic control equipment operating in the same frequency band continued.

2. (U) FY 1982 Program: Initiated development of depot support equipment for the E-3A terminal. Full scale development of the fighter terminal will continue. Production of the Adaptable Surface Interface Terminal began in December 1981 under Program Element 27434F.

3. (U) FY 1983 Planned Program: Continue development of depot support equipment. Full scale development of the fighter terminal will continue, but development of aircraft integration equipment has been delayed until after F-15 aircraft flight tests in 1984. Funding has been rephased to reflect this new program schedule. Incorporation of the new joint service approved message standard will be initiated.

4. (U) FY 1984 Planned Program: Full scale development of the fighter terminal will continue with flight tests on three F-15 aircraft. Software modifications to incorporate the new message standard will also continue.

5. (U) Program to Completion: Development of depot support equipment will be completed. Development of the fighter terminal and integration equipment will also be completed and flight testing will be continued in the F-15 in 1985. (Note: The development of aircraft integration equipment has been delayed until after F-15 aircraft flight tests in 1984.) Production of the fighter terminal and F-15 interfacing equipment will be initiated in late FY 1985. The first JTIDS-equipped F-15 will be operational in FY 1987.

Program Element: #64754F TITLE: Joint Tactical Information Distribution System (JTIDS)
DoD Mission Area: Tactical Communications, #343 Budget Activity: Tactical Programs, #4

6. (U) Milestones:

A.	Waveform Decision		Feb 1976
B.	Initial E-3A Prototype Delivery		Jun 1977
C.	Start Surface Terminal Development		Jun 1977
D.	Start E-3A (Class I) terminals low-rate initial production		Jul 1980
E.	Start Fighter Terminal Full Scale Development		Jan 1981
F.	Surface Terminal Production Decision	*(3QCY1981)	Dec 1981
C.	Fighter Terminal Production Decision	*(Jun 1986)	Jun 1985

*Date presented in FY 1982 Descriptive Summary

Revised program direction to delay the development of aircraft integration kits and their testing until after the 1984 flight tests has resulted in a revision of the program schedule.

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

Budget Activity: Tactical Programs, #4
Program Element: #64754F - Joint Tactical Information Distribution System

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Joint Tactical Information Distribution System will develop a highly jam resistant, secure digital information distribution system for use in a tactical combat environment. This joint development effort is a merger of the earlier efforts of Air Force (SEEK BUS) and Navy development programs.

(U) The feasibility of Time Division Multiple Access was demonstrated during the March 1973 E-3A brassboard flight test. Future tests will occur throughout the development cycle of each class of terminal.

(U) An extensive flight and bench test program to demonstrate compatibility with air traffic control equipments operating in the same portion of the frequency spectrum has been completed. These tests, which were conducted under the auspices of the Office of Telecommunications Policy, Executive Office of the President, in conjunction with the Federal Aviation Administration, demonstrated that the Joint Tactical Information Distribution System can co-exist with the other systems in the band without harmful interference.

(U) Contractor flight tests of the Class 1 Advanced Development Model terminal on the E-3A aircraft evaluated net entry, synchronization, operation, and jamming margin. All specific operating parameters of the Class 1 terminal were met or exceeded in test programs in 1977 and 1978. Net management was assessed to be time consuming. Resolution of this problem is being addressed in net management studies and the development of a new net management time-slot assignment algorithm. Additional testing of the Class I full scale development model took place in September and October 1981.

(U) Additional testing in 1979 of the multipath propagation and doppler shift did not cause any adverse degradation with the Joint Tactical Information Distribution System in the full anti-jam mode. Performance specifications were met under jamming conditions.

(U) During development flight tests at Eglin Air Force Base from November 1979 through October 1980, the Class 1 terminal was interfaced with the existing Tactical Air Control System through the Adaptable Surface Interface Terminal. Functional performance was successful, but reliability of the Class I terminal was below expectations. Further testing of Class I terminal reliability is being accomplished at the contractors facility and during the September-October 1981 tests.

(U) Contractor acceptance testing of the Singer-Kearfott advanced development models of a Class 2 terminal were completed late in 1978. The Naval Air Development Center completed bench and flight testing of this terminal in September 1979. Some net management, relative navigation, anti-jam, and TACAN operations were deficient. Further testing is being conducted during the pod-configured Class 2 Advanced Development Model tests which started in June 1981. The objective of packaging the functions in a fighter-sized terminal was successful.

(U) Electromagnetic Compatibility testing has begun in the United Kingdom to support frequency clearance in Europe.

2. (U) Operational Test and Evaluation: Testing of the Joint Tactical Information Distribution System (JTIDS) is a multiservice (Army, Navy, Air Force, and Marine Corps) combined Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) program. Some service-unique testing will also be conducted. The Air Force Test and Evaluation Center (AFTEC) will conduct operational tests for the Air Force and be the lead agency for multiservice operational tests. The other service operational test and evaluation organizations are the United States Army Operational Test and Evaluation Agency (USAOTEA), the Navy Operational Test and Evaluation Force (OPTEVFOR) and the Marine Corps Operational Test and Evaluation Activity (MCOTEA). The purpose of the tests will be to assess the operational effectiveness and operational suitability of JTIDS terminals and the ability of JTIDS to support both individual and joint service concepts in an operational environment.

(U) Test and Production Milestones:

E-3A Advanced Development Model Class 1 terminal DT&E/IOT&E	May-June 78
Adaptable Surface Interface Terminal (ASIT) Full-Scale Engineering Development Terminal DT&E/IOT&E.	Nov 79-Dec 80
Pod Advanced Development Model terminal operational utility evaluation	Jun 81-Jan 82
Adaptable Surface Interface Terminal long lead production decision	December 81
E-3A Class 1 terminal low rate initial production	July 80
E-3A Full Scale Engineering Development Model Class 1 terminal DT&E/IOT&E	Sep-Oct 81
Adaptable Surface Interface Terminal follow-on test and evaluation (FOT&E)	Late 1983
Class 2 (fighter) Full Scale Engineering Development Model Terminal IOT&E	Jul-Dec 84
Class 2 terminal/F-15 integration DT&E/IOT&E	TBD

Initial Operational Testing of a JTIDS Class 1 terminal on the E-3A was conducted during May-June 1978 by AFTEC. During this test, a preliminary evaluation of the JTIDS time division multiple access (TDMA) system was conducted using an advanced development model terminal. The purpose of the test was to determine communications coverage, E-3A system performance with JTIDS, and to provide an initial estimate of the operational effectiveness/suitability of this planned enhancement. Major emphasis was placed on assessing the resistance of JTIDS to electronic countermeasures (ECM). The test demonstrated the potential to greatly enhance digital information distribution. Problems associated with the establishment of the JTIDS net and net operations were identified during testing. The results of the E-3A/JTIDS IOT&E were reported in the AFTEC E-3A Joint Tactical Information Distribution System (JTIDS) Terminal IOT&E Final Report, December 1978. The operational suitability could not be conclusively determined due to reliance on the contractor for system maintenance and support, the limited test period, and the small number of failures. AFTEC recommended that further operational suitability testing of the JTIDS Class 1 terminal should be conducted using Air Force personnel and representative preproduction assets.

(U) Additional DT&E/IOT&E of JTIDS in the E-3A was conducted between 15 September and 30 October 1981, using a preproduction terminal designated the Hughes Improved Terminal (HIT).

(U) The Adaptable Surface Interface Terminal (ASIT) provides a transparent interface between JTIDS-equipped systems (such as the E-3A) and existing command and control systems which use Tactical Digital Information Link B (TADIL-B). The ASIT consists of two principal subsystems. The first is a Translator-Processor (computer) which converts existing Tactical Air Control System/Tactical Air Defense System (TACS/TADS) messages passed over TADIL-B into JTIDS equivalents and vice versa. The second subsystem is the JTIDS Class 1 Terminal which performs signal transmission, reception, and related digital processing of the JTIDS signal.

(U) An IOT&E of three Adaptable Surface Interface Terminals (ASITs) was conducted by AFTEC, assisted by the Army and Marine Corps test organizations, in a multiservice combined DT&E/IOT&E at Eglin AFB, Florida, from November 1979 to December 1980. Principal units/facilities to which the ASIT has been interfaced are an Air Force Message Processing Center, an Air Force Control and Reporting Center, an Air National Guard Control and Reporting Post, an Army AN/TSQ-73 Air Defense Command and Control System, and a Marine Corps Tactical Air Operations Center. Test results are documented in the Joint Tactical Information Distribution System (JTIDS) Adaptable Surface Interface Terminal IOT&E Air Force Evaluation Report, March 1981. Although maintenance was performed exclusively by contractor personnel with military personnel being limited to over-the-shoulder observation, overall operational suitability was found to be deficient. This was due to the low reliability of the JTIDS Class I terminal. A continuation of the ASIT operational suitability assessment was initiated in May 1981 and will continue through 15 December 1981. Air Force technicians are maintaining the ASIT equipment (less the Class 1 terminal) during this assessment. Contractor personnel maintain the Class 1 terminal since technical data and support equipment will not be available until at least 1983. As a consequence, an operational suitability evaluation will need to be conducted in the future. The ASIT IOT&E confirmed the findings of the 1978 E-3A/JTIDS Advanced Development Model terminal IOT&E that JTIDS provides an Electronic Countermeasures-resistant data link between the E-3A and ground command and control elements. The test also demonstrated that JTIDS provides solid data-link communications that were relatively easy to establish and maintain.

(U) A preliminary evaluation of JTIDS implementation in fighter aircraft began on 30 June 1981 and will run through 31 January 1982. A Singer-Kearfott AN/URQ-28 Advanced Development Model JTIDS terminal and associated support equipment have been installed in an AN/ALQ-76 pod which is designed for use only on board Maverick-capable aircraft and makes use of existing controls, displays, and pylon interfaces. Three such pods are being flown on F-4 and A-10 aircraft to evaluate the contribution of JTIDS in defensive counterair, close air support, and air interdiction mission roles. The pod is intended primarily to give early hands-on fighter experience with JTIDS. A test report will be published in March 1982.

(U) An IOT&E will be conducted on a Full Scale Engineering Development Model fighter terminal installed internally in three F-15 aircraft during 1984. Based on preliminary planning, these tests will be conducted primarily at Eglin AFB with other ranges used as needed. The evaluation will assess the contribution of JTIDS to the effectiveness of the F-15 in an air-to-air role. To the extent possible, suitability data will be collected as well. A production decision for the terminal will follow the evaluation.

(U) Class 2 terminal integration DT&E/IOT&E. Assuming a favorable production decision for the terminal in 1985, a combined DT&E/IOT&E of the permanent integration of the Class 2 into the F-15 in the 1987 time frame will be conducted.

3. <u>System Characteristics:</u>

Characteristic	Objective	Demonstrated to Date
Frequency	960-1215 Mega Hertz	960-1215 Mega Hertz
Range	300 nautical miles (1200 nautical miles with relay)	300 nautical miles
Capacity	57.6 Kilo bits per second	57.6 Kilo bits per second
Users	2-2000	3
Message Error Rate	10^{-2}	10^{-2}
Anti-jam Margin		
Range Accuracy	300 feet at 150 nautical miles	To be determined

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64756F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Side Looking Airborne Radar (SLAR)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	22,331*	29,090	27,192	20,197	Continuing**	Not Applicable**
2037	SLAR Sensors	14,831	12,200	7,323	990	Continuing	Not Applicable
2451	SLAR Exploitation	5,500	14,890	19,869	19,207	Continuing	Not Applicable
2647	Manual Radar Reconnaissance Exploitation System (MARRES)	2,000	2,000				4,000

*PE 63746F Side Looking Airborne Radar applies **Multi-task projects.

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This product oriented Program Element develops radar sensors, processors, software, and exploitation equipment for use on ground stations and reconnaissance aircraft including the RF-4C, TR-1 and potentially on the Advanced Tactical Airborne Reconnaissance System. The objective of this program is to develop and test advanced high resolution SLAR components and systems capable of collecting from an airborne platform, transmitting, processing, and exploiting reconnaissance and strike information during night and adverse weather conditions. Requirements include reliable detection, _ and location of fixed tactical targets from long standoff ranges, near real time data exploitation, and direct handoff to strike systems. Ground radar processing and exploitation is required to achieve the high resolution and provide for real time retasking of radar collection.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds to: support deployed operations and test of advanced digital SLAR ground exploitation systems; continue development of an initial demonstration prototype of the TR-1 SLAR exploitation system and initiate nonrecurring engineering for the ground station; complete the prototype exploitation system critical design review on the Advanced Synthetic Aperture Radar System (ASARS), continue advanced development of SLAR electronic counter-countermeasures. The costs for all projects are based upon existing contracts and government estimates based upon contractor proposals.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	22,700	29,800	19,200		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #64756F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Side Looking Airborne Radar (SLAR)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop and test advanced SLAR components and systems to meet operational adverse weather reconnaissance and strike requirements. SLAR reconnaissance systems provide a unique capability to penetrate clouds and other atmospheric conditions in daylight or at night, operate at ranges beyond defensive threats, and provide accurate location and other useful intelligence about targets under conditions in which non-radar sensors are ineffective.

Operational requirements include: reliable detection, location and strike of fixed, mobile, moving, non-emitting tactical size tarets (jeep, truck, tank) from long ranges (to nautical miles) over wide areas nautical mile swaths); near real time air-to-surface data transfer (up to nautical miles); and near real time processing and exploitation (less than The ability to selectively targets is desired. Additionally, the capability to detect targets concealed by camouflage or foliage is desired. To meet these requirements, advanced digital sensor processing and exploitation technologies will be used. Current operational SLAR equipment is limited to a maximum range of nautical miles, which is inadequate for operation in a environment or for adequate border surveillance. Lack of near real time air-to-surface data transfer and use of analog optical image processing and exploitation limits information timeliness. Also, current SLAR systems have resolutions that are not sufficient for

In 1979, Competitive design of the Tactical Reconnaissance Exploitation Demonstration System (TREDS) began in FY 1980, and a contract for TREDS was signed June 1981.

(U) Additional efforts in this program include near time development and qualification of components and techniques required to reduce deficiencies in current operational SLAR systems in the areas of target positioning and electronic counter-countermeasures.

(U) RELATED ACTIVITIES: Program Element 63208F, Reconnaissance Sensors/Processing Technology, is performing advanced development efforts in foliage penetration radar techniques. Program Element 27431F, Tactical Air Intelligence Systems Activities is developing advanced techniques for managing tactical reconnaissance information. Exploited SLAR data will be an input to this system. Program Element 27215F, TR-1 Squadrons, procures operational Advanced Synthetic Aperture Radar System (ASARS) SLAR sensors and ground stations.

(U) WORK PERFORMED BY: This program is managed by Aeronautical Systems Division, Wright Patterson AFB, OH, and supported by the Air Force Avionics Laboratory, Wright Patterson AFB, OH, Rome Air Development Center, Griffiss AFB, NY, and Electronic Systems Division, Hanscom AFB, MA.

Program Element: #64756F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Side Looking Airborne Radar (SLAR)
Budget Activity: Tactical Programs, #4

(U) Contractors for current effort are: Control Data Corporation, Minneapolis, MN, implements automatic change detection in ABLE ground station; Environmental Research Institute of Michigan, Ann Arbor, MI, provides program technical support; Goodyear Aerospace Corp; Litchfield Park, AZ, modifies RF-4 digital radar processing device and develops exploitation prototypes; Texas Instruments provides software to support ground facilities procurement to support the RF-4C Squadron SLAR exploitation; Hughes Aircraft Corp, Culver City, CA, develops the ASARS and performs electronic counter-countermeasure analysis; Technology Services Corp, LaJolla, CA, performs electronic counter-countermeasures analysis; Ford Aerospace, Palo Alto, CA, is developing the Tactical Exploitation Demonstration System (TREDS) to support TR-1 reconnaissance exploitation.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Fabrication of a digital radar processor device and an automatic change detection device was used to process data from an AN/UPD-10 radar (the airborne segment of a currently operational RF-4C SLAR) demonstrates digital processing of a radar with nautical mile range, swath, and resolution The final acceptance tests of the digital change detection device were completed and the operational demonstration of near real time SLAR data transmission and processing was carried out in Europe (1981 REFORGER exercise).

The ASARS Deployable Processing Station (ADPS) continued development through Preliminary Design Review and functional software module checkout. Real time digital processing and exploitation of full swath width mile) and full resolution RF-4C SLAR data was demonstrated in REFORGER 81 with automatic change detection. Development of the Tactical Reconnaissance Exploitation Demonstration System (TREDS) began. ASARS flight testing has started and data has been processed to produce SLAR imagery in modes. Engineering checkout is continuing. Procurement of the SLAR exploitation software to support the RF-4C squadrons was initiated.

2. (U) FY 1982 Planned Program: The United States and the Federal Republic of Germany (FRG) through a formal agreement, will share the use of the SLAR digital ground processing equipment, designated as the Advanced Building Block Large Area Exploitation (ABLE), in Germany. Per the agreement, the FRG will test and evaluate the ABLE system for three months to commence after US testing and evaluation. Development and test of the Advanced Synthetic Aperture Radar System (ASARS) Deployable Processing Station (ADPS) will be completed. Development of the Tactical Reconnaissance Exploitation Demonstration System (TREDS) will pass preliminary design review. The FY 1981 congressional reduction of $5 million caused the TREDS contract award to slip six months and moved FY 1981 work into FY 1982.

3. FY 1983 Planned Program: Development of the TREDS will continue through critical design review of the ground exploitation facility and integration of completed TREDS components.
Product improvement will continue.

Program Element: #64756F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Side Looking Airborne Radar (SLAR)
Budget Activity: Tactical Programs, #4

4. FY 1984 Planned Program: TREDS will deploy to Europe in Electronic Counter-Countermeasures (ECCM) will be designed for the ASARS II production sensors. Product improvements for TREDS will continue for application to the production TR-1 Ground Station (TRIGS). TRIGS CDR will be completed.

5. (U) Program to Completion: Test and evaluation for the TREDS will be completed in Calendar Year (CY) 1985 establishing the basis for the initial operational capability. Design of the TRIGS will be completed with production decisions in CY 1985 for two systems. Product improvements will continue.

6. Milestones:

	Milestones	Date
A.	Initiation of Phase I, Analysis and Digital Demonstration	July 1973
B.	Complete Phase I	September 1977
C.	Complete Phase II, Initial Baseline Prototyping	October 1981
D.	Complete Phase III, Preproduction Prototyping	December 1984
E.	Initial Operational Capability (IOC) (TREDS)	
F.	Full Operational Capability (FOC) (TRIGS)	

* Date presented in FY 1982 Descriptive Summaries.

Project: #2037
Program Element: #64756F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Side Looking Airborne Radar Sensor
Title: Side Looking Airborne Radar Sensor (SLAR)
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to develop the Advanced Synthetic Aperture Radar System (ASARS), ASARS Deployable Processing Station (ADPS), Electronically Scanned Antenna, and interface with other radar collection systems. The radar system will provide a unique capability to penetrate clouds and other atmospheric conditions in daylight or at night, operate at ranges beyond defensive threats, and provide accurate location and other intelligence about targets under conditions in which non-radar sensors are ineffective. Operational requirements include real time processing to achieve reliable detection The sensor includes search nautical mile swath) and spot modes with resolution of respectively. The antenna will scan up to

(U) RELATED ACTIVITIES: PE 27215F, TR-1 Squadron, procures operational radar sensors, processors, and ground exploitation equipment developed by this program element.

(U) WORK PERFORMED BY: This project is managed by Aeronautical Systems Division, Wright Patterson Air Force Base, Ohio. The contractor for the current effort is Hughes Aircraft Corporation, Culver City, California.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The ASARS II began in 1977 to develop an interim processor capable of being deployed and an ADPS capable of processing Based upon the tactical commanders' urgent information needs, the requirement for TR-1 and real time night/all weather imagery was revalidated in 1979. Integration and flight testing of the interim digital processing system was completed. Integration of hardware for the ADPS was completed. Functional software requirements documents were completed and the preliminary design review of the ADPS was held.

2. (U) FY 1982 Planned Program: Development and test of the ASARS and ADPS will be completed.

3. (U) FY 1983 Planned Program: The ADPS will be integrated with the Tactical Reconnaissance Exploitation Demonstration System. Studies and analysis of the Electronic Countermeasures (ECM) threat to ASARS II operation will be initiated.

4. FY 1984 Planned Program: Electronic Counter Countermeasures (ECCM) will be designed for the ASARS II production sensors to counter the

5. (U) Program to Completion: ECCM designs will be fabricated and tested.

Project: #2037
Program Element: #64756F
DOD Mission Area: TIARA for Tactical Air Warfare, #327

Title: Side Looking Airborne Radar Sensor
Title: Side Looking Airborne Radar Sensor (SLAR)
Budget Activity: Tactical Programs, #4

6. (U) Milestones:

		Date
A.	Initiation of Phase I, Analysis and Digital Demonstration	July 1973
B.	Complete Phase I	September 1977
C.	Initiate development of the Advanced Synthetic Aperture Radar System	September 1977
D.	Complete development, test and integration of the radar and initial processing system	September 1981
E.	Complete ASARS Deployable Processing Station	December 1982
F.	Integrate ASARS Deployable Processing Station with Tactical Reconnaissance Ground Exploitation Demonstration System	July 1983
G.	Initiate ECCM analysis and design	August 1983

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	14,831	12,200	7,323	930	Continuing*	Not Applicable*

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	14,800	10,700	4,800		0	69,321

A. FY 82 cost increase and part of FY 83 increase to fund extended engineering and performance testing.

B. Remainder of FY 83 increase and FY 84 increase due to redefinition of the complexity of the ECM environment.

*Multi-task project.

Project: #2451
Program Element: #64756F
DOD Mission Area: Tactical Surveillance, Reconnaissance and Target Acquisition, #225

Title: SLAR Exploitation
Title: Side Looking Airborne Radar Sensor (SLAR)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to develop and test SLAR exploitation components and systems. SLAR reconnaissance systems provide a unique capability to penetrate clouds and other atmospheric conditions in daylight or at night, operate at ranges beyond defensive threats, and provide accurate location and other useful intelligence about targets under conditions in which non-radar sensors are ineffective.

Operational requirements include near real time processing and exploitation (less than to achieve reliable detection, and location of fixed, mobile, moving tactical size targets (SAM's, trucks, tanks) over wide areas nautical mile swaths). To meet these requirements, advanced digital exploitation technologies will be used. Lack of near real time image exploitation limits information timeliness of current operational SLAR systems.

(U) The Advanced Synthetic Aperture Radar System (ASARS) is the baseline operational sensor to be exploited. The development of the image exploitation/data handling segment for the ASARS system is the highest priority element of this project. This includes development of the Tactical Reconnaissance Exploitation Demonstration System (TREDS) and design of the TR-1 ground system (TRIGS).

(U) RELATED ACTIVITIES: PE 27215F, TR-1 Squadrons, procures operational ASARS and the TRIGS developed under this project.

(U) WORK PERFORMED BY: This project is managed by Aeronautical Systems Division, Wright Patterson Air Force Base, Ohio and supported by the Air Force Avionics Laboratory, Wright Patterson AFB, Ohio, Rome Air Development Center, Griffis AFB, NY, and Electronic Systems Division, Hanscom AFB, MA.

(U) Contractors for current efforts are: Control Data Corporation, Minneapolis, MN, modifies the automatic change detection device previously fabricated; Environmental Research Institute of Michigan, Ann Arbor, MI, provides program technical support; and Goodyear Aerospace Corp, Litchfield Park, AZ, develops exploitation prototypes. The prime contractor for the TREDS development and design of TRIGS is Ford Aerospace Corp, Palo Alto, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Real time digital processing and exploitation of SLAR imagery was demonstrated on the Advanced Building Block Large Area Exploitation System (ABLE) in REFORGER 81. Development of the TREDS began.

2. (U) FY 1982 Planned Program: Development of the TREDS will pass critical design review. The United States and the Federal Republic of Germany (FRG), through a formal agreement, will share the use of the SLAR processing equipment, designated as ABLE, in Germany. Per the agreement, the FRG will operate and evaluate the ABLE System for three months to be completed March 1982. Evaluation of automatic change detection in ABLE will be completed concurrent with FRG test and evaluation.

Project: #2451
Program Element: #64756F
DOD Mission Area: Tactical Surveillance, Reconnaissance and Target Acquisition, #225

Title: SLAR Exploitation
Title: Side Looking Airborne Radar Sensor (SLAR)
Budget Activity: Tactical Programs, #4

3. (U) FY 1983 Planned Program: Integration of appropriate elements of the Tactical Reconnaissance Exploitation Demonstration System (TREDS) with the radar ground processing system will be completed as a part of the initial production ground processing and exploitation system specification preparation.

4. (U) FY 1984 Planned Program: The demonstration system will deploy to Europe for initial operational evaluation. The TRIGS design will be initiated.

5. Program to Completion: Test and evaluation of the TREDS will be completed in establishing the basis for the initial operational capability. TREDS will deploy to Europe and product improvements will be incorporated from to include electronic counter-countermeasures and interoperability with the RF-4C radar. Design of the production TR-1 Ground Station (TRIGS) will be complete in and two TRIGS will be deployed to hardened sites in Europe in

6. Milestones: Date

A. Initiation of Phase I, Analysis and Digital Demonstration
B. Complete Phase I
C. Complete Phase II. Initial Baseline Prototyping
D. Complete Phase III, Preproduction Prototyping
E. Initial Operational Capability (TREDS)
F. Full Operational Capability (TRIGS)

* Date presented in FY 1982 Descriptive Summary.

EXPLANATION OF MILESTONE CHANGES: The Initial Operational Capability for the TR-1 system (TREDS) has been delayed to the due to delay in contract start. Full operational capability (fielding of the TRIGS) has been added.

Project: #2451
Program Element: #64756F
DOD Mission Area: Tactical Surveillance, Reconnaissance and Target Acquisition, #225

Title: SLAR Exploitation
Title: Side Looking Airborne Radar Sensor (SLAR)
Budget Activity: Tactical Programs, #4

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,500	14,890	19,869	19,207	Continuing*	Not Applicable*

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	5,900	17,100	14,400		37,200	88,700

A. Reduction in FY 1982 funding due primarily to additional funding requirement in ASARS development (Proj 2037).

B. Increased FY 1983 and outyear funding estimates due to negotiation costs with contractor for ongoing TREDS contract and increased TRIGS production costs extracted from contractor proposal documents.

*Multi-task project.

BUDGET ACTIVITY: Tactical Programs, 04 (SLAR)
PROGRAM ELEMENT: 64756F, Side Looking Airborne Radar

SIDE LOOKING AIRBORNE RADAR (SLAR)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The SLAR system development is based upon a building block approach to providing a Tactical Reconnaissance System called TR-1. The TR-1 Reconnaissance System acquisition is a follow-on to the U-2R. Test and Evaluation plans and reports of completed evaluations are documented in special access programs and will be made available to appropriately cleared personnel. Tests on the Advanced Synthetic Aperture Radar System (ASARS) sensor began in fiscal year 1981. Tests on the ground processing and exploitation station are planned for fiscal year 1983 through fiscal year 1984.

DT&E of the SENIOR SPEAR Transportable Ground Intercept Facility (TGIF) capability for processing and reporting is complete. This system completed contractor integration and testing in October 1979, and Initial Operational Test and Evaluation in March 1980. Air Force Test and Evaluation Center will conduct a follow-on test and evaluation on the second generation TGIF scheduled for delivery in fiscal year

The Advanced Synthetic Aperture Radar System (ASARS II) development effort consists of three major projects managed by the Aeronautical Systems Division. Two of these projects are with the Hughes Aircraft Corporation for development of an airborne sensor and a ground processor. The third project involves design of a ground facility to exploit ASARS imagery. Multiple program requirements are being addressed in these ASARS and related projects to meet the need for strategic/national and tactical Side Looking Airborne Radar collection, processing, timely exploitation and reporting during peace, crisis and war.

These tests are documented in the Descriptive Summary for Program Element 64756F.

2. (U) Operational Test and Evaluation: An Operational Test and Evaluation (OT&E) of the Side Looking Airborne Radar (SLAR) exploitation segment will be conducted in conjunction with the TR-1 Reconnaissance System OT&E. The purpose of the OT&E is to evaluate the aggregate system capability to provide near-real-time intelligence information to tactical commanders.

(U) The Air Force Test and Evaluation Center will plan and manage operational testing of the Advanced Synthetic Aperture Radar System, Tactical Reconnaissance Exploitation Demonstration System, and the TR-1 Ground Station. These segments are being developed to support the TR-1 Reconnaissance System and are discussed in the TR-1 Squadron Congressional Data Sheet. The Strategic Air Command, the Tactical Air Forces, Air Force Logistics Command, Air Force Systems Command, Electronic Security Command, Air Force Communications Command, Air Training Command, and US Army Intelligence Center and School will support the operational testing. Testing will be conducted as follows:

(U) Advanced Synthetic Aperture Radar System: Air Force Test and Evaluation Center will conduct an operational utility evaluation of the airborne sensor in support of the sensor production decision. The initial evaluation will be based on the limited capabilities of the sensor while operating with the Interim Digital Processing Station (IDPS). An estimate will be made of the operational effectiveness and suitability of the sensor and will address both strategic and tactical mission requirements. A complete operational test and evaluation of the full system capability will not be made during this time period since all full-capability antenna and ground processing components will not be available. Therefore a full operational assessment of the Advanced Synthetic Aperture Radar System (ASARS) is planned as an integral part of the TR-1 Reconnaissance System initial operational test and evaluation. The full assessment will be conducted using the prototype ASARS Deployable Processing Station (ADPS) which provides full sensor operational capability. Collected data will support the ADPS production decision, identify any operational deficiencies, and recommend desirable growth potential to the basic system.

(U) Tactical Reconnaissance Exploitation Demonstration System (TREDS): TREDS development will provide an interim operational ground facility. This demonstration prototype will contain the same primary functions and interfaces as the final production facility, although at a reduced capability. Operational test and evaluation (OT&E) and developmental test and evaluation (DT&E) will be combined to provide inputs for the final facility design and to evaluate the capability of the aggregate system to support the operational mission. The Air Force Test and Evaluation Center will plan and manage the operational testing during the combined DT&E/OT&E at Ford Aerospace and Communications Corporation, Western Development Laboratories, Palo Alto, California, and the designated operational location.

(U) TR-1 Ground Segment (TRIGS): The Air Force Test and Evaluation Center will plan and manage the first phase of a two phased operational test and evaluation of the final system. United States Air Force Europe will manage the second phase. The operational test and evaluation (OT&E) program will include TRIGS and will concentrate on changes/ enhancements over the interim system operational capability. The OT&E will evaluate the aggregate system ability to support the required full operational capability. The scope of the testing will be determined by the extent of changes to the interim system.

(U) As described in the TR-1 Squadron Congressional data sheet, the operational test and evaluation programs for both the interim and final capabilities will evaluate the system as an integral unit. The Air Force Test and Evaluation Center will publish reports upon completion of the operational assessment of the Advanced Synthetic Aperture Radar System sensor and the interim and final capability test programs. These reports will provide estimates on the overall system operational effectiveness and suitability and identify any deficiencies.

(U) Test Schedule Summary

EVENT/ACTIVITY	START DATE	COMPLETION DATE
ASARS 1/ DT&E 2/	April 1981	November 1981
ASARS Operational Assessment	September 1981	March 1982
TGIF 3/ II FOT&E 4/	October 1982	December 1983
TREDS 5/ DT&E	July 1983	March 1984
TREDS OT&E 6/	April 1984	August 1985

1/ Advanced Synthetic Aperture Radar System

2/ Developmental Test and Evaluation

3/ Transportable Ground Intercept Facility

4/ Follow-on Test and Evaluation

5/ Tactical Reconnaissance Exploitation Demonstration System

6/ Operational Test and Evaluation

3. System Characteristics:

TR-1 AIRCRAFT:

All required operational characteristics verified by ten years of U-2R operation. Procurement organization will perform normal acceptance flight test(s) of each aircraft.

ITEM/ CHARACTERISTIC	PARAMETER	DEMON- STRATED	DT&E 1/ TESTED/ VERIFIED	OT&E 2/ TESTED/ VERIFIED
SENIOR SPEAR				
				4/ 5/
		YES		ESC/AFTEC
		YES		ESC/AFTEC
		YES		ESC/AFTEC
		YES		ESC/AFTEC
		YES		ESC/AFTEC
		YES	ASD 13/	AFTEC
		YES	ASD	AFTEC

NO	ASD	AFTEC
YES	ASD	AFTEC
NO	ASD	AFTEC
NO	ASD	AFTEC
NO	ASD	AFTEC
NO	ASD	AFTEC

1/ Developmental Test and Evaluation
2/ Operational Test and Evaluation
3/ Line of Sight
4/ Electronic Security Command
5/ Air Force Test and Evaluation Center
6/ Megahertz
7/ Airborne Radio Direction Finding
8/ Degree
9/ Root Mean Square
10/ Line of Bearing
11/ Nautical Mile
12/ Advanced Synthetic Aperture Radar System
13/ Aeronautical Systems Division
14/ Plus/Minus
15/ Less Than
16/ Feet
17/ Square

(U) Reliability/Maintainability (R&M)

SENIOR SPEAR. Interchangeability is assured under provisions of MIL-I-8500Z. Associated support equipment is designed to reduce the total maintenance effort to the lowest practical level. Maintainability analysis according to MIL-M-265-12C is being accomplished for each increment of existing and new equipment. Prime Mission Equipment will use three levels of maintenance as under Air Force Regulation 66-14. All equipment must be capable of being maintained by a 5-skill level technician. Reliability testing is tailored in this case to insure that new equipment/capabilities do not degrade performance of the baseline operational system.

Advanced Synthetic Aperture Radar System. The system specification has a reliability design goal of 50 hours mean-time-between-failure for the total system and a mean-time-to-repair goal of two hours. Test results to date have been within the reliability and maintainability goals.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64779F Title: Joint Interoperability of Tactical Command and Control Systems (JINTACCS)
DOD Mission Area: Tactical Command and Control, #344 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	7,557	7,472	3,837	5,752	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: JINTACCS is a joint interoperability program to provide improved operational effectiveness of Service (Army, Navy, Air Force, Marine Corps) tactical command and control systems planned for use in support of joint operations through the 1980s. Air Force objectives are to: develop interface design standards with the other services; modify affected Air Force equipments; participate in testing and joint operational effectiveness demonstrations; recommend joint standards for adoption by the North Atlantic Treaty Organization and prepare Air Force facilities for the implementation and configuration control of JINTACCS interface standards.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 request provides for the continuation of interface planning, analyses and design. Systems integration and test planning will continue, system modifications will be performed and test support provided. Air operations operational effectiveness demonstration and operations control compatibility and interoperability testing will be initiated. Cost estimates for the JINTACCS program are based on experience gained in the Tactical Air Control System/Tactical Air Defense System Program. These estimates were made by the Air Force Systems Command and the Tactical Air Command on 12 November 1981.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	9,577	7,500	7,500		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: # 64779F Title: Joint Interoperability of Tactical Command and Control Systems (JINTACCS)
DOD Mission Area: Tactical Command and Control, #344 Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: JINTACCS was established in August 1977 as the successor to the Ground and Amphibious Military Operations (GAMO) Program. Its purpose is to improve the operational effectiveness of the Service (Army, Navy, Air Force and Marine Corps) command and control systems used in support of Joint Operations through the 1980s. Also incorporated are the intelligence facilities of the National Security Agency and the Defense Intelligence Agency. Consideration of NATO interoperability was added in 1978. The Services and Agencies are utilizing the program to develop common interface standards and to modify their command and control equipment and procedures as necessary to insure systems interoperability, compatibility and operational effectiveness. To facilitate management, the program is divided into functional segments including intelligence, air operations, amphibious operations, fire support, and operations control. Within the Air Force, the primary command and control facility interfaces to be analyzed and defined exist within the Tactical Air Control Center (TACC), Control and Reporting Center/Post, Direct Air Support Center, Airborne Warning and Control System, Airborne Battlefield Command and Control Center and the intelligence element supporting the TACC. An Air Force test facility identified as the Participating Test Unit is being established to evaluate Air Force modified command, control and communications elements, to support compatibility & interoperability testing and operational effectiveness demonstrations and to provide ongoing configuration control.

(U) RELATED ACTIVITIES: This program element supports Air Force participation in the JINTACCS Program (with the Army as the Joint Chiefs of Staff (JCS) Executive Agent). Service and agency activities are governed by jointly agreed upon and JCS approved documentation including the Technical Interface Concepts, and Technical Interface Design Plans. The Air Force Tactical Air Forces Interoperability Group (TAFIG), as coordinating authority, and the Air Force Systems Command program office maintain coordination with program managers for Tactical Air Control System Improvements, Joint Tactical Information Distribution System, Airborne Warning and Control System, Tactical Information Processing and Interpretation and Joint Tactical Communications, TRI-TAC.

(U) WORK PERFORMED BY: TAFIG is coordinating authority for Air Force participation in the JCS JINTACCS Program. Technical and Engineering responsibility is assigned to the Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA. The Tactical Air Command provides operational support, including a Participating Test Unit at the Air Force Tactical Systems Interoperability Support Center at Langley AFB, VA, to support compatibility & interoperability testing and operational effectiveness demonstrations. The JINTACCS contractors are Planning Research Corporation, McLean, VA; Systems Development Corporation, McLean, VA; Martin-Marietta, Denver, CO. and the MITRE C^3 Division, a Federal Contract Research Center, located at Bedford MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Development of the test editions of the JINTACCS Technical Interface Design Plans has been completed. Studies were conducted for the planning, analysis and design of the Air Force interfaces as well as interfaces between Air Force elements and other Service facilities. Test-only modifications were completed for the intelligence segment and compatibility and interoperability testing and operational effectiveness demonstrations were conducted. An Air Force Participating Test Unit was established at the Air Force Tactical Systems Interoperability Support Center.

Program Element: #64779F Title: Joint Interoperability of Tactical Command and Control Systems (JINTACCS)
DoD Mission Area: Tactical Command and Control, #344 Budget Activity: Tactical Programs, #6

2. (U) FY 1982 Program: Interface planning, analysis and design efforts will continue during FY 1982 as well as modification of test-only hardware and software. Test planning and support will be provided for the air operations and operations control compatibility and interoperability testing and operational effectiveness demonstrations. The air operations segment testing will be completed. System modifications to support the testing of the remaining segments (amphibious, fire support and operations control) will continue. Procurement of the baseline portion of the Participating Test Unit's test support system for test support and configuration control will be completed.

3. (U) FY 1983 Planned Program: Continue to refine Technical Interface Design Plans. Operations control segment testing will be initiated and the Air Force will participate in the air operations operational effectiveness demonstraton. The decrease in FY 1983 requirements is necessary to support higher priority requirements and is offset by the elimination of impact analysis and systems integration effort and delay in planned enhancements to the test support system.

4. (U) FY 1984 Planned Program: Delayed procurement of the test support system will continue. Fire support and amphibious compatibility and interoperability testing will be conducted. Planning will be provided for the 1985 combined operational effectiveness demonstration.

5. (U) Program to Completion: The remaining functional segments will be tested for compatibility and interoperability and will be followed by operational effectiveness demonstrations. The technical interface design plans will be updated and subsequently incorporated as standards into appropriate Joint Chiefs of Staff publications. Test completion is scheduled for 1985.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1981 Budget Data: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27129F — Title: F-111 Squadrons
DoD Mission Area: Close Air Support and Interdiction #223 — Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5,288	2,690	39,290	36,571	77,047	168,886
2056	PAVE TACK/VATS	5,288	2,690	3,690	3,471	11,247	26,386
xxxx	F-111 Avionics Intermediate Stations	500 1/	7,500 1/	35,600	33,100	65,600	142,500

1/ Funded under Appropriation 3400, PE 27129F

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides funds for two separate development activities associated with F-111 aircraft. The first development activity is PAVE TACK Forward Looking Infrared target acquisition and laser designator/ranger development to enable tactical aircraft to deliver precision guided and unguided weapons during day, night, and limited adverse weather conditions. One of the most pressing deficiencies in the Interdiction/Naval Strike mission area is the limited ability to interdict the enemy's forces at night and beneath low ceilings in the European theater. These limitations also restrict the Air Force's ability to exploit minimum altitude aircraft tactics. The PAVE TACK system responds directly to these mission needs of the 1980s. The Video Augmented Tracker System (VATS) is a much improved scene stabilizing technique which will free the crew members for defensive maneuvers during an active attack. The second development activity is an engineering effort to prepare Test Program Sets as a part of the program which has been implemented to replace the existing F-111 Avionics Intermediate Shop Test Stations. Each Test Program Set will include the hardware adapters and software test programs required to test an F-111 avionics component or group of similar components. Replacement of the existing F-111 Avionics Stations is necessary because these stations have become obsolete, unreliable, and unsupportable.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Continues full-scale development, flight tests and software reassembly leading up to completion of PAVE TACK/AGM65D Maverick Hand-Off Program. Support equipment design for the Video Augmented Tracker System will be completed. Cost estimate for Video Augmented Tracking System development is based on current test experience and projected contract maintenance costs. Increase in FY83 funding is to support development tasks associated with Test Program Set engineering within the F-111 Avionics Intermediate Shop Replacement program. Basis for cost is projected estimates from competitive source selection activity currently ongoing.

Program Element: #27129F
DoD Mission Area: Close Air Support and Interdiction #223

Title: F-111 Squadrons
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,600	4,800	3,900	-	Continuing	Not Applicable
Procurement (aircraft, PE 27129F) 3010						
PAVE TACK Pods (P-1900)						240,800
PAVE TACK F-111F Modification (P-1100)	14,100					100,500
(3010, P-1200)						

Program Element: #27129F
DoD Mission Area: Close Air Support and Interdiction #223

Title: F-111 Squadrons
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The F-111 force represents a unique capability to conduct attack/strike missions during all night and weather conditions. The F-111 aircraft is and will remain a key player in the Air Force's Offensive Counter Air mission against the known threat, but it requires very precise target acquisition and designation to conduct lethal weapons deliveries against point targets. The aircraft is capable of precise acquisition and attack during day visual conditions, but not during night and adverse weather conditions. The PAVE TACK project which was transferred to this program element was developed to provide a common, precise night and limited adverse weather target acquisition system for the F-4, RF-4, and F-111 aircraft. A Forward Looking Infrared (FLIR) sensor, laser target designator/ranger, common stabilized and slewable optics for the infrared and laser systems, and necessary digital control electronics are contained in a pod carried externally on the F/RF-4 aircraft centerline and either retracted and stowed internally or extended for operation in the F-111 weapons bay. F/RF-4 and F-111 digital avionics permit flexible integration of the navigation equipment, weapons delivery computer, radar, PAVE TACK sensors and guided weapons. PAVE TACK equipped aircraft are therefore capable of performing accurate low altitude high speed air-to-surface attack and reconnaissance missions at night and limited adverse weather using a variety of available weapons and reconnaissance sensors. PAVE TACK production for the F/RF-4 was initiated in July 1977; F-111F production started in August 1978. During FY 1980 deficiencies identified during development and initial operational tests were corrected. The development tasks required as a part of the F-111 Avionics Intermediate Shop (AIS) Replacement Program were included in F-111 research and development under program element 27129F beginning FY 1983. These tasks are concerned with the engineering of 130 test program sets which will enable the new test stations being acquired under the F-111 AIS Replacement Program to test the existing F-111 avionics components. Each test program set includes the hardware adaptors and software test programs required to test an F-111 avionics component or group of similar components on one of the automatic test stations. The F-111 AIS Replacement Program has been implemented because the test stations which make up the existing F-111 AIS have become obsolete, unreliable, and unsupportable.

(U) RELATED ACTIVITIES: The DOD common-module Forward Looking Infrared (FLIR) sensor which is used in the PAVE TACK pod was developed in Program Element (PE) 64710F, Reconnaissance Equipment. The development tasks conducted in PE 64728F, Tactical LORAN/F/RF-4 Digital Avionics, were critical to the success of the F-4 PAVE TACK program. PE 64733F, Surface Defense Suppression, has provided weapons integration support for the development of a single Group A aircraft wiring kit for PAVE TACK and guided weapons for the F-111F. The integration approach allowed for an efficient one time modification of the F-111F. The Video Augmented Tracking System, initially developed under PE 63203F, Advanced Avionics for Aircraft, was transitioned into the PAVE TACK project for integration and flight demonstration. Full scale development will be completed with the PAVE TACK project.

(U) WORK PERFORMED BY: All PAVE TACK Air Force development effort is being managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The initial engineering study on upgrading the F-111A/F from the current analog system to a digital bomb/navigation system was performed by General Dynamics, Fort Worth, TX. The PAVE TACK contractors include PAVE TACK Pod and F-4 Integration, Ford Aerospace, Newport Beach, CA (Prime Contractor); FLIR, Texas Instruments, Dallas, TX; Laser, International Laser Systems, Orlando, FL; F-4/F-111 Cockpit Display, Texas Instruments, Dallas, TX and General Electric Corp, Utica, NY; F-111 Integration, General Dynamics, Fort Worth, TX. Flight test responsibility has been assigned to the Armament Division at Eglin AFB, FL. The F-111 Avionics Intermediate Shop competitive procurement is being managed by San Antonio Air Logistics Center, Texas. As this effort is now in source selection, the contractor who will build the test stations has not yet been determined. The F-111 System Manager is located at Sacramento Air Logistics Center, California.

Program Element: #27129F Title: F-111 Squadrons
DoD Mission Area: Close Air Support and Interdiction #223 Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: During FY 1977 studies conducted by Air Force Logistics Command and Air Force Systems Command on the feasibility of modification of the F-111A/E's analog AN/AJQ-20A Bomb Navigation System (BNS) for delivery of modern weapons at supersonic speeds concluded that refurbishment of the analog system was not cost effective. On the other hand, its replacement with a digital BNS would provide not only capability to deliver current inventory weapons with the F-111A/E, but growth capability for future systems as well. Following the initial engineering study, a judgement was made that F-111 A/E digital bomb/navigation update was too expensive for funding within existing priorities, and the Air Force decided to terminate the effort in favor of other programs for the tactical forces. The remaining effort within the PAVE TACK Project has been transferred from PE 64709, Improved Tactical Bombing, to this Program Element. The PAVE TACK pod development and F/RF-4 combined development and initial operational test and evaluation were completed in April 1977. Pod production and F-4 aircraft modification direction was provided in July 1977. The F-111F interface design and prototype hardware fabrication were completed with two test aircraft delivered by September 1977. PAVE TACK F-111F development and operational testing began in September 1977 and were completed in September 1978. F-111F aircraft modification direction was provided in August 1978. The F-111F flight test was completed in December 1979. The FY 1980 and 1981 effort resulted in development of a ready for production, proven Video Augmented Tracking System (VATS), as well as contractor maintenance support for VATS testing and continued flight training of TAC crews in advance of production systems availability. VATS will reduce operator workload by 75% during critical target tracking phase of mission allowing operator to assist in survivability tasks. The basic production pod configuration contains all provisions for VATS without any modification. The 48th Tactical Fighter Wing (USAFE) achieved Pave Tack F-111F initial operational capability with one squadron on 15 Sep 81. In December 81, the wing commander briefed members of the Air Staff and the AFSC commander on the success with which the system has been deployed and the dramatic increase in operational capability it has given his wing.

2. (U) FY 1982 Program: The Video Augmented Tracking System will complete Initial Operational Test and Evaluation on the F-111. Automated adjustment of the FLIR controls will continue in development as a proposed engineering change improvement.

3. (U) FY 1983 Planned Program: Development will be initiated for integration of PAVE TACK Acquisition capability with AGM-65 Maverick control to insure accurate and timely pointing of the Maverick seeker at the target selected. Engineering effort for preparation of 20 test program sets will be accomplished under the F-111 Avionics Intermediate Shop Replacement Program.

4. (U) FY 1984 Planned Program: Development will continue for integration of PAVE TACK and Maverick on F-111 aircraft, leading to modification decision in late FY 1984. Engineering of an additional 30 test program sets will be completed.

Program Element: #27129F Title: F-111 Squadrons
DoD Mission Area: Close Air Support and Interdiction #223 Budget Activity: Tactical Programs, #4

5. (U) Program to Completion: Engineering changes developed through FY 1984 will be installed as Class IV or Class V modification to the PAVE TACK pod. Engineering of 60 more AIS test program sets will be completed, resulting in a total of 130 test program sets which will become a part of the replacement F-111 Avionics Intermediate Shop.

6. (U) Milestones:

	Date
A. (U) Complete F-111 PAVE TACK/VATS flight tests	Sep 82
B. (U) Begin tests for Maverick correlation with PAVE TACK	Sep 83
C. (U) Contract Award F-111 AIS Test Sets	Jun 82
D. (U) First Delivery F-111 AIS Test Sets	Sep 84
E. (U) IOC F-111 AIS Test Sets	Dec 85

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27130F
DOD Mission Area: Counter Air, #221

Title: F-15 Squadrons
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	10,991	32,288	125,318	127,292	90,300	2,482,600
0131	F-15 A-D	10,991	32,288	99,018	105,392	76,600	2,420,700
2858	F-15 Derivative			26,300	21,900	13,700	61,900

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The F-15 is a high performance, highly maneuverable fighter equipped with a long range look-down radar and a balanced mix of air-to-air weapons to provide an outstanding close-in visual and medium range all-weather kill capability. Designed specifically to gain and maintain air superiority, the F-15 has significantly upgraded United States Air Force Tactical Forces supporting the counter-air and tactical support missions. Continued equipage of the active force with the F-15 contributes to force modernization, replacement of the aging F-106 in the Air Defense role; and expansion of the force to satisfy force structure requirements.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 request includes funds to complete F-15 conformal fuel tank certification tests, to continue integration of radar programmable signal processor improvements into the F-15, and to continue flight testing of radar, electronic warfare, and weapons updates including F-15 Advanced Medium Range Air-to-Air Missile (AMRAAM) integration and compatibility tests. A programmable armament control set is being developed to facilitate integration of the AMRAAM, AIM-7M guided missile, Prototype Miniature Anti-Satellite Launch System (PMALS) and Joint Tactical Information Distribution System (JTIDS). Aircraft structural life assessment is to be conducted to assure the original projections will be met. Significant efforts will be accomplished in the area of non-cooperative target recognition in order to fully exploit APG-63 radar hardware/software potential and AMRAAM capabilities. Electronic Warfare and communications integration efforts will be addressed as part of the F-15 Multi-staged Improvement Program. The FY 1983 request also includes funds to initiate development, integration and flight test of F-15 air-to-surface interfaces. Cost estimates are based on an analysis of current experience with ongoing flight test support contracts and development contracts, contractor proposals, development phasing, and Air Force estimates.

Program Element: #27130F
DOD Mission Area: Counter Air, #221

Title: F-15 Squadrons
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	10,991	57,100	TBD	---	TBD	TBD
Procurement (Aircraft)	1,108,400	1,301,900	TBD	---	TBD	TBD
(Quantity)	(42)	(42)	(42)	---	TBD	(765)TBD

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Aircraft)*	1,103,300	1,175,000	1,682,300	2,156,700	21,283,400	36,925,400
(Quantity)	(42)	(36)	(42)	(60)	(576)	(1395)

* Includes initial spares

** The F-15 procurement estimate of 1395 aircraft supports Air Force efforts to build toward a force structure that increases the number of tactical fighter wings to 44 by FY 90. Of the 1395 aircraft, incremental costing has been included for 400 F-15 derivative aircraft. Funding for initial development and production of F-15 variants is provided in the FY 83 budget, however, a firm decision on the exact F-15 force structure mix will not be made until after the F-15/F-16 derivative flight comparison is completed. The Air Force has provided costing estimates that support the current optimum build to the required tactical fighter force structure. Balanced procurement of F-15 and F-16 will continue until availability of ATF assured.

Project: #0131
Program Element: #27130F
DoD Mission Area: Counter Air #221

Title: F-15 A-D
Title: F-15 Squadrons
Budget Activity: Tactical Programs #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Until deployment of the F-15, the F-4E was our finest air-to-air fighter. The F-4 has marginal capability in air combat against the MIG-21, models of which are expected to remain in the Soviet Block inventory through the 1980s. In addition, three new interceptors; the Flagon, Foxbat and Flogger are operating in significant numbers in Soviet tactical forces. Thus the fighter threat through the 1990s will range from simple, highly maneuverable, day visual fighters to all-weather interceptors with advanced fire control systems. At present, the F-15 is the only aircraft in the USAF inventory with the maneuverability, all weather armament, and fire control system that can counter this threat. Holder of six world time-to-climb records, the F-15 combines an advanced pulse doppler radar for long range detection and tracking with a mix of radar and infrared missiles and a 20mm rapid-fire cannon to provide a close-in visual and medium range all-weather kill capability. The F-15 has four model designations, the F-15A/B/C/D. The F-15C and its two-seat version, the F-15D, incorporate radar signal processor and Production Eagle Package (PEP) 2000 improvements. The programmable signal processor provides the capability to rapidly reprogram the radar via software changes and permits improved electronic counter countermeasure performance, higher resolution, and the introduction of new radar modes, such as the track-while-scan (March 1983 IOC). PEP 2000 provides an additional 2000 pounds internal fuel, provisions for conformal fuel tanks, and increases maximum takeoff weight by 12,000 pounds. The single-seat A and two-seat D models do not have these improvements. The F-15 significantly upgrades the United States Air Force Tactical Forces performing combat air patrol, escort, and fighter-sweep missions.

It has replaced the F-4E as our primary air superiority fighter in the force structure. Equipage of active forces with the F-15 and the resultant transfer of the F-4 is helping to continue modernization of Reserve and Guard forces. Conversion of CONUS Air Defense squadrons from the F-106 to the F-15 was initiated in October 1981.

(U) RELATED ACTIVITIES: The Tactical Electronic Warfare System for F-15 application is being developed in Program Element (PE) #64739F, Tactical Protective Systems. AIM-9L, AIM-9M, AIM-7F and AIM-7M (Advanced Monopulse Seeker) air-to-air missiles are being developed and procured for use on the F-15 under PE #27161F, Tactical Air Intercept Missiles. The Joint Tactical Information Distribution System (JTIDS) is being developed for use on multiple aircraft including the F-15 under PE #64754F, JTIDS. The Advanced Medium Range Air-to-Air Missile is being developed under PEs 64314F and 63370F&N. Generic radar software algorithms, applicable to programmable signal processor radars, and Mil-Std-1750 computer software interfaces are being developed under PE #64201F, Aircraft Avionics Equipment Development, for possible use in the F-15 and other fighter aircraft.

(U) WORK PERFORMED BY: The F-15 development program is being managed by the F-15 Program Office, Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. McDonnell-Douglas Corporation, St. Louis, MO, is the prime contractor for development and production of the F-15 aircraft. Pratt & Whitney Division of the United Aircraft Corporation, West Palm Beach, FL, is the engine contractor. Hughes Aircraft Company, Culver City, CA, is the radar subcontractor to McDonnell-Douglas Corporation.

Project: #0131
Program Element: #27130F
DOD Mission Area: Counter Air #221

Title: F-15 A-D
Title: F-15 Squadrons
Budget Activity: Tactical Programs #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The F-15 is an outgrowth of the F-X program which originated in 1965 with an Aeronautical Systems Division effort to develop a "representative" F-X design. This effort culminated in an advanced fighter point-design study released in July 1966. While the Concept Formulation Package for the Advanced Tactical Fighter (F-X) was approved by the Secretary of the Air Force in August 1967 and supplemented in August 1968, significant controversy remained over F-X design criteria. The question of flexible versus specialized (air superiority) capability was deferred to the contract definition phase for a final tradeoff decision. In September 1968, Requests for Proposal were released to industry; four responses were received. In December 1968, contracts were awarded to three of these manufacturers for "contract definition" of the aircraft. Based on its technical and cost proposal, McDonnell-Douglas Corporation was announced "winner" of the F-X competition in December 1969. Airframe, engine and avionic requirements were specified and McDonnell-Douglas charged with overall system responsibility for the development and production of the F-15. Earlier, in August 1968, Air Force had released contracts for advanced engine development. After evaluating the proposals of two manufacturers, the Air Force selected Pratt & Whitney aircraft in March 1970 to develop and produce the F-15 engine. Finally, McDonnell-Douglas awarded a subcontract to Hughes in September 1970 for development of the F-15 radar. The remainder of this paragraph summarizes the significant events in the F-15 program from the beginning of full scale development in January 1970 to date. The air vehicle critical design review and the avionics equipment development review were completed in April and June 1971, respectively. From July 1971, efforts were directed to fabrication of components and flight test airplanes and extensive ground testing of subsystems. Three demonstration milestones were completed in February 1972, including the Engine/Inlet Compatibility Test, the Structural Test Major Subassemblies, and the Engine Preliminary Flight Rating Test (PFRT) Milestones. To obtain increased engine efficiencies over the PFRT engine (Series I configuration) the Air Force decided, in March 1972, to use the alternate design being carried as a parallel effort. This engine became Series II, the configuration planned for Military Qualification Tests and subsequent production. On 26 June 1972, at the "Roll Out" ceremony, the F-15 was officially christened the "Eagle". First flight occurred on 27 July 1972 beginning a highly successful flight test program. The flying qualities Air Force Preliminary Evaluation was completed in September 1972, with favorable results. The initial Airborne Avionics Performance Milestone was completed on 2 December 1972. Two structural demonstration milestones were completed in January 1973, including the Fatigue Test One Lifetime and Static Test to Critical Conditions. The Defense Systems Acquisition Review Council (DSARC) held on 15 February 1973 approved production go-ahead for the first F-15 wing. The F100 engine endurance qualification test, delayed beyond planned completion date of February 1973 by technical problems, was successfully completed on 12 October 1973. All major structural testing milestones were met when the fatigue tests to three and four lifetimes were completed in October 1973 and February 1974, respectively, and static tests for the major critical conditions were completed in March 1974. The increased production rate tooling DSARC was held on 17 January 1974 and approval was granted to proceed with the FY 1974 production of 62 aircraft and for the purchase of the increased tooling to produce it. The Air Force Development, Test, and Evaluation began at Edwards AFB in February 1974. The second wing DSARC was held on 15 October 1974 and approval was given for the FY 1975 procurement of 72 aircraft.

Project: #0131
Program Element: #27130F
DOD Mission Area: Counter Air #221

Title: F-15 A-D
Title: F-15 Squadrons
Budget Activity: Tactical Programs #4

The first two production aircraft were delivered to Tactical Air Command in November 1974. The External Stores Flutter Release Milestone was completed in August 1974. With the exception of a single aircraft conducting limited armament follow-on testing, all contractor Development, Test and Evaluation was completed in November 1974. F-15 Follow-on Operational Test and Evaluation started in March 1975 and was completed in July 1976. All high angle-of-attack and spin testing was completed in August 1975. The Initial Operational Capability (IOC) for the first training squadron was delayed from July 1975 to September 1975 due to a strike at McDonnell-Douglas. The IOC for the first operational squadron was in October 1976.

(U) The Equipment Qualified Milestone was completed in March 1977 and the Aerospace Ground Equipment In-Place Milestone was completed in May 1977. Flight evaluation of the Air Intercept Missile Evaluation/Air Combat Evaluation changes to the computer software, of F-15/F-16 radar mutual interference tests, and of the AIM-9L integration effort was completed in 1978. Air Force Development, Test, and Evaluation (AFDT&E) of the AN/ALR-56 Radar Warning Receiver "New Threat" program was completed in 1978. Contractor Development, Test, and Evaluation (CDT&E) and AFDT&E of the Jet Fuel Starter air start capability was completed in 1978. Development of the F-15 C/D model with Production Eagle Package 2000 improvements (2,000 lbs additional internal fuel, provisions for conformal fuel tanks, and capability for higher take-off gross weight), was initiated in mid-1976 and continued into 1980. Development and test of the radar programmable signal processor (PSP), which began in 1978, also continued through 1980. In October 1980, a PSP operational flight tape was released duplicating the current hardware radar functions and adding doppler beam sharpening for a 10:1 resolution improvement and additional electronic counter countermeasures against velocity gate stealers. To verify the 12,000 lb higher takeoff weight capability of the F-15 C/D models and to demonstrate AIM-7/F-15 conformal fuel tank compatibility, a joint USAF/Israeli Cooperative Flight Test Program was initiated in mid-1980. FY 1980 efforts also included flight test evaluations of electronic warfare hardware/software threat updates and integration/certification tests of improved air-to-air weapons (AIM-9M and AIM-7M). FY 1981 RDT&E included efforts for flight test, for air vehicle updates and for general management and engineering support. Primary flight test efforts included evaluation of electronic warfare and radar software updates, generated in response to changing Soviet threats, and continued certification efforts on the conformal fuel tank. Earlier tests verified the aircraft's 68,000 pound gross take off weight capability with the conformal tanks. Air vehicle updates included continued development and integration of radar programmable signal processor capabilities, such as track-while-scan, passive ranging, and additional Electronic Counter Countermeasure features; jet fuel starter improvements for increased air start capability; and improvements to various aircraft avionic weapon interfaces.

2. (U) FY 1982 Planned Program: FY 1982 RDT&E funds will be used to continue conformal fuel tank certification tests; to continue integration of radar PSP improvements into the F-15; to continue flight testing of radar, electronic warfare, and weapons updates; to initiate F-15/Advanced Medium Range Air-to-Air Missile (AMRAAM) integration and compatibility tests; and for management and engineering support. These avionics and armament improvements are grouped into a cost effective, comprehensive Multi Staged Improvement Program (MSIP).

Project: #0131 Title: F-15 A-D
Program Element: #27130F Title: F-15 Squadrons
DOD Mission Area: Counter Air #221 Budget Activity: Tactical Programs #4

3. (U) FY 1983 Planned Program: The Multi-Staged Improvement Program, initiated for the F-15 with FY 82 funding, was designed to address specific capability requirements essential to meet the late 1980s and 1990s threat. The stages include development of improved weapon system interfaces hardware and software improvements; production incorporation of the new capabilities; and retrofit of the system improvements to aircraft already in the fleet. The improvements fall into several generic areas; target acquisition, identification and destruction; command and control; and self protection. These changes are specifically directed towards maintaining the F-15s air superiority capability against the numerically superior and technologically improving Soviet threat. These developments will provide the F-15 with capabilities required to meet the expanding threat by utilizing available technology in combination with F-15 growth potential and adaptability.

(U) The expanded funding requirements for RDT&E associated with the FY 1983 program represent efforts to maintain USAF force strength without more expensive development efforts which could not be realistically fielded in the near term. The planned program efficiently and effectively extends the F-15 operational effectiveness and utility. The Air Force has identified the requirement for additional F-15s to correct strategic defense force deficiencies, modernize tactical forces, and reach force structure goals. The F-15 offers the flexibility and potential to fulfill worldwide air combat tasks, and the USAF is identifying the best configuration, given force structure and fiscal constraints.

4. (U) FY 1984 Planned Program: A number of MSIP development items will reach demonstration/validation/certification stages prior to FY 1985 initiation of production incorporation and retrofit. Efforts include integration of the Programmable Armament Control Set and interface development with AMRAAM, JTIDS, and AIM-7M; continued development and test of electronic warfare updates; and design/development of communications command and control interfaces.

5. (U) Program to Completion: This is a continuing program. The FY 1985 - 1987 RDT&E funding will be used to continue integration of improved hardware and software radar air-to-air and ECCM features into the F-15; to complete F-15 armament systems integration; and for flight test of radar, electronic warfare and weapons updates. Funds continue F-15/AMRAAM integration; and continued mission support, flight test, and other activities. The total program procurement request has also increased between the two budget submissions. The Air Force identified planning in the FY 82 Amended Budget to significantly increase F-15 aircraft procurement. The FY 83 budget raises F-15 production to a more efficient rate and provides for advance procurement to support a logical FY 84/FY 85 procurement increase to 60 and 96 aircraft respectively. This results in considerable efficiencies (TY $300M) due to more efficient rates in the total procurement planned through the FYDP of 1107 F-15 aircraft (729+378). The increased rate coincides with the orderly incorporation of production avionics developed to improve the F-15 its mission scenarios.

Project: #0131
Program Element: #27130F
DOD Mission Area: Counter Air #221

Title: F-15 A-D
Title: F-15 Squadrons
Budget Activity: Tactical Programs #4

6. (U) Milestones:

		Date	
A.	Award Total System Development Contract	January	1970
B.	Preliminary Design Review	September	1970
C.	Critical Design Review	April	1971
D.	Engine Preliminary Flight Rating Test	February	1972
E.	First Flight	July	1972
F.	Long Lead Release (Production Approval)	October	1972
G.	First Wing Full Release	February	1973
H.	Engine Qualification Test	October	1973
I.	Fatigue Test-3 Lifetimes	October	1973
J.	Increase Production Rate	January	1974
K.	Begin Air Force Development, Test, and Evaluation	February	1974
L.	Fatigue Test-4 Lifetimes	February	1974
M.	Second Wing Release	October	1974
N.	First Aircraft to Tactical Air Command	November	1974
O.	Initial Operational Capability (First Tng Sq)	September	1975
P.	First USAFE Operational Unit (Bitburg AB, FRG)	April	1977
Q.	First F-15C/D Aircraft Delivered (Kadena AB, JA)	July	1979
R.	First PACAF Operational Unit (Kadena AB, JA)	August	1979
S.	First Programmable Signal Processor Configured Radar (Camp New Amsterdam, NL)	June	1980
T.	First AMRAAM Firing (Unguided)	June	1980
U.	MCAIR IR&D Synthetic Aperture Radar (SAR) Demonstration (Volk Field)	June-Oct	1981
V.	First AMRAAM Guided Launch	November	1981
W.	First ADTAC Conversion (Langley AFB, Va)	January	1982
X.	MCAIR IR&D SAR Weapons Delivery Evaluation (Eglin AFB, Fl)	Jan-Mar	1982
Y.	USAF Ten Flight Evaluation of SAR Demonstrator (Eglin AFB, FL)	March	1982
Z.	Upgraded Radar Software Operational Flight Program (OFP) (ECCM, Raid Assessment)	June	1982
a.	Upgraded Radar Software OFP (Long Range Search, TWS, Display)	March	1983

Project: #2858	Title: F-15 Derivative
Project Element: #27130F	Title: F-15 Squadrons
DOD Mission Area: Counter Air #221	Budget Activity: Tactical Progams #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The USAF has stated requirements for increased quantities of around-the-clock air-to-surface tactical aircraft capable of under-the-weather attack, to counter the increasing capabilities of threat systems which can operate in the air at low level and on the surface in poor weather conditions. The current TAF capability to peform adverse weather missions is extremely limited and only aircraft equipped to operate in such condition can satisfy the operational need. The aircrew workload to accomplish low altitude, under-the-weather weather navigation, penetration and attack tasks with state-of-the-art automation/integration will require two crewmembers.

The F-111 is today the only aircraft capable of providing all weather air-to-surface capability with extended long range. As the dual role F-4, which performs shorter range air-to-surface missions, is retired, replacement aircraft are required. In order to minimize the expenditure of development funding, derivatives of aircraft now in production offer an affordable alternative to satisfy under-the-weather mission requirements.

The proposed F-15 derivative is a near term/low risk option for meeting around-the-clock air-to-surface mission requirement and incorporates avionics provisions for the under-the-weather mission. The contractor has initiated development of this configuration by IR&D. The additional capability does not require any structural modifications, nor are current performance capabilities degraded. The effort is largely involved with incorporation of state-of-the-art displays and controls; the software integration of air-to-surface modes into the radar and armament control system, and development and integration of improved air-to-surface armament interfaces.

(U) RELATED ACTIVITIES: PE 27133, F-16 Squadrons, Project 2385.

(U) WORK PERFORMED BY: The F-15 derivative development program will be managed by the F-15 Project Office, Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. Contractors involved remain unchanged. McDonnell-Douglas Corporation, St. Louis, MO, is the prime contractor for development and production of the F-15 aircraft. Pratt & Whitney Division of the United Aircraft Corporation, West Palm Beach, FL, is the engine contractor. Hughes Aircraft Company, Culver City, CA produces the radar.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: McDonnell-Douglas, the aircraft prime contractor, initiated through IR&D a series of demonstrations of F-15 air-to-surface capabilities utilizing one of the original F-15 two seat prototype aircraft. These demonstrations included weapons delivery, improved radar air-to-surface features and rear seat integrated weapons systems operator controls and displays.

Project: #2858
Program Element: #27130F
DOD Mission Area: Counter Air #221

Title: F-15 Derivative
Title: F-15 Squadrons
Budget Activity: Tactical Programs #4

2. (U) FY 1982 Planned Program: The USAF requested $32.8M to initiate development of avionics and armament interfaces to improve F-15 air-to-surface capabilities in a derivative aircraft. These funds were not provided by the Congress and authorization for development of an F-15 air-to-surface derivative was withheld pending satisfactory explanation by the USAF of its total air-to-surface requirements. The USAF plans to respond to the Congress during the second quarter of the fiscal year. If the Congress authorizes the Air Force to initiate the derivative development, funding as available, will be used to demonstrate air-to-surface flight performance capabilities and initiate planning for development of necessary avionics and armament interfaces.

3. (U) FY 1983 Planned Program: The RDT&E funding requested would initiate efforts associated with demonstration of F-15E derivative flight performance characteristics; analysis of required avionics and armament tradeoffs; development of avionics and armament interfaces; and final definition/development of missionized weapon systems operator station. The program has been restructured due to the FY 82 funding denial and plans for an F-15/F-16 derivative comparative flight demonstration.

4. (U) FY 1984 Planned Program: Air-to-surface avionics and armament interfaces would enter validation/verification performance demonstrations. Preproduction avionics LRUs would be installed in an F-15D aircraft (identical to the F-15E in airframe configuration) to accomplish these tasks.

5. (U) Program to Completion: The FY 1985-1986 funding would be used to complete validation/verification of derivative model avionics and armament equipment changes.

6. (U) Milestones

1.	USAF Presentation of Air-to-Surface Requirement	NLT Mar 1982
2.	Initiate Derivative Flight Performance Demonstration	NLT Jul 1982

Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

Test and Evaluation Data

(U) The F-15 test program was composed of Contractor Development Test and Evaluation (CDT&E), Air Force Development Test and Evaluation (AFDT&E), Air Force Initial Operational Test and Evaluation (IOT&E) and Follow-on Test and Evaluation. The purpose of CDT&E and AFDT&E was to provide necessary test and analysis data to assure that an operational air superiority weapon system would be available at the earliest practical time. Test objectives addressed compliance with specifications, established performance capabilities, assessed handling qualities, etc. IOT&E was conducted throughout Development Test and Evaluation (DT&E) to evaluate the operational capability and suitability of the F-15 weapon system. A portion of Tactical Air Command's (TAC) IOT&E involved their participation in eleven system/subsystem F-15 Air Force Preliminary Evaluations (AFPE). Additionally, seven system/subsystem Initial AFDT&E were conducted to permit Air Force Flight Test Center and TAC pilots to evaluate contractor fixes of mandatory correction items discovered during AFPEs and to satisfy early Air Force developmental and operational test objectives. Eighteen F-15As and two F-15Bs (two-seat version) were dedicated to the DT&E/IOT&E tests.

1. Development Test and Evaluation:

(U) As of 30 September 1981, the USAF and McDonnell Douglas DT&E test teams had accumulated 8885 test flights and 10590 flight hours on F-15 test aircraft during the 110 months of F-15 DT&E. during CY 1978 and CY 1979 included Tactical Electronic Warfare System AFDT&E, Air Intercept Missile Evaluation/ Air Combat Evaluation computer software change evaluations, F100 engine stall/stagnation and component improvement tests, F-15/F-16 radar mutual interference tests, improved 20MM ammunition tests, programmable signal processor CDT&E, F-15 C/D model DT&E, and numerous evaluations of weapon system improvements designed to satisfy recommendations resulting from earlier testing. The remainder of this paragraph summarizes the significant DT&E accomplishments in the F-15 program from the beginning of full scale development in January 1970 to date. The air vehicle critical design review and the avionics equipment development review were completed in April and June 1971, respectively. From July 1971, efforts were directed to fabrication of components and flight test airplanes and extensive ground testing of subsystems. Three demonstration milestones were completed in February 1972, including the Engine/Inlet Compatibility Test, the Structural Test Major Subassemblies, and

Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

the Engine Preliminary Flight Rating Test (PFRT) Milestones. To obtain increased engine efficiencies over the PFRT engine (Series I configuration) the Air Force decided, in March 1972, to use the alternate design being carried as a parallel effort. This engine became Series II, the configuration planned for Military Qualification Tests and subsequent production. F-15 first flight occurred on 27 July 1972 beginning a highly successful flight test program. The flying qualities AFPE was completed in September 1972, with favorable results. The initial Airborne Avionics Performance Milestone was completed on 2 December 1972. Two structural demonstration milestones were completed in January 1973, including the Fatigue Test One Lifetime and Static Test to Critical Conditions. The F100 engine endurance qualification test, delayed beyond planned completion date of February 1973 by technical problems, was successfully completed on 12 October 1973.

All major structural testing milestones were met when the fatigue tests to three and four lifetimes were completed in March 1974. The Air Force Development Test and Evaluation (AFDT&E) began at Edwards AFB in February 1974. The external Stores Flutter Release Milestone was completed in August 1974. With the exception of a single aircraft conducting limited armament follow-on testing, all Contractor Development, Test, and Evaluation (CDT&E) was completed in November 1974. All high angle-of-attack and spin testing was completed in August 1975. The Equipment Qualified Milestone was completed in March 1977, and the Aerospace Ground Equipment In-Place Milestone was completed in May 1977. Flight evaluation of the Air Intercept Missile Evaluation/Air Combat Evaluation changes to the computer software, F-15/F-16 radar mutual interference tests, and the AIM-9L integration effort was completed in 1978. AFDT&E of the AN/ALR-56 Radar Warning Receiver "New Threat" program was completed and an interim flight test report published in 1978. The New Threats consisted of three major improvements. One feature allows the ALR-56 to sort out and analyze capability. A second modification gives increased capability to detect threats that are The final change, termed Successful operation of the were demonstrated. However, the software tape still had New Threat related problems as well as some carry-over deficiencies from the current Operational Flight Program. Further development and testing was required before release. In 1978, CDT&E and AFDT&E of the Jet Fuel Starter air start capability was completed. Testing under the F100 Engine Component Improvement Program, including solutions to the F100 stall/stagnation problem, continued throughout 1979 and 1980. The susceptibility of the F100 engine to compressor stalls followed by stagnations

Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

and the resultant durability problems have been areas of major concern. With incorporation of planned fixes, all of which have been tested, the previous F-15 stall/stagnation rate of 1.0 incident per 1000 engine flight hours was reduced. Development and test of the F-15 C/D model, Production Eagle Package 2000 improvement (2,000 lbs additional internal fuel, provisions for conformal fuel tanks and capability for higher takeoff gross weight), which was initiated in mid-1976, was completed in 1980. CDT&E and AFDT&E of the C/D model began in February and May 1979, respectively. CDT&E of the improved monopulse AIM-7M began in October 1979. Finally, development and test of the programmable signal processor (PSP) for the F-15 radar, which began in 1978, continued into 1982. While containing some minor discrepancies, the first PSP operational flight program delivered in May 1980 was as good or better than current aircraft radar capabilities. The discrepancies were corrected with a tape revision in October 1980. The development of the Raid Assessment Mode (RAM) took longer than originally expected. Radar incorporation of the RAM occurred in May 1981. Maintainability and reliability testing of the F-15 Weapon System was a special subject of Operational Test and Evaluation as discussed below.

2. Operational Test and Evaluations:

(U) Initial Operational Test and Evaluation (IOT&E): The F-15 IOT&E was part of a combined IOT&E/Air Force and contractor Development Test and Evaluation (DT&E) conducted at Edwards AFB, CA, using data from contractor and Air Force DT&E sorties flown July 1972 through 30 June 1975. The Initial Operational Test and Evaluation (IOT&E) was USAF directed, Tactical Air Command conducted, and Air Force Test and Evaluation Center monitored. The IOT&E provided estimates of system operational effectiveness and suitability in support of Defense System Acquisition Review Council decisions related to increased production rate. Specific test objectives addressed both air-to-air and air-to-ground mission roles. 4460 sorties were flown in the 2.5 year effort. Major findings were:

(U) The aircraft had superior handling and flight characteristics. Improvements were requested to cockpit situation awareness cueing to assist pilots in taking full advantage of the aircraft capabilities.

Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

(U) Pilot workload was satisfactory, but certain fire control automation was requested for close-in engagements.

(U) AIM-7F/F-15 interface was satisfactory. Carriage problems and cueing errors were noted in AIM-9E testing.

(U) F-15 was an effective platform for air-to-ground ordnance delivery.

(U) The continual change of hardware and software throughout the test program precluded establishment of a data base for reliability assessments. The immaturity of the builtin-test and non-delivery of major segments of test equipment were major limiting factors in the overall suitability evaluation.

(U) Follow-on Test and Evaluation (FOT&E): The F-15 FOT&E was an independent test and evaluation managed by the Air Force Test and Evaluation Center (AFTEC) and conducted by the 58th Tactical Fighter Training Wing at Luke AFB, Arizona. The objectives of FOT&E were to verify the operational effectiveness and suitability, which included assessment of the logistical supportability, life cycle costs, and identification of desirable modifications or trade-offs for the production F-15 System. The FOT&E commenced in March 1975 and finished in July 1976 using a total of 1111 F-15 sorties and approximately 900 support sorties. Evaluation sorties were flown by AFTEC and Tactical Air Command pilots. Maintenance was performed by Air Force personnel.

The F-15 was found to be an excellent weapon system for air-to-air combat. The long-range, look-down capability of the radar made it extremely effective in intercept operations and allowed it to enter most engagements from a position of advantage. However, there were several major operational deficiencies identified during Follow-on Test and Evaluation which were felt to limit the full operational capability of the F-15A. The major operational deficiencies identified were (1) unreliable fuel supply to the engines in the event of aircraft electrical failure, (2) fuel transfer problems, (3) unreliable landing gear indications (4) fire control system problems and (5) The F-15 Program Office took action to correct each of these deficiencies. Improvements in the emergency boost pump ground check switch and the emergency power system are being incorporated into production aircraft and have been retrofitted

Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

into all previously delivered F-15s to eliminate unreliable fuel supply during electrical failures. Problems associated with fuel transfer pump malfunctions were corrected by providing more detailed information to the pilot on actions to be taken when a transfer malfunction occurs. A review was also initiated to determine whether additional cockpit cues of this malfunction were required. Action resulting from this problem was closed in April 1977. The landing gear position indicating system was corrected by minor engineering changes approved in October 1976 and February 1977. These changes have been in all production aircraft since February 1977 and were also retrofitted into all previously delivered F-15s. Fire control system problems were corrected by a central computer operational flight program update. Finally, solution to the problem has been identified and the fix was included in the

(U) Testing indicated that the F-15 would return from a mission capable of further missions 50 percent of the time. Experience shows that with the F-15C/D this to be 69.1 percent. Testing resulted in an estimate of 40 maintenance manhours per flying hour. Experience reflects 31.16 and 23.28 for the F-15A/B and F-15C/D respectively. The manpower requirements necessary to support a 72 aircraft wing were estimated at approximately 1000 authorizations.

In addition to the above testing, an Initial Operational Test and Evaluation (IOT&E) of the F-15 Tactical Electronic Warfare System (TEWS) was conducted by the US Air Force Tactical Air Warfare Center, Eglin AFB, Florida. The resources of the Armament Development and Test Center, the Naval Weapons Center, and the 6512 Test Squadron, Air Force Systems Command were used during the test. The test was conducted simultaneously with Air Force and contractor Development Test and Evaluation (DT&E) from February 1974 through October 1976. The IOT&E, Air Force directed and Air Force Test and Evaluation Center monitored, was comprised of 325 sorties. The purpose of this IOT&E was to evaluate the capability of the F-15 TEWS to protect the aircraft against surface-to-air and air-to-air threats. Air Force personnel performed organizational level maintenance for the F-15 TEWS. However, intermediate and depot maintenance support was accomplished entirely by contractor engineers and technicians using interim special test equipment. Major conclusions were (1) basic system operation was verified, [

]

Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

(U) The TEWS has the potential to give the fighter pilot an electronic warfare (EW) capability far superior to that of previous tactical EW systems. A number of equipment design changes and software modifications have been implemented to correct both the functional deficiencies and to provide additional capability. These changes and modifications are currently being tested by the USAF Tactical Air Warfare Center in an extension of the previous Development Test and Evaluation (DT&E)/Initial Operational Test and Evaluation (IOT&E). A report addressing ongoing testing of Radar Warning Receiver (RWR) threat updates was published in late 1980, and a similar detailed review of Air Force Systems Command Countermeasures Dispenser Set (CDS) test activities was completed in the latter part of 1981.

(U) An IOT&E of the Overload Warning System (OWS) was conducted by the U.S. Air Force Tactical Fighter Weapons Center, Nellis AFB, Nevada. The purpose of this IOT&E was to evaluate the capability of the F-15 OWS to provide timely pilot warning of an impending aircraft overload condition. The OWS should reduce F-15 airframe damage resulting from flight overload situations as well as permitting more effective employment of the F-15. The OWS IOT&E report was relased in March 1981.

(U) An improved software programmable version of the F-15 APG-63 radar signal processor entered in development in 1978. Production units were initially delivered to the Air Force in May 1980. The Tactical Air Command (TAC) participated in the Air Force Systems Command conducted DT&E of the improved radar. Phase I of this DT&E was completed in April 1981. TAC conducted a Qualification Operational Test and Evaluation to evaluate the operational effectiveness and suitability, supportability, and maintainability of F-15 aircraft equipped with the modified radar. This test was completed in May 1981 and a final report was released in July 1981. During DT&E several deficiencies were addressed by Air Force Systems Command and contractor teams. An initial version of the software program was delivered to the tactical forces in 1980 and an expanded version, including the raid assessment mode (RAM), was released to the Tactical Air Forces in May 1981. The modified APG-63 with fully developed software provides the F-15 with increased electronic counter countermeasures (ECCM), improved target resolution, and the capability to expeditiously incorporate track-while-scan (TWS) and non-cooperative

Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

target identification modes.

3. Systems Characteristics:

The F-15 is an advanced tactical fighter developed for the air superiority mission. It is a twin engine, single place, fixed swept wing airplane characterized by high thrust-toweight and low wing loading for superior acceleration and maneuverability. The F-15 is equipped with a balanced mix of air-to-air weapons, ranging from medium range all-weather missiles to rapid fire 20mm cannon and provides an outstanding capability against the postulated enemy air threat.

A. Operational	DEVELOPMENT ESTIMATE	DEMONSTRATED PERFORMANCE
1. Max Mach No @ Altitude (Sustained/Burst)	2.3/2.5	2.3/2.5
2. Max Mach No @ Sea Level (Sustained)	1.2	1.16
3. Design Maximum Load Factor (80% Internal Fuel), g	7.33	7.33
4. Maximum Buffet-Free Maneuver g (0.8M, 30K ft), g		
5. Energy Maneuverability (Ps), fps		
a. 0.9M, 30,000 ft, 5g, Mil Pwr		
b. 0.6M, 10,000 ft, 5g, Max Pwr		
c. 0.9M, 10,000 ft, 1g, Max Pwr		
d. 0.9M, 10,000 ft, 5g, Max Pwr		
e. 0.9M, 30,000 ft, 5g, Max Pwr		
f. 0.9M, 35,000 ft, 5g, Max Pwr		

Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

8. Technical

1.	Design Mission Take-off Wt, lb	40,000	41,491
2.	Take-off Wing Loading, lb/ft	66	68
3.	Uninstalled Thrust-to-Take-off Weight Ratio	1.17	1.15

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27131F (64225F) Title: A-10 Squadrons
DOD Mission Area: Close Air Support/Battlefield Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	34,796	13,947	6,488	4,845	5,776	493,852

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The A-10 is a single seat aircraft specifically designed for the Close Air Support (CAS) mission. High survivability is a primary design feature. It has a high velocity, rapid fire, 30 millimeter(mm) gun for increased target kill effectiveness and can carry a large and variable external load of conventional ordnance. The A-10 is designed to operate in the European threat environment and its primary mission is to attack targets in close proximity to friendly forces in support of the ground battle.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds to continue minimal flight testing and laboratory and engineering support to resolve correction of service revealed problems. Continuation of the development of the two-seat A-10B trainer configuration directed by Congress in the FY 81 Defense Appropriation Bill is included in the FY 1983 request. The request also includes A-10 peculiar LANTIRN integration and improvements for potential avionics enhancements for self-protection. The FY 1983 RDT&E estimate was provided by the A-10 program office at Wright-Patterson AFB, OH and was based in part on contractor inputs.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	33,446	14,000	4,600		[illegible],200	465,200
Procurement (Aircraft) 1/	623,600	550,900	0		0	[illegible],903,300
(Quantity)	(60)	(60)2/	0		0	(747)2/

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional To Completion	Total Estimated Costs
Procurement (Aircraft) 1/	513,500	235,900	360,700	0	0	4,940,500
(Quantity)	(60)	(20)	(2[illegible])2/			(727) 2/

1/ Includes initial spares 2/ Includes 14 two-seat A-10B trainer aircraft

Program Element: #27131F Title: A-10 Squadrons
DOD Mission Area: Close Air Support/Battlefield Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The A-10 is a specialized aircraft designed for the Close Air Support (CAS) mission. It will replace aging or less effective aircraft in CAS. Studies performed between 1967 and 1969 led to a firm definition of the mission requirements and an optimized set of aircraft characteristics. The development of the A-10 was initiated, using a competitive prototype approach, with "design-to-cost" management goals. The A-10, a single seat, twin turbofan aircraft, is designed to operate in the intense antiaircraft artillery (AAA) environment that is anticipated to be employed by enemy forces. The European threat environment includes a high density of 23 millimeter (mm) AAA weapons, infrared heat seeking and radar guided surface-to-air missiles. The aircraft has been hardened to counter the Soviet 23mm weapons and will carry those infrared and electronic countermeasures known to counter Soviet surface-to-air missile threat. The A-10 has an austere basing and extended air loiter capability. This aircraft has both a standoff and close-in capability to defeat enemy armor. The A-10 will utilize the Maverick missile when standoff tactics are employed and the GAU-8 30mm gun for close-in attack of enemy armor. The A-10 is highly maneuverable and can carry a large and flexible external ordnance payload.

(U) RELATED ACTIVITIES: The A-10 utilizes the General Electric TF34-100 engine which is a modification of the TF34-400 engine developed by the Navy for the S-3A (Anti-Submarine Warfare Aircraft), Program Element (PE) 24215N. The TF34-100 engine was developed by the Air Force for A-10 application and includes several cost saving features. The A-10 Program Office and Navy have worked closely to ensure a high degree of commonality between both engine models. The A-10 is the first weapon system to use the GAU-8 30mm gun system, developed under PE 64605F. The A-10 Program Office had overall management responsibility for the GAU-8; however, the gun program was transferred to Warner-Robins Air Logistics Center, Robins AFB, Ga. Sacramento Air Logistics Center, McClellan AFB, Ca, now has overall program management responsibility for the A-10 program. The cost of the gun development as related to integration and testing with the A-10 is borne by the A-10 element. The A-10 also employs the Maverick AGM-65 (Tactical Air-to-Ground Missile), PE 27313F. Weapon System Trainers for the A-10 were developed in PE 64227F. The Standard Inertial Navigation System, developed under PE 64201F, is being installed in the A-10. The $14.9M for PE 64201F is not shown in the A-10 RDT&E although the A-10 Selected Acquisition Report has included these costs in the A-10 Development. The Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) being developed under PE 63219F is planned for integration on the A-10 by a Class V Aircraft Modification.

(U) WORK PERFORMED BY: The A-10 production program is managed by the A-10 System Program Office, Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. The prime contractor for the A-10 is Fairchild Republic Company, Farmingdale, L.I., NY. The GAU-8 30mm gun contractor is General Electric, Burlington, VT. The TF34-100 engine is managed by the San Antonio Air Logistics Center, Kelly AFB, Tx. The engine contractor is General Electric, Lynn, MA.

Program Element: #27131F: Title: A-10 Squadrons
DOD Mission Area: Close Air Support/Battlefield Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The A-10 was selected for development as the result of a prototype competition ending in December 1972. Comparative analyses showed that the A-10 would be more than twice as cost-effective as other candidate aircraft in supporting ground forces in a European environment. DOD approval was granted and the A-10 development contracts were awarded on 1 March 1973. The detailed design refinement of the A-10 began, and prototype aircraft testing and TF34-100 development continued through June 1975. The static test article entered fabrication in January 1974. In response to Congressional direction on the FY 1974 budget, the quantity of Development, Test and Evaluation (DT&E) aircraft in FY 1974 was reduced from ten to six and a fly-off between the A-10 and A-7 was conducted. The A-10 was declared the winner in June 1974. The first DT&E aircraft was delivered in February 1975. DT&E testing was initiated in February 1975 and was completed in September 1977. Initial operational capability of the first operating squadron was accomplished in October 1977. Follow-on DT&E testing of directed aircraft enhancements (Inertial Navigation System, internal chaff/flare system and ALR-69 radar warning system) is in progress. Development and testing have been initiated to prevent excessive gun gases from entering the engine. Follow-on fatigue testing was initiated to verify changes required as a result of more severe operational usage as well as changes required to increase the fatigue life from 6000 hours to 8000 hours. The two-seat A-10B trainer aircraft development was initiated.

2. (U) FY 1982 Planned Program: Includes effort to provide minimum sustaining flight test, laboratory and engineering support to resolve service revealed problems, improve the environmental control system, and evaluate potential avionics enhancements to increase effectiveness and survivability in night/low altitude environments, such as Low Altitude Navigation and Targeting Infrared Systems for Night (LANTIRN). The FY 1982 RDT&E program funding is unchanged. The procurement estimate was decreased by $315.0 million as a result of reducing the quantity from 60 aircraft to 20. The resulting unit flyaway cost increases 22% because of lower production rates.

3. (U) FY 1983 Planned Program: Continue minimum sustaining flight test, laboratory and engineering support to resolve service revealed problems, improve ammunition storage and shipping containers, continue LANTIRN integration, and evaluate potential avionics enhancements for improved self-protection. The FY 1983 RDT&E program funding increased by $1.9 million for continued development and test of the two-seat A-10B trainer aircraft. The procurement estimate was increased by $360.7 million as a result of stretching the A-10 aircraft procurement through FY 1983. The resulting FY 1983 unit flyaway cost increases 57% above the FY 1982 unit cost based on the FY 1982 Descriptive Summary.

4. (U) FY 1984 Planned Program: Continue minimum sustaining flight test, laboratory, and engineering support to resolve service revealed problems, continue LANTIRN integration, and evaluate potential avionics enhancements for improved self-protection.

5. (U) Program to completion: Follow-on development efforts are planned through FY 1986. RDT&E efforts will generally be directed toward expanding capabilities and resolving service revealed problems.

Program Element: #27131F | Title: A-10 Squadrons
DoD Mission Area: Close Air Support/Battlefield Interdiction,#233 | Budget Activity: Tactical Programs,#4

6. (U) Milestones:

	Milestone		DATE
A.	Award full-scale dev/prod contract		Mar 1973
B.	Critical Design Review		May 1974
C.	Complete GAU-8/A prototype demonstration		May 1974
D.	Production Readiness Review		May 1974
E.	DSARC IIIA & long lead production release		Jul 1974
F.	Engine Qualification Test Complete		Oct 1974
G.	First flight DT&E aircraft		Feb 1975
H.	Fatigue test one lifetime complete		Oct 1975
I.	First Single-Seat Production Aircraft Delivery		Nov 1975
J.	DSARC IIIB major production decision		Feb 1976
K.	Initial Operational Capability		Oct 1977
L.	Activate USAFE Base		Jan 1979
M.	First Two-Seat Production Aircraft Delivery	*(Dec 1983)	Apr 1984
N.	Complete Follow-on Development Program		Sep 1986

* Date presented in Fiscal Year 1982 Descriptive Summary

(U) Explanation of Milestone Changes

M. Delivery of first two-seat aircraft delayed as a result of restructuring the A-10 production as 20 aircraft in FY 82 and 20 in FY 83.

7. (U) Resources: N/A

8. (U) Comparison with FY 1982 Budget Data: N/A

Program Element: 527131F Title: A-10 Squadrons
DoD Mission Area: Close Air Support/Battlefield Interdiction, #223 Budget Activity: Tactical Programs, #4

1. (U) Development Test and Evaluation: In 1966, the Chief of Staff of the Air Force directed that action be taken to develop a new aircraft specialized for the Close Air Support mission. This direction reflected the need for an aircraft which would replace aging or less effective aircraft used in Close Air Support and to provide optimum Close Air Support at least cost. This requirement still exists and is being satisfied by the A-10. The development of the A-10 was initiated, using a competitive prototype approach, with "design-to-cost" management goals. On 28 February 1973, the Department of Defense approved the development of the A-10 and the Air Force awarded contracts to Fairchild Republic Company (airframe) and General Electric Company (TF34 engine) for this effort.

(U) An extensive review of the A-10 program was accomplished in July 1974 to determine if the A-10 was ready to enter low rate production. A detailed assessment of the test program and a review of the A-10's production readiness posture were made. The results of this review culminated in the approval to procure 52 A-10 production aircraft.

(U) The TF34-100 engine completed qualification testing in October 1974. The two prototype aircraft continued to support the development program until June 1975. The first of six Development Test and Evaluation aircraft was delivered in February 1975. These aircraft were used to test the following areas: aerodynamics, performance, freedom from flutter, 100 percent air loads, armament systems, subsystems, climatic/adverse weather testing and initial operational tests. The performance thresholds were met or exceeded with the exception of forward airstrip takeoff and landing distance. These parameter values were assessed and found to have little impact on the A-10's operational utility. All major test milestones required prior to the full rate production decision were accomplished. The bomb and strafe accuracy tests demonstrated the A-10's excellent weapon delivery capability. The A-10 technical risks were minimized prior to production go ahead.

(U) The static test article has successfully demonstrated freedom from permanent deformation at design limit load and the ability to withstand ultimate strength (1.5 times limit load). The A-10 was certified to 6000 hours service life in May 1976; however, current operational usage is more severe than originally forecast resulting in a service life of 4500 hours. The cold work of approximately 1400 fastener holes in the center wing section is required to achieve at least 6000 hours based on the current, more severe operational usage. Three fatigue test failures following the certification confirmed the cold work of the fastener holes in the center wing section and resulted in a decision to thicken the outer wing section skin panels to extend the wing life to 8000 hours. Additional testing is being conducted to validate an 8000 hour service life with the more severe operational usage.

(U) In June 1978 and again in the summer of 1979, engine rollbacks during gunfiring were experienced. An extensive flight test investigation was initiated and interim and permanent solutions are being developed. The interim solution provides continuous engine ignition whenever the gun is fired. Continuous engine ignition and regularly scheduled engine water washings have eliminated engine disturbances during gunfiring. Two solutions which divert the hot gun gases away from the engine are being tested prior to incorporation on all A-10s.

Program Element: #27131F　　　　　　　　　　　　　　Title: A-10 Squadrons
DoD Mission Area: Close Air Support/Battlefield Interdiction,#223　　　　Budget Activity: Tactical Programs,#4

(U) Follow-on Development Test and Evaluation testing of selected enhancements (internal chaff/flare, inertial navigation system, improved ALR-69 and night/low altitude avionics) is now in progress. The Research, Development, Test and Evaluation aircraft have been modified to logistics supportable configurations. These aircraft will be used within Air Force Systems Command for follow-on testing requiring the use of A-10 test bed aircraft.

2. (U) Operational Test and Evaluation: Phase I Initial Operational Test and Evaluation of the A-10 was conducted in conjunction with Development Test and Evaluation of the prototype YA-10 aircraft from March 1973 through June 1975. Phase II Initial Operational Test and Evaluation, using six preproduction aircraft and later three production aircraft, began in April 1975 and was completed in March 1976. Limited aircraft availability prohibited evaluation of multiship employment concepts and tactics; however, adequate data were available to make an assessment of the A-10A aircraft.

(U) The combined Development Test and Evaluation/Initial Operational Test and Evaluation for the preproduction aircraft was conducted at the Edwards Air Force Base, George Air Force Base, and Nellis Air Force Base ranges. An Air Force Test and Evaluation Center test team composed of personnel from Air Force Test and Evaluation Center, Tactical Air Command, Air Force Logistics Command, and Air Training Command conducted the Initial Operational Test and Evaluation portion of the test. The purpose of the Initial Operational Test and Evaluation was to evaluate the operational suitability and operational effectiveness of the A-10 preproduction aircraft. Missions were flown to evaluate the aircraft, airborne performance, and handling qualities; pilot workload; air refueling capability; weapons delivery accuracy; defensive combat maneuvering capability; and night/weather operations. In addition, the close air support missions (support of troops, convoy escort, preparatory attacks, armed reconnaissance, and combat search and rescue) were evaluated. The interface of the GAU-8 gun with the A-10 was a primary objective. Data were gathered and analyzed to evaluate the A-10 survivability, reliability, maintainability, logistic supportability, and maintenance training requirements.

(U) Follow-on Operational Test and Evaluation was accomplished in two phases. Phase I, conducted by Air Force Test and Evaluation Center and the 355th Tactical Fighter Wing, commenced in August 1976 and was completed in February 1977. This phase involved six production aircraft flying 388 sorties. Test location was Davis-Monthan Air Force Base with deployments to Nellis Air Force Base and McChord Air Force Base for accomplishment of surge and low visibility test objectives. Based on the results of phase I Follow-on Test and Evaluation, Air Force Test and Evaluation Center has concluded that the production A-10A can perform the close air support mission better than any existing aircraft in the United States Air Force inventory. Although some aircraft performance thresholds were missed, the overall performance is satisfactory in the context of tailoring loads and tactics to the specific missions. Primary weapons include the AGM-65 Maverick missiles and the 30 millimeter gun. The 30 millimeter gun is a superior weapon when attacking current and projected Warsaw Pact front line armor. Excellent accuracy is achieved even when firing beyond 4000 feet slant range.

Program Element: #27131F Title: A-10 Squadrons
DoD Mission Area: Close Air Support/Battlefield Interdiction,#223 Budget Activity: Tactical Programs,#4

(U) Lack of sophisticated avionics has relegated the aircraft to daytime usage in a high threat environment. With low altitude target ingress, dead reckoning navigation causes an excessive pilot workload. Therefore, an inertial navigational system is needed. An initial navigation system was introduced in production aircraft number 431. A retrofit program for all A-10 aircraft has been approved. In the low ceiling/visibility environment, the aircraft's capability to attack small passive targets is unmatched by any other aircraft in the inventory.

(U) The A-10A is well suited to forward operating location operations. Medium weight takeoffs and landings resulted in average distances of 2175 feet and 1600 feet, respectively. The simplicity of the aircraft and the self-contained power unit combine to aid in quick and safe turnaround operations.

(U) Aircraft reliability, as measured by Mean Time Between Failure, was excellent. The Mean Time Between Failure of 1.8 hours was better than the predicted value of 1.34 and the Decision Coordinating Paper number of 1.78. Maintainability, as measured in maintenance man-hours per flying hour, closely approximated the predicted value of 26.0 maintenance man-hours per flying hour. Availability was also satisfactory with the flyable rate slightly below the prediction of 61 percent.

(U) Major deficiencies identified during the test were inadequate stability augmentation, unsatisfactory night lighting and a limited use head-up display. The first two deficiencies have been corrected, and work is continuing on the head-up display. The above information is from the phase I Follow-on Test and Evaluation Final Report, May 1977. However, the head-up display deficiency has now been corrected.

(U) Phase II follow-on test and evaluation conducted by Tactical Air Command and the 354th Tactical Fighter Wing using operational squadron aircraft, began in January 1978 and terminated in June 1978. Follow-on Test and Evaluation was conducted at Myrtle Beach Air Force Base SC with deployment/employments to Shaw Air Force Base SC and Savannah Airport GA. The objectives of phase II Follow-on Test and Evaluation were to verify the data gathered during phase I as applied to an operational squadron and to document the A-10 weapon system capability when employed in squadron strength operating from both a permanent base and deployed in forward operating locations. This latter objective included the operation under normal and surge sortie rates.

(U) Aircraft availability was very good during the test, especially in view of system maturity. Reliability and maintainability were very good. Phase II test values were 21.78 maintenance man-hours per flying hour and a Mean Time Between Failure of 4.47 hours; predicted values were 21.00 and 1.78, respectively. Aircrew training requirements were completed with relative ease due to aircraft availability. Logistics supportability revealed initial spares supply level deficiencies concerning engine related items, and provisions were made to correct the situation. All operational effectiveness objectives were met. The 24 primary aircraft authorized A-10 squadron with its mobility support package showed an excellent capability to mobilize, deploy, and perform its mission under normal and surge sorties from both a fixed base and deployed forward operating locations.

Program Element: #27131F   Title: A-10 Squadrons
DoD Mission Area: Close Air Support/Battlefield Interdiction,#222   Budget Activity: Tactical Programs,#4

(U) The phase II Follow-on Test and Evaluation report, July 1979, concluded that A-10 availability, from either a main operating base or a forward operation location, was excellent. Weapon system reliability and maintainability were satisfactory during the evaluation. The deficiencies encountered in the test consisted of inadequate technical data, an unreliable aircraft boarding ladder and the unavailability of the GAU-8 automatic loading assembly. All of these deficiencies are being corrected.

(U) The A-10 was the first aircraft to receive the Air Force's Standard Medium Accuracy Inertial Navigation System. The inertial navigation system Follow-on Test and Evaluation was completed in September 1981 and demonstrated accuracies within the specifications. Production effectivity was aircraft No. 431 (November 1980). Retrofit of the inertial navigation system is scheduled to begin in calendar year 1984.

3. (U) System Characteristics: The significant A-10 performance parameters with the Decision Coordinating Paper goal/threshold values are shown below.

CHARACTERISTIC	DEVELOPMENT ESTIMATE	DEMONSTRATED PERFORMANCE
Cruise Speed (KTAS)	300	342
Forward Airstrip 1/		
Take-off (ft)	1200	1900
Landing (ft)	1200	1460
Loiter at 250 NM Radius (hr)		
Close Air Support Mission	2.0 2/	1.8 3/
Anti-Armor 4/	-	1.8 5/
Bombing Accuracy, MK-82 (CEP)(mils)	15	13.6
Strafing Accuracy (CEP)(mils)	10	4
Sustained Load Factor 2/		
at 275 Kt (g)	3.5	3.2
at 150 Kt (g)	2.2	2.0

Program Element: #27131F Title: A-10 Squadrons
DoD Mission Area: Close Air Support/Battlefield Interdiction,#223 Budget Activity: Tactical Programs,#4

(U) NOTE: All values for tropic day conditions.

1/ (U) 4 MK82, 750 rounds of 30mm ammunition and fuel for 50 nautical miles cruise to target, 30 minute loiter, combat, 150 nautical miles return to base, and land with fuel reserve
2/ (U) 18 MK82, 750 rounds of 30mm ammunition, and fuel for combat and land with fuel reserve
3/ (U) 16 MK82, 750 rounds of 30mm ammunition, and fuel for combat and land with fuel reserve
4/ (U) 6 Mavericks, 1350 rounds of 30mm ammunition, two ECM pods, full chaff/flare system, same mission profile as close air support mission
5/ (U) Estimated
6/ (U) 6 MK82, 750 rounds of 30mm ammunition, fuel for 300 nautical miles land with fuel reserve

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27133F (64229F) Title: F-16 Squadrons
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactic Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	42,357*	57,284	86,142	220,202	680,300	1,941,385
2671	F-16A-D	42,357*	42,000	65,100	90,900	60,700	1,156,157
2835	F-16 Derivative		15,284	21,042	129,302	619,600	785,228

*Includes $500 thousand reprogrammed in Oct 81 for radar warning receiver studies.

(U) BRIEF DESCRIPTION OF PROGRAM ELEMENT AND MISSION NEED: This program will satisfy mission need for a lightweight, high performance, multimission fighter capable of performing a broad spectrum of tactical air warfare tasks at an affordable cost. The F-16 is designed for high sortie rates with rapid turnaround, minimum manpower/logistics burden, and exceptional air combat maneuvering performance coupled with a potent air-to-surface weapons delivery capability. The F-16 will replace aging F-4s in the active inventory as well as modernize the Reserve Forces.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request will support continued F-16 airframe, radar, engine, and stores certification flight tests. Test efforts will focus on development of avionics and radar improvement designed to provide increased air-to-surface capability and enhanced utilization of a beyond visual range air-to-air missile (Advanced Medium Range Air-to-Air Missile (AMRAAM)) on the F-16. Flight test of an F-16 derivative prototype initiated in FY 1982 is continued in FY 1983. Cost estimates are based on annual "GRASS ROOTS" program office estimating procedure.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	42,200	43,000	42,000		66,000	1,050,800
Procurement (Aircraft)*	1,953,300	1,647,600	1,679,700		10,799,000	20,855,000
(Quantity)	(180)	(96)	(96)		(591)	(1,388)

* (U) Includes weapon system and initial spares.

Program Element: #27133F (64229F) Title: F-16 Squadrons
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
Procurement (Aircraft)*	1,941,900	2,273,000	2,225,900	2,108,700	25,685,200	38,962,600
(Quantity)**	(180)	(120)	(120)	(120)	(1020)	(1985)

*(U) Includes weapon system and initial spares.

** (U) The F-16 procurement estimate of 1985 aircraft supports Air Force efforts to build toward a force structure that increases the number of tactical fighter wings to 44 by FY 90. Of the 1985 aircraft, costing has been included for 597 additional F-16s cost-estimated using a weighted factor for aircraft configuration changes. Funding for development and production of F-16 variants is provided in the FY 83 budget, however, a firm decision on the exact F-16 force structure mix will not be made until after the F-15/F-16 derivative comparison is completed. Balanced procurement of F-15 and F-16 will continue until availability of the Advanced Tactical Fighter (ATF) is assured.

Project: #2671
Program Element: #27133F (64229F)
DOD Mission Area: Close Air Support and Interdiction, #223

Title: F-16 A-D
Title: F-16 Squadrons
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The F-16 Multimission Fighter will provide the Air Force with a means of modernizing and expanding the Tactical Fighter Force under tight fiscal and manpower constraints. Department of Defense efforts to improve the total acquisition process of major weapons systems resulted in increased emphasis on prototyping which led to initiation of the Lightweight Fighter (LWF) prototype program in April 1972. As the LWF prototype program progressed, a growing awareness of the operational performance, capability, and cost advantages offered by the YF-16 and YF-17 resulted in the Air Force decision in April 1974 to pursue development of a missionized LWF to be included in the tactical fighter force structure. At the same time, European interest in the LWF as an F-104G replacement in the 1978-1980 time frame offered the additional potential of foreign military sales and increased North Atlantic Treaty Organization (NATO) force effectiveness. The F-16 will help offset the quantitative advantages of threat forces as well as provide the theater commander the flexibility to counter changing tactical situations.

(U) RELATED ACTIVITIES: The following program elements contain development efforts which are applicable to the F-16: PE 64602F, Armament/Ordnance Development (30mm gun pod, Multiple Stores Ejector Rack); PE 64314F/27163F, Advanced Medium Range Air-to-Air Missile; PE 63249F, Night Attack Program; PE 64249, Night/Precision Attack, (Low Altitude Navigation and Target Infrared System for Night); PE 64725 Aircraft Identification System (Combat Identification System); PE 64201F, Aircraft Avionics Equipment Development (Project 2519, Radar Programmable Signal Processor); PE 64212, Aircraft Equipment Development, (F100 Engine Diagnostic System (EDS)), PE 64218F Engine Model Derivative Program; PE 64737F, Airborne Self Protection Jammer; PE 27423F, Advanced Communication Systems and PE 64778/35164, Global Positioning System. In addition, PE 64268F, Component Improvement Program, funds improvements for the F100 engine which is used in both the F-16 and F 15. Changes from the FY 82 program include addition of the following development efforts which are applicable to the F-16: PE 64742F/27244F Precision Location Strike Systems, PE 64607F Wide Area Antiarmor Munitions (WAAM) and PE 63742 Combat Identification Technology.

(U) WORK PERFORMED BY: The F-16 Program Office of the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH, has management responsibility for the F-16 program. The major contractors are General Dynamics, Fort Worth, TX - F-16 airframe; Pratt & Whitney, East Hartford, CT - engine; Westinghouse, Baltimore, MD - radar; and Singer Kearfott, Little Falls, NJ - inertial navigation set. Major United States subcontractors include Bendix, South Bend, IN - unified fuel control; Sundstrand Aviation, Rockford, IL - starter and constant speed drive; Delco Electronics, Goleta, CA - fire control computer; Menasco Manufacturing, Fort Worth, TX - landing gear; Hamilton Standard, Windsor Locks, CT - augmentor fuel pump, electronic engine control; and AiResearch Manufacturing, Torrance, CA - flap drive and emergency power unit. In addition to these, there are over 4,000 other subcontractors and suppliers in the United States. Major European manufacturers include Fabrique Nationale, Belgium - engine; SABCA/SONACA, Belgium - assembly; FOKKER, The Netherlands - center fuselage and assembly; Per Udsen, Denmark - pylons and vertical fin; Kongsberg Vapenfabrikk, Norway - inertial navigation set, fan drive; and Marconi-Elliott, England - head-up display. Over 40 items are currently being produced in Europe.

Project: #2671 | Title: F-16 A-D
Program Element: #27133F (64229F) | Title: F-16 Squadrons
DOD Mission Area: Counter Air Support and Interdiction, #223 | Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In January 1975, the General Dynamics YF-16 was selected as the winner of the prototype flyoff between the YF-16 and the Northrop YF-17. Pratt & Whitney was selected as the engine contractor. In November 1975, Westinghouse was selected as the radar contractor after a flyoff competition with Hughes. The first Full Scale Development (FSD) aircraft was delivered in December 1976 and the last of the eight FSD aircraft was delivered in June 1978. More than 5,000 test hours have been flown using prototype and preproduction aircraft. The F-16 was approved for full rate production by the Defense Systems Acquisition Review Council in October 1977 and the first production aircraft was delivered in August 1978. Twenty-nine contracts totaling more than $1.5 billion were signed by the end of FY 1978 when our European co-producers with assembly lines in both Belgium and The Netherlands started producing European aircraft. During 1978, Iran and Israel signed agreements with the United States to purchase 160 and 75 aircraft, respectively; Iran cancelled its order in 1979. Israel, the first Foreign Military Sales customer, received the first of their 75 aircraft in January 1980 for training at a United States site. In 1979 the first USAF F-16 unit was activated at Hill AFB, UT, and the first F-16 (European co-produced) was delivered to Belgium. During February through May 1979, the Air Force deployed three full scale development F-16s to Europe for development and operational testing of the aircraft in its intended environment. This testing was completed in 1980 and the results were highly satisfactory. The key problems identified were in radar performance and weapons delivery accuracy. Fixes have been incorporated. For the first three years of operational service, the F-16 performed at or above Tactical Air Command standards in sortie utilization rates and reliability and maintainability. A major milestone was achieved in October 1980 when the first operational squadron at Hill AFB, UT, became combat ready. To date the Air Force has activated F-16 units at MacDill AFB, FL; Nellis AFB, NV; Kunsan AB, Korea, and Hahn AB, GR. In November 1980, the Tactical Air Force (TAF) Commanders approved the F-16 Configuration Plan. The plan, subsequently approved by the Air Force, missionized the F-16 into three basic groups - initial production, air-to-air (swing) and air-to-surface, and configures the aircraft with planned improvements necessary to accomplish the mission. The Multinational Staged Improvement Plan (MSIP) is the management architecture designed to efficiently and effectively implement the TAF F-16 Configuration Plan. MSIP Stage I, initiated in February 1980, provides F-16 aircraft delivered after November 1981 with essential structure, wiring, and interface provisions to support planned aircraft avionics improvements and growth systems (AMRAAM, LANTIRN, PLSS, SEEK TALK, ASPJ, etc.). MSIP II, initiated in May 1981, will provide aircraft avionics and subsystems improvements necessary to support the growth systems. MSIP III is multiphased and is dependent on growth system production availability. The US production rate reached 15 aircraft per month in October 1980 -- the planned maximum. In July 1980, Egypt signed an agreement with the United States to purchase 40 aircraft of which 30 will be diverted from the United States Air Force to be paid back in 1983. Initial development of an improved APG-66 radar to enhance air-to-air and air-to-surface capabilities of the F-16 was started in FY 1980 and will continue into FY 1983. The radar improvements will increase radar detection range and ground image resolution; allow multiple target discrimination and track, and ground moving target track; and improve countering of hostile jamming. Follow-on coproduction with The Netherlands for 111 aircraft as attrition aircraft and F-5B replacements was initiated in FY 1981 with the initial procurement of 22 aircraft.

Project: #2671 | Title: F-16 A-D
Program Element: #27133F (64229F) | Title: F-16 Squadrons
DOD Mission Area: Counter Air Support and Interdiction, #223 | Budget Activity: Tactical Programs, #4

2. (U) FY 1982 Planned Program: The FY 1982 RDT&E funds ($42.0 million) are being used to continue the programmable signal processor (PSP)/dual mode transmitter (DMT) radar improvement effort ($19.1M) and initiate flight test of the hardware (December 1981), to continue air vehicle/engine updates and flight testing including stores certification ($14.2 million), to initiate F-16/Advanced Medium Range Air-to-Air Missile (AMRAAM) integration and compatibility tests ($2.9 million), and for management and engineering support ($5.8 million). The follow-on development program will continue to concentrate on additional airframe, avionics, and weapons certification testing. Primary air vehicle update efforts include avionics software improvements, improved handling qualities and resolution of engine icing problems. Funding for procurement of 120 aircraft is in the FY 1982 Budget. The procurement plan specifies a multiyear procurement strategy for a 120 aircraft per year production rate with a 480 total aircraft buy during FY 1982-1985. The multiyear procurement program should result in an estimated $259.5 million savings over annual procurement of 480 aircraft. Follow-on coproduction efforts are being negotiated with The Netherlands for the second increment (18 aircraft) of the follow-on 111 aircraft procurement. During 1981, Pakistan and Korea signed agreements with the United States to purchase 40 and 36 aircraft, respectively. Venezuela is expected to sign an agreement with the United States by mid FY 1982 for 24 aircraft.

3. (U) FY 1983 Planned Program: The FY 1983 RDT&E funds ($65.1 million) will be used to continue the PSP/DMT radar improvement development and hardware flight test ($26.2 million) and to continue F-16/AMRAAM integration ($10.5 million). Follow-on development efforts (air vehicle engine update and flight testing to include stores certification ($13.6 million)) and management and engineering support ($4.8 million) will continue. Initial development ($10.0 million) of an emergency back-up pump system (EBPS) for the F100-PW-200 engine will start in FY 1983. The EBPS will provide main fuel pump redundancy. Also in FY 1983, AFTEC will initiate operational testing of the Multinational Staged Improvement Plan (MSIP) Stage I' configured F-16 emphasizing testing of the improved radar. The FY 1983 procurement request funds 120 F-16 aircraft within the FY 1982-1985 multiyear procurement program. The last half of the FY 1983 procurement (60 aircraft) is scheduled to be the MSIP Stage II configuration (aircraft No. 786 and on) and will be designated the F-16 C/D. The planned total F-16 procurement increases from 1388 aircraft to 2333 with the FY 1983 Budget Request. This increased aircraft procurement supports continued modernization of the Tactical and Air Reserve Force, while at the same time building force structure.

4. (U) FY 1984 Planned Program: The RDT&E program will continue to support follow-on test requirements on equipment upgrades and identified deficiencies, and will focus on continued development of previously initiated efforts. Funding ($90.9 million) will be used for improved radar follow-on development ($8.9 million), F-16/AMRAAM integration ($30.4 million), emergency back-up pump system development ($13.5 million), Stage II Multinational Staged Improvement Plan (MSIP) retrofit kit development ($24.8 million), AFTEC MSIP Stage II operational testing ($2.2 million), weapons certification ($ 1.5 million) and air vehicle update/management/engineering support/flight test ($9.6 million). The planned FY 1984 procurement request will be for 120 aircraft bringing the total procured through FY 1984 under the 480 aircraft multiyear procurement program to 360 aircraft. Follow-on multiyear procurement plans, if any, for the F-16 (FY 86 and outyear) will be addressed in FY 1984.

Project: #2671
Program Element: #27133F (64229F)
DOD Mission Area: Counter Air Support and Interdiction, #223

Title: F-16 A-D
Title: F-16 Squadrons
Budget Activity: Tactical Programs, #4

5. (U) Program to Completion: This is a continuing program. The FY 1985-1987 RDT&E funding ($60.7 million) will be used to continue integration of improved radar modes in the F-16; to complete F-16/AMRAAM integration; for follow-on testing of the basic APG-66 radar, electronic warfare and weapons updates; and continued mission support. The total F-16 A-D RDT&E program has grown ($105.4 million) between the two budget submissions. Major increases are for additional flight testing/management support for stores certification and improved systems test ($27.2 million); programmable signal processor (PSP)/dual mode transmitter (DMT) radar ($9.2 million); impact of inflation (-$5.7 million); and development of Multinational Staged Improvement Plan Class V modification kits ($24.8 million); re-estimate of AMRAAM integration development ($18.5 million); development of Emergency Backup Pump System ($34.3 million); other estimate refinements (-$2.9 million). Delivery of 10 F-16 C/D aircraft per month to the USAF will continue into FY 1987 increasing to 15 per month in early 1988. The F-16 production program estimate increased from $20855.0 million to $38962.6 million because of the following factors: increased aircraft quantities (1388 to 1985) ($13230.8 million); peculiar support and initial spares for added aircraft ($4393.9 million); revision of the impact of inflation (-$467.4 million); adjustment in the cost of purchasing foreign currency (-$80.4 million); multiyear procurement (FY 1982-1985) (-$259.5 million); PSP/DMT APG-66 radar ($193.6 million); SEEK TALK Group A/B ($111.4 million); ASPJ Group A/B ($480.8 million); AGM-65D and 30mm gun pod Group A ($25.4 million); ALR-74 update Group A/B ($78.2 million); PLSS Group A ($20.7 million); Multinational Staged Improvement Plan (MSIP) Stage II ($335.5 million); AMRAAM Group B ($61.1 million); classified project ($123.8 million); procurement of Alternate Mission Equipment (AME) for attrition aircraft ($43.1 million); production rate change from 8 to 10 aircraft per month effective with FY 1982 procurement (-$1012.3 million); re-estimate of flyaway costs (-$16.2 million); Multiple Stores Ejector Rack ($74.8 million); estimated impact of Netherlands follow-on coproduction ($20.0 million); expanded engine warranty ($64.5 million); peculiar support (AGE, training, data) to support MSIP Stages II and III systems ($581.6 million); repricing of support equipment (-$61.4 million); refinement of estimate for maintenance/training requirements ($11.9 million); data refinement ($8.7 million); and revision of initial spares ($95.0 million) for the first 1388 aircraft.

Project: #2671
Program Element: #27133F (64229F)
DOD Mission Area: Counter Air Support and Interdiction, #223

Title: F-16 A-D
Title: F-16 Squadrons
Budget Activity: Tactical Programs, #4

6. (U) Milestones:

	Date
A. (U) Source Selection/Award Development Contract	Jan 1975
B. (U) Defense Systems Acquisition Review Council (DSARC) II	Mar 1975
C. (U) European Long Lead Funds Released	Jun 1976
D. (U) Delivery First Full Scale Development Aircraft	Dec 1976
E. (U) DSARC IIIA (Long Lead Release)	Jan 1977
F. (U) DSARC IIIB (Production)	Oct 1977
G. (U) First Aircraft to Tactical Air Command	Jan 1979
H. (U) First European Aircraft	Jan 1979
I. (U) Initial Operational Capability (IOC)	Oct 1980
J. (U) Delivery of 651st Aircraft	Sep 1983
K. (U) Delivery of Last F-16 (1985) *(1388, Dec 1991)	May 1992

* (U) The F-16 procurement estimate of 1985 aircraft supports Air Force efforts to build toward a force structure that increases the number of tactical fighter wings to 44 by FY 90. Of the 1985 aircraft, costing has been included for 597 additional F-16s cost-estimated using a weighted factor for aircraft configuration changes. Funding for development and production of F-16 variants is provided in the FY 83 budget, however, a firm decision on the exact F-16 force structure mix will not be made until after the F-15/F-16 derivative comparison is completed. Balanced procurement of F-15 and F-16 will continue until availability of the Advanced Tactical Fighter (ATF) is assured.

Project: #2671
Program Element: #27133F (64229F)
DOD Mission Area: Counter Air Support and Interdiction, #223

Title: F-16 A-D
Title: F-16 Squadrons
Budget Activity: Tactical Programs, #4

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	42,357	42,000	65,100	90,900	60,700	1,156,157
Procurement (Aircraft)*	1,941,900	2,273,000	2,225,900	2,108,700	25,685,200	38,962,600
(Quantity)*	(180)	(120)	(120)	(120)	(1020)	(1985)

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	42,200	43,000	42,000		66,000	1,050,800
Procurement (Aircraft)*	1,953,300	1,641,600	1,679,700		10,799,000	20,855,000
(Quantity)	(180)	(96)	(96)		(591)	(1388)

* (U) Includes initial spares.

** (U) The F-16 procurement estimate of 1985 aircraft supports Air Force efforts to build toward a force structure that increases the number of tactical fighter wings to 44 by FY 90. Of the 1985 aircraft, costing has been included for 597 additional F-16s cost-estimated using a weighted factor for aircraft configuration changes. Funding for development and production of F-16 variants is provided in the FY 83 budget, however, a firm decision on the exact F-16 force structure mix will not be made until after the F-15/F-16 derivative comparison is completed. Balanced procurement of F-15 and F-16 will continue until availability of the Advanced Tactical Fighter (ATF) is assured.

Project: #2835 Title: F-16 Derivative
Program Element: #27133F (64229F) Title: F-16 Squadrons
DOD Mission Area: Close Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: During the FY 1982 Congressional Budget deliberations, Congress approved an additional $15.3 million for the F-16 program to be applied to the flight demonstration of the F-16 derivative ($7 million for the demonstration and $8.3 million to support a flight test evaluation of the F-16 variant using competitive derivative engines). The USAF has stated requirements for increased quantities of around-the-clock air-to-surface tactical aircraft capable of under-the-weather attack at long range. The current TAF capability to perform adverse weather missions is extremely limited and only aircraft equipped to operate in such conditions can satisfy the operational need. The workload to accomplish low altitude, under-the-weather navigation, penetration and attack tasks with state-of-the-art automation/integration will require two crewmembers. The F-111 is the only inventory aircraft capable of providing all weather air-to-surface capability at long ranges. As the multirole F-4 is retired, replacement aircraft are required. In order to minimize the expenditure of development funding, derivatives of aircraft now in production offer an affordable alternative. The proposed F-16 derivative is a near term/medium risk option for meeting around-the-clock air-to-surface mission requirements, and it possesses excellent growth provision for an in-weather capability. In 1980, General Dynamics initiated a company sponsored independent research and development (IR&D) of a new version of the F-16, to enhance its air-to-surface capabilities while still maintaining air superiority characteristics. The major difference between the F-16 variant and the basic F-16 is its advanced aerodynamic configuration. The F-16 wing and horizontal tail are replaced by a cambered "cranked arrow" wing. The fuselage is stretched and a new wing added which provides additional store stations capable of semi-conformal carriage of inventory weapons. The larger wing and fuselage permit increased internal fuel capacity, thereby providing an increase in combat radius The advanced aerodynamic and manufacturing technology wing design also provides improvements in flying qualities and maneuverability, as well as reductions in radar signature and take off and landing roll. Although its primary purpose is to increase the TAF capability to attack targets at greater ranges at night and in adverse weather, the F-16 derivative retains the F-16 air superiority qualities while increasing the long range intercept capability. The F-16 Derivative Project is planned in two phases (Phase I - Aerodynamic/Weapon System validation/verification (FY 82/83); and Phase II Development (FY 84-87)). A decision on development or the exact mix of F-16A through derivative aircraft has not been made.

(U) RELATED ACTIVITIES: The following program elements contain development efforts which are applicable to the F-16 derivatives: Program Element (PE) 64268F Component Improvement Program - funds improvements for the F100 Engine which is used in both the F-15 and F-16; PE 64218F Engine Model Derivative Program; and PE 27130F, F-15 Squadrons, Project 2353.

(U) WORK PERFORMED BY: The F-16 Program Office of the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH, has management responsibility for the F-16 program. The major contractor is General Dynamics, Fort Worth, TX; Westinghouse, Baltimore, MD - radar; and engine - (to be determined; both Pratt & Whitney, East Hartford, CT and General Electric, Cincinnati, OH derivative engines will be evaluated.

Project: #2835
Program Element: #27133F (64229F)
DOD Mission Area: Close Air Support and Interdiction, #223

Title: F-16 Derivative
Title: F-16 Squadrons
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The F-16 derivative prototype program is a General Dynamics' sponsored Independent Research and Development Program and was initiated in December 1980. The program objective is to design, build and safety-of-flight test two prototype vehicles by modification of leased F-16 FSD aircraft. One single place and one two place aircraft are being built. During the FY 1982 Congressional Budget deliberations, Congress approved an additional $15.3 million to be applied to the flight demonstration of the F-16 derivative ($7 million for the F-16 derivative demonstration and $8.3 million to support a flight test evaluation of the F-16 derivative using competitive derivative engines).

2. (U) FY 1982 Planned Program: The FY 1982 RDT&E funds ($15.3 million) are dedicated to developing/testing a semi-conformal weapons carriage release capability and the F-16 derivative demonstration flight tests. Demonstration flight test is scheduled to start in July 1982 using the No. 1 F-16 derivative prototype aircraft. Using Congressional added FY 1982 funding, a flight demonstration program will be initiated to conduct basic flight performance, flutter, loads stability/control testing, and selected weapons carriage and release. This flight test demonstration of the F-16 derivative is needed to validate projected performance and mission capability improvements. Fabrication of the No. 2 F-16 derivative prototype (two-seat) aircraft will be continued in FY 1982 within the General Dynamics' contractor sponsored effort. Engineering of the semi-conformal weapons carriage equipment, including wind tunnel tests, will commence in early FY 82. The General Electrical F101 Derivative Fighter Engine will be installed in the No. 2 F-16 derivative for evaluation.

3. (U) FY 1983 Planned Program: The FY 1983 RDT&E funds ($21.0 million) will be used to complete the F-16 derivative demonstration flight test program. The No. 2 F-16 derivative prototype will begin flight testing in FY 1983 (October 1982). Basic aircraft performance, stability, and control characteristics and flutter will be evaluated. The flight demonstration will include weapons release/accuracy, limited mission capability and other derivative engine evaluations as engine hardware availability and funding permits.

4. (U) FY 1984 Planned Program: The FY 1984 RDT&E ($129.3 million) funds a planned four plus year F-16 derivative development and qualification program (January 1984 through July 1988). This activity will consist of design/fabrication of two F-16 derivative aircraft (Nos. 3 and 4), durability tests; flight and qualification testing of the air vehicle; and development of F-16 derivative peculiar support systems.

5. (U) Program to Completion: This is a continuing program. The FY 1985-1988 RDT&E funding to complete full scale development (FSD) is $519.9 million. F-16 derivatives No. 1 and No. 2 from the demonstration program will be flown throughout the period joined in mid FY 1986 by aircraft No. 3 and No. 4 to complete the full complement of FSD type evaluation flight tests. F-16 derivative peculiar tech data will be prepared and peculiar support and training equipment will be qualified by the end of this development period.

Project: #2835 | Title: F-16 Derivative
Program Element: #27133F (64229F) | Title: F-16 Squadrons
DOD Mission Area: Close Air Support and Interdiction, #223 | Budget Activity: Tactical Programs, #4

6. (U) Milestones:

	Date
A. (U) F-16 No. 1 Prototype First Flight	Jul 1982
B. (U) F-16 No. 2 Prototype First Flight	Oct 1982
C. (U) F-16 Derivative Full Scale Development Start	Jan 1984

(U) EXPLANATION OF MILESTONE CHANGES

The F-16 derivative was not addressed in the FY 1982 descriptive summary.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		15,284	21,042	129,302	619,600	785,228
Procurement (Aircraft)						
(Quantity)						

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

Program Element: #27133F (64229F) Title: F-16 Squadrons
DOD Mission Area: Counter Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

Test and Evaluation Data

1. (U) Development Test and Evaluation: General Dynamics is the prime contractor for airframe and support equipment development and Pratt & Whitney is responsible for continued development of the F100 engine. Most of the major development testing on the basic aircraft, subsystems, and support equipment have been completed. Performance and stability and control testing indicate that the aircraft can meet design specifications and be employed effectively throughout the flight envelope. The F-16 has demonstrated that it can carry and employ a varied mix of weapons including air-to-air ordnance, air-to-surface guided missiles, conventional bombs, and nuclear weapons. The F-16 radar meets basic specifications and can be used effectively to deliver air-to-air and air-to-ground weapons. Ground testing results indicate an airframe life of at least 8,000 hours. As would be expected in any development program, there have been changes required to correct problems identified during the test program. Fixes have been designed, tested, and incorporated into the production aircraft. The last of the development aircraft was delivered in August 1978 and the first F-16 unit was activated at Hill Air Force Base, UT, in January 1979. All weather testing in desert and tropical climates is completed. Alaskan cold weather tests and an evaluation in European weather conditions were completed in early 1979. Testing to evaluate engine inlet icing problems was initiated in Calendar Year 1979 and verified the value of the heated inlet strut. Additional climatic lab entries and in-flight icing tests will continue in Fiscal Year 1981 to explore long term improvements to minimize foreign object damage due to ice ingestion.

(U) Future flight tests will include certification of additional weapons, continued systems integration tests, and evaluation of fixes for previously identified deficiencies. The major test activity in follow-on development will be evaluation of the enhancement of aircraft systems necessitated by threat evolution. Reliability and Maintainability (R&M) testing has been an integral part of the development effort and the F-16 currently indicates it can meet R&M goals established at program approval.

(U) A January 1980 decision by the Air Force to authorize 11 production aircraft for follow-on testing initiated a major effort by Air Force Systems Command to upgrade the F-16 test fleet. Seven aircraft will be assigned to Eglin AFB (Advanced Medium Range Air-to-Air Missile, Low Altitude Navigation Targeting Infrared Night, SEEK EAGLE and weapons development) and four will be assigned to Air Force Flight Test Center (systems verification and follow-on structures/improvement). Current testing is provided by five (of eight original) full scale development aircraft and the first three test designated production aircraft. F-16A, No. 4, has been decommissioned and will be used as an Air Training Command loading trainer. A second F-16A, No. 6, supports the control configured vehicle Advanced Fighter Technology Integration program. F-16B, No. 2, has been leased to General Dynamics for the F-16/J-79 program. Flight testing of the F-16/J-79 was conducted October-December 1980. Flight testing of the F-16/F101 (F-16A, No. 1) Derivative Fighter Engine was initiated in mid-December 1980 and was completed May 1981. The Air Force has leased F-16As, Nos. 3 and 5 to General Dynamics to support a contractor Independent Research and Development (IR&D) of an F-16 derivative prototype. Congress supported Air Force flight evaluation of the derivative aircraft adding FY 1982 funding to the F-16 program.

First flight of the number one derivative prototype is scheduled in July 1982 followed by flight of the number two derivative prototype in October 1982. The No. 2 prototype will incorporate the General Electric F101 derivative fighter engine for evaluation. The demonstration flight test is to validate/verify aircraft aerodynamic changes and weapon carriage/release capabilities. Flight test of the Programmable Signal Processor (PSP) Dual Mode Transmitter (DMT) APG-66 radar in a saberline was initiated in December 1981. The improved radar testing will continue into 1983.

2. Operational Test and Evaluation:

a. (U) The initial operational test and evaluation (IOT&E) was conducted in conjunction with the development test and evaluation (DT&E) from December 1976 to October 1977. The IOT&E results, reported in the Air Combat Fighter IOT&E Final Report, January 1978, US Government distribution, supported a production recommendation to the Defense Systems Acquisition Review Council IIIB. Follow-on operational test and evaluation (FOT&E), Phase I, was completed in January 1979, and reported in the F-16 FOT&E Final Report, Phase I, June 1979, US Government distribution.

b. (U) The purpose of the operational test and evaluation (OT&E) is to evaluate the operational suitability and effectiveness of the F-16 weapon system. The radar/heads-up display/fire-control system interface was evaluated in air-to-air missions against projected simulated threat aircraft and in air-to-surface attack missions. Air-to-air weapons such as the AIM-9 and M61 gun were fired at realistic maneuvering targets. Day and night evaluation of the F-16 air refueling capability was accomplished. The F-16's performance and handling characteristics were qualitatively and quantitatively evaluated while performing basic fighter maneuvers and air combat maneuvers against current and projected simulated threat aircraft. The electronic countermeasures capability and electromagnetic interference susceptibility of the F-16 were evaluated. In addition, the operational suitability evaluation included: reliability and maintainability to include maintenance support factors, potential maintenance safety hazards, and determination of training requirements and operating and support costs.

c. (U) The combined DT&E/IOT&E was conducted primarily at Edwards Air Force Base, CA. Other test sites were Nellis Test Range, NV; China Lake, CA; Alaska; El Centro, CA; Yuma, AZ; Panama, CZ; and Eglin AFB, FL. An Air Force Test and Evaluation Center (AFTEC) test team composed of personnel from AFTEC, Tactical Air Command, Air Force Logistics Command, and Air Training Command conducted the OT&E portion of the combined tests. Test resources were incrementally increased to a total of 11 aircraft of which eight were preproduction aircraft and three were production. Additionally, a combined Air Force Systems Command/Air Force Test and Evaluation Center (AFTEC) European Test and Evaluation (ET&E) with three aircraft was conducted from February to May 1979. Test sites included Bodo Air Base, Norway; Skrydstrup Air Base, Denmark; Hahn Air Base, Germany; and Alconbury Air Base, United Kingdom.

d. (U) Follow-on test and evaluation Phase II was conducted at Hill Air Force Base, UT, and in Europe from January 1979 through December 1980. Tactical Air Command was responsible for operational effectiveness, and Air Force Test and Evaluation Center (AFTEC) further evaluated operational suitability. The AFTEC assessment included reliability/maintainability data generated by all F-16 aircraft assigned to Hill AFB, UT.

e. (U) F-16 Follow-on Operational Test and Evaluation (FOT&E)/Tactics Development and Evaluation (TD&E) Phase II commenced during January 1979 at Hill AFB, UT. This FOT&E/TD&E was carried out jointly by the Air Forces of Belgium, Denmark, The Netherlands, Norway, and the United States. FOT&E/TD&E Phase II has been designated as the Multinational Operational Test and Evaluation (MOT&E). The MOT&E consisted of two parts: Part I was accomplished in the United States (Hill AFB) from January 1979 through June 1980, and utilized test facilities and ranges at the following locations: Utah Test and Training Range, UT; White Sands Missile Range, NM; and the Nellis Range Complex in Nevada. Part II was carried out in Europe, from locations within the countries of the European Participating Air Forces (EPAF) between July and December 1980. In both parts of the Multinational Operational Test and Evaluation (MOT&E) program, a mix of USAF and European Participating Air Force (EPAF) production aircraft were used, with a maximum of 10 F-16s used as test assets during Part I. Tactical Air Command was responsible for the operational effectiveness and tactics development objectives, Air Force Test and Evaluation Center (AFTEC was responsible for the suitability assessment).

f. (U) The purpose of the MOT&E was to refine estimates of F-16 operational effectiveness, assist in evaluation of configuration changes, develop tactics and operating concepts for F-16 employment, and assess the operational suitability of the aircraft. Multinational test team training was accomplished between January 1979 and July 1979.

g. (U) AFTEC flew 467 front seat and 98 back seat sorties during initial operational test and evaluation (IOT&E)/ Follow-On Operational Test and Evaluation (FOT&E). This included six months of testing on two near production configured full-scale development aircraft and seven aircraft-months on the first three production aircraft. Operational test and evaluation (OT&E) testing included beyond visual range missions with F-4 and T-38 aircraft; operational comparisons, basic flight maneuvers and air combat maneuvers with F-4E, F-5, A-37, and T-38 aircraft; night and day air-to-surface bombing and strafing; air-to-air gunnery against towed targets; and AIM-9J/L firings against BQM-34, PQM102, and QB-50 drones.

h. (U) Weapons system performance was overall satisfactory. Major operational effectiveness deficiencies by the end of IOT&E/FOT&E and status were as follows:

(1) Improvements were incorporated during European Test and Evaluation (ET&E) and were satisfactory.

(2) Corrections are identified in Engineering Change Proposal 206 and are being evaluated during MOT&E.

Program Element: #27133F (64229F) Title: F-16 Squadrons
DOD Mission Area: Counter Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

(3) Deficiencies were verified during ET&E. An accuracy test program is underway during follow-on full scale development (FSD) and MOT&E.

(4) (U) Poor reliability of jet fuel starter: Satisfactory performance was demonstrated during ET&E, but problems still exist. Extensive changes are in work and will be further evaluated during MOT&E.

i. (U) Reliability and Maintainability (R&M) estimates indicated an overall satisfactory rating. The IOT&E/FOT&E assessments for late FSD and production aircraft projected satisfactory mean time between maintenance (MTBMa) and maintenance man-hours per flying hour (MMH/FH) for the mature F-16. Average F-16 MTBMa (for inherent failures) of 0.87 hours compared very favorably with the F-4 and A-7D mature average of 1.0 at the end of FSD. F-16 MMH/FH of 35.7 nearly equalled the mature F-4's 35. Corrective actions to fix major discrepancies affecting R&M goals (i.e., chafing and routing of aircraft wiring, high rate of fuel leaks, and excessive fuel venting due to heat expansion) were incorporated and were satisfactory during ET&E. Damage or loss in flight of nonmetallic panels is no longer a problem due to replacement with metal panels. Concerns remaining at the end of IOT&E/ FOT&E included high could-not-duplicate rates for built-in-test/pneumatic, auxiliary power, flight control, and fuel systems; and supportability of the hydrazine emergency power unit. Further evaluation of these areas continued during MOT&E as the F-16 Weapon System matures.

j. During the European Test and Evaluation (ET&E), the F-16 was exercised through a wide variety of realistic operational mission scenarios to provide an early assessment of its effectiveness and suitability when operated in its intended environment. One hundred forty-two sorties were flown for an effective sortie rate of 0.78. This was well above the planned rate of 0.50. As reported in the European Test and Evaluation Final Report Addendum, F-16 Follow-on Operational Test and Evaluation (FOT&E) Phase I, November 1979, US Government distribution overall F-16 performance was highly satisfactory. The aircraft performed exceptionally well during air combat maneuvers, F-15/F-16 composite operation tactical air-to-surface missions, and conventional nuclear weapon strike, and sea surveillance missions were satisfactory. Radar sea modes performance was excellent during sea surveillance missions. Taxi, takeoff, and landing on icy surfaces presented no major problems.

k. (U) Operational effectiveness deficiencies noted during ET&E included the following:

(1) (U) Engine icing during ground operations: At near freezing temperature, induction icing occurred when the engine ingested standing water. Although this creates the potential for engine damage, none was observed during the test. Numerous fixes in work include: (a) pilot manual selection of anti-ice; (b) heated intake strut; and (c) additional heat through thirteenth stage compressor inlet guide vanes.

(2) (U) Inadequate lighting for night air refueling: Satisfactory solutions have been identified.

(3) (U) Fuel venting during air refueling: Problem attributed to fuel distribution. Engineering Change Proposal (ECP) 478 incorporates redesign with effectivity during late Calendar Year 1980-early Calendar Year 1981.

Program Element: #27133F (64229F) Title. F-16 Squadrons
DOD Mission Element: Counter Air Support and Interdiction, #223 Budget Activity: Tactical Programs, #4

(4) (U) False radar targets: Caused by radar side lobes reflecting off the surface and frequency instability in the main beam. Solutions have been tested, approved, and incorporated.

(5) European test and evaluation software updates provided significant improvement. Further corrections were evaluated during Multinational Operational Test and Evaluations (MOT&E).

(6) Software changes were evaluated by Multinational Test and Evaluation. Progress is evident.

(7) A pilot selectable fix is in test.

(8) Inaccuracies were observed during follow-on operational test and evaluation (FOT&E) and verified during European Test and Evaluation (ET&E). Bore-sig procedures have been improved; corrected canopy distortion algorithms and slant range corrections have been installed in the fire control computer; and updated weapons separation effects have been included in the storage management compute Testing has demonstrated that these solutions meet specifications, and fixes are in the field.

(9) This deficiency was identified late in the Follow-on Operational Test and Evaluation (FOT&E) program. Corrections through ECP 206 have been evaluated by MOT&E and determined to be satisfactory.

(10) (U) Fire control/navigation panel difficult to operate by pilot: Fixes have been tested, approved, and production incorporated.

l. (U) F-16 reliability and maintainability during ET&E was satisfactory to excellent. Mean man-hours per flying hour was 17.3. Aircraft flyable rate was excellent at 82 percent. This compares with the end follow-on operational test and evaluation rate of 54 percent. Problems included low reliability of the radar digital signal processor and low power radio frequency units, and a high rate of nonduplicatable avionics/electrical malfunction indications. A hydrazine spill resulted in equipment improvements. Operations from five different North Atlantic Treaty Organization (NATO) shelter types were satisfactory.

m. (U) Final operational suitability evaluation will be reported by Air Force Test and Evaluation Center (AFTEC) at the close of multinational operational test and evaluation.

Program Element: #27133F (64229F)
DOD Mission Area: Counter Air Support and Interdiction, #223

Title: F-16 Squadrons
Budget Activity: Tactical Programs, #4

3. (U) Systems Characteristics:

(U) Technical Information:

(U) Length (ft)	49.5
(U) Wing Span (w/missiles) (ft)	32.8
(U) Operating Weight (empty) (lbs)	16,126 1/
(U) Internal Fuel (lbs)	6,972
(U) Current Max Takeoff Gross Weight (lbs)	35,400
(U) Max Payload w/Full Internal Fuel (lbs)	12,302
Engine Thrust (lbs)	

1/ Projected Block II weight (aircraft #160).

(U) Performance Thresholds: (F-16 Development Concept Paper)

	Threshold	Performance Demonstrated
Radius - Air Superiority Mission (NM)		
Radius - Air-to-Surface Mission (NM) 1/		
Sustained Turn Rates		
1.2 Mach/30,000 ft (°/sec)		
1.2 Mach/30,000 ft (G)		
0.9 Mach/30,000 ft (°/sec)		
0.9 Mach/30,000 ft (G)		
Acceleration Time		
0.9-1.6 Mach/30,000 ft (sec)		
Max Controllable G		
0.8 Mach/40,000 ft (G)		
Ferry Range (NM)		

1/ Assumes maximum gross weight increased to 35,400 pounds.

(U) Other Characteristics:

(U) Takeoff Distance (Air-to-Air Mission) (ft)	N/A	2200
(U) Landing Distance (ft) (estimated)	N/A	3300
(U) Mission Reliability (%)	90	91
(U) Mean Flight Time Between Failure (hrs)	2.90	2.20
Radar Detection Range, 2 sq meter Target (look up/look down)		

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27136F
DoD Mission Area: Defense Suppression, #224

Title: F-4G Wild Weasel Squadrons
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981* Actual	FY 1982* Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL PROGRAM FOR ELEMENT	4,525	6,276	21,472	18,020	Continuing	Not Applicable
327B	F-4G Wild Weasel Squadrons	4,525	6,276	21,472	18,020	Continuing	Not Applicable

* Effort performed in PE 27128F, F-4 Squadrons

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The F-4G Wild Weasel represents the only lethal defense suppression weapons system in the Air Force inventory. This system is specifically designed to automatically detect, identify, locate, and destroy hostile radar emitters by the use of anti-radiation missiles, standoff guided munitions, or conventional F-4 weapons. The F-4G is classically employed in the counter-air role as an escort for a penetrating strike force or independently as a hunter-killer force against targets of opportunity.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Engineering design and development of system updates are required to maintain the F-4G/APR-38 capability at a level commensurate with the ever increasing hostile radar threat environment. Engineering development of performance updates is on a priority basis to the stated needs of the tactical air force. The performance updates will be grouped to ease aircraft configuration control during F-4G modification periods, the first of which is expected to begin in 1986. Performance updates and various aircraft modifications require similar engineering efforts to maintain the F-4G simulator currency. Cost estimate is based on Air Force Systems Command pricing models.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: (PE 27128F)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	6,800	6,400	6,700		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: None

Program Element: #27136F   Title: F-4G Wild Weasel Squadrons
DoD Mission Area: Defense Suppression, #224   Budget Activity: Tactical Programs,

DETAILED BACKGROUND AND DESCRIPTION: The USAF initially encountered radar controlled surface-to-air missile (SAM) weapons systems in North Vietnam in 1965. Wild Weasel configurations of the F-105 and F-4C were developed from off-the-shelf hardware as a quick reaction counter to this threat. The SAM and radar controlled anti-aircraft artillery (AAA) threat has continued to expand in both quantity and quality since then. Development of the F-4G Wild Weasel started in 1970 as a counter to this increasingly hostile threat environment. The F-4G/APR-38 system provides a cockpit display to identify the type of threat (SAM, AAA, etc.), the azimuth to that threat, [

] It employs a phase interferometer antenna system to provide highly accurate target azimuth and elevation direction finding (DF) information, 360 degrees around the aircraft. Digital computer controls allow the location of a designated target to be carried in memory if the tracking emitter is shut down; the DF information is of the quality necessary to successfully execute blind delivery of area munitions via the memory function. With the information available in the cockpit, the aircrew has a range of attack options. If the emitter remains active during the engagement the crew can hand-off APR-38 data directly to an antiradiation missile. Should the emitter shut down before an antiradiation missile engagement can be completed, the crew can use the position data in the APR-38 memory to either cue them for visual delivery of conventional or guided weapons or allow them to execute a blind delivery of area munitions. Intelligence data suggests the threat will continue to increase in complexity and technical sophistication. This program will develop updates to the F-4G to keep it a responsive system to the enemy threat environment into the It will also enable the F-4G to fully exploit the capabilities of the High-Speed Antiradiation Missile (HARM). Immediate tasks include computer expansion, integration of the HARM, receiver-processor modification to handle frequency agile threats, and frequency expansion to Future updates will include detection, identification, and location of and other advanced enemy threats. All updates will be incorporated into the F-4G simulator.

(U) RELATED ACTIVITIES: Air Force advanced and engineering development program elements (PE 63718F - Electronic Warfare Technology, 64738F - Protective Systems, 64739F - Tactical Protective Systems) are currently developing the generic electronic warfare technologies necessary to counter the advanced threat radars. The imaging infrared (IIR) Maverick and HARM are both programmed for interface with the F-4G (PE 27162F and PE 27313F, respectively). New inertial navigation system is to be installed by Air Force Logistics Command as a Class IV modification and will interface with the APR-38. The above programs are responsible for funding and developing the required interfaces for the F-4G/APR-38 system; however, this program will ensure overall system compatibility/integration. Modification of F-4G aircraft with performance updates developed in this program will begin in FY 1985.

(U) WORK PERFORMED BY: Ogden Aerospace Logistics Center, Utah is responsible for the management of F-4G enhancement programs. Air Force Systems Command (AFSC); Air Force Test and Evaluation Center, Kirtland AFB, NM; and Tactical Air Command, Langley AFB, VA are jointly responsible for the testing of the F-4G. AFSC is responsible for the subsystem and interface development of F-4G/APR-38 enhancements. Contractors are: McDonnell-Douglas, St. Louis, MO - Airframe; IBM, Owego, NY - Receiver; LORAL, New York, NY - Display; Texas Instruments, Austin, TX - Processor; Singer-Link, Binghamton, NY - Simulator.

Program Element: #27136F
DoD Mission Area: Defense Suppression, #224

Title: F-4G Wild Weasel Squadrons
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Initial contracts to develop the APR-38 receiver system for integration into the F-4D aircraft were awarded in December 1970; F-4D development test and evaluation flight testing was completed in FY 1974. In January 1974, the Air Force Council expanded the program's scope for the following reasons: (a) force structure projection: (b) F-4D versus F-4E airframe service life; and (c) intelligence information gained from the 1973 Middle East conflict. This redirection added a special warning receiver function, inflight recorder, and ground playback station; doubled computer memory capacity to increase the threat handling capability; converted to the F-4E aircraft; and for logistical support considerations, redesignated the weapons system F-4G. F-4G development test and evaluation/initial operational test and evaluation (DT&E/IOT&E), continued on the above mentioned items with flight test completion in August 1976. The IOT&E identified system deficiencies that necessitated returning the aircraft to DT&E. These deficiencies were (1) low-band location inaccuracy; (2) signal processing prioritizing and display errors, (3) improper indications from the special warning function, and (4) built-in-test malfunction. Follow-up DT&E/IOT&E began in September 1976 and was satisfactorily completed in February 1977. Full scale production of the F-4G was approved in March 1977.

The first production F-4G was delivered to Tactical Air Command in October 1977 and verification flight testing was satisfactorily completed in February 1978. The second aircraft was delivered in January 1978. These two aircraft entered follow-on test and evaluation on 6 February 1978; testing was satisfactorily completed on 28 July 1979. Delivery of the last (116th) F-4G was completed in May 1981. Tactical Air Command achieved initial operational capability in April 1979 when the first squadron (24 primary aircraft authorization (PAA)) was declared combat ready. The full operational capability was achieved in January 1981. Force structure beddown includes: in the United States Air Forces in Europe; in Pacific Air Forces; and in Tactical Air Command. is also assigned to Tactical Air Command.

With the exception of the ground playback station, all planned development for the basic F-4G was completed with FY 1977 funds. The Air Force completed the ground playback station in FY 1979. The Air Force started a threat update program in FY 1978 to ensure the F-4G maintains a viable operational capability against the constantly changing threat environment. Specific updates being addressed include: (1) frequency extension from (3) increased computer capability; (4) component technology and technique updates to reduce system operations and maintenance costs; (5) increased accuracy in the low band receiver system; (6) incorporation of an detection capability; (7) modification required to effectively engage (8) frequency extension to (9) improved total system accuracy to increase the probability of kill when employing smart munitions cued by the APR-38, particularly the imaging infrared Maverick; and (10) incorporation of the capability to detect and engage threat systems. In FY 1979 the Air Force completed the engineering development and design feasibility studies started in 1978 and assembled resulting data for evaluation in FY 1980.

Program Element: #27136F DoD Mission Area: Defense Suppression, #224

Title: F-4G Wild Weasel Squadrons Budget Activity: Tactical Programs, #4

(U) In FY 1981 the Air Force planned to begin full scale development of an APR-38 performance update as a result of the FY 1980 data evaluation. Requests for proposal were prepared and released followed by evaluation of the two proposals submitted. Both submissions were deemed by the Air Force to be non-responsive and source selection for the full scale development was terminated.

2. FY 1982 Program: The Air Force will complete the source selection for the performance update program originally planned for FY 1981. The total slip in the program schedule is estimated to be six months. The full scale development will be in two phases. Phase I will concentrate on expanding the on-board computer capability so the F-4G will have the necessary memory to interface with the HARM, high-speed anti-radiation missile. The computer expansion is planned for operations. Phase II will engineer the other hardware and software changes identified in the FY 1980 evaluation. These changes are scheduled to be operational in

3. (U) FY 1983 Planned Program: The Air Force will continue the engineering efforts started in FY 1982. The increase in FY 1983 funds from $6,700K shown in the FY 1982 Descriptive Summary to $21,671K shown this year reflects the Air Force decision to implement the F-4G performance updates based on the FY 1980 evaluation.

4. FY 1984 Planned Program: The Air Force will continue the engineering efforts started in FY 1982 and will investigate available technology for further performance expansions

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27162F
DoD Mission Area: Defense Suppression, #224

Title: Tactical Air-to-Ground Missiles
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	7,057	4,284	4,790	3,759	0	29,146
2330	High Speed Anti-Radiation Missile (HARM), AGM-88	7,057	4,284	4,790	3,759	0	29,146

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The increased sophistication, concentration, and lethality of enemy ground-based, radar guided, missile and antiaircraft artillery systems threaten the ability of tactical aviation to accomplish its mission and survive. Antiradiation missiles provide a lethal counter to this threat. The High Speed Anti-Radiation Missile (AGM-88, HARM) is being developed by the Navy to provide a significant upgraded capability against the threat. The F-4G Wild Weasel represents the only dedicated lethal defense suppression weapon system in the Air Force inventory. When deployed, HARM will be its primary weapon. This element will fund the Air Force unique portions of the joint Navy/Air Force HARM development program.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Program funding completes residual tasks remaining from the FY 1982 Initial Operational Test & Evaluation and from the September FY 1982 Defense System Acquisition Review Council III. This effort also incorporates Pre-Planned Product Improvement activity in FY 1983, whose focus is to increase the cost effectiveness of the F-4C/HARM weapon system. RDT&E cost estimate is based on Program Office engineering cost projections and contractor quotes.

COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	8,100	4,300	TBD	TBD	TBD	TBD
Procurement (Missile)*		93,100	TBD	TBD	TBD	TBD
Quantities		136	TBD	TBD	TBD	

Project: #2330
Program Element: #27162F
DoD Mission Area: Defense Suppression, #224

Title: AGM-88, HARM (High Speed Anti-Radiation Missile)
Title: Tactical Air-to-Ground Missiles
Budget Activity: Tactical Programs, #4

OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
Procurement (Missile)*		93 000	169,100	249,300	3,397,800	3,909,200
Quantities		136	206	358	13,621	

*Includes initial spares

Project: #2330
Program Element: #27162F
DoD Mission Area: Defense Suppression, #224

Title: AGM-88, HARM (High Speed Anti-Radiation Missile)
Title: Tactical Air-to-Ground Missiles
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The HARM is an air-to-surface antiradiation missile which has been in development by the Navy since 1971. It is an evolution of current Anti-Radiation Missile (ARM) weapons designed to damage or suppress radar-directed air defense systems. Antiradiation missiles currently in the inventory (AGM-45 SHRIKE and AGM-78 STANDARD ARM) are and SHRIKE procurement was terminated in FY 1978. The requirement for an advanced High Speed Anti-Radiation Missile (HARM) was identified by the Tactical Air Forces in March 1975. The Air Force has identified HARM as the solution for the near-term portion of this requirement. Missile design goals are: moderate missile size and weight, and the ability to The HARM, when integrated with the F-4G Wild Weasel, will give the Tactical Air Force a dedicated and highly capable antiradiation weapon system.

(U) The Air Force, as participating service in the joint Navy/Air Force HARM Program, will fund only those development efforts that are unique to the Air Force. The main thrust of this program will be to integrate the HARM with the F-4G. This integration will require the development and testing of computer software, tests necessary to certify the missile for carriage and launch from the aircraft, and ground and flight tests of the avionics/missile interface. Additionally, peculiar Air Force ground support equipment and technical manuals will be developed. HARM begins joint full scale production in FY 1982. The F-4G/HARM will be the only dedicated lethal defense suppression weapon system in the field for a considerable time into the future. As such, one focus of related follow-on Air Force HARM development effort in FY 1983/84 will be to conduct a Pre-Planned Product Improvement for HARM to optimize the F-4G/HARM cost-effectiveness.

A recent Air Force Studies and Analyses evaluation of HARM effectiveness (SABER COUNTER HOTEL) reported that the F-4G/HARM defense suppression system could increase A-10 survivability by as a result of having HARM coverage available. In additon, A-10 attrition rate per sortie is reduced by when HARM, vice SHRIKE or Standard ARM are employed in a Central European engagement with the Soviets. Moreover, at least less HARMs than SHRIKEs or Standard ARMs are fired for each aircraft saved. HARM alone was effective, in the study, when the enemy used SHRIKE and Standard ARM are and HARM will replace both of them. The break even unit cost of HARM was over

(U) RELATED ACTIVITIES: The HARM has been designated as the primary Anti-Radiation Missile for the F-4G Wild Weasel. A Memorandum of Agreement of July 1975 between the Air Force and Navy Assistant Secretaries for Research and Development names the Navy as the Executive Service and the Air Force as the Participating Service in the Joint Service HARM Development Program. The F-4G APR-38 Radar Homing and Warning Receiver is optimized in Program Element 27136F, F-4G Wild Weasel Squadrons, to fully utilize HARM's capabilities.

(U) WORK PERFORMED BY: The HARM Development Program is managed by the Navy HARM Program Office, at Naval Air Systems Command, Arlington VA, with an Air Force Deputy Program Manager and staff. Management of Air Force unique requirements

Program Element: #27162F
DoD Mission Area: Defense Suppression, #224

Title: Tactical Air-to-Ground Missiles
Budget Activity: Tactical Programs, #4

is provided by the Armament Division, Eglin AFB, FL. Principal contractors are: Texas Instruments, Lewisville, TX; McDonnell Douglas Aircraft Corporation, St Louis, MO; Thiokol, Brigham City, UT; and Motorola, Scottsdale, AZ. Government facilities such as the Aeronautical Systems Division, Wright-Patterson, AFB, OH; Naval Weapons Center, China Lake, CA; and the Air Force Flight Test Center, Edwards AFB, CA are also utilized. Air Force independent testing is conducted by dedicated personnel from the Air Force Test and Evaluation Center (AFTEC), Kirtland AFB, NM; and by operational Tactical Air Command pilots detailed to the AFTEC test detachment from George AFB, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 AND PRIOR ACCOMPLISHMENTS: Studies and flight tests began in June 1977 to certify the HARM and LAU-122 launcher for carriage on the F-4G Wild Weasel. Development of computer software to integrate the HARM with the F-4G APR-38 avionics began in 1978. A Defense System Acquisition Review Council II A was held on 14 Feb 1978. On 23 March 1978 the Secretary of Defense approved HARM's entry into engineering development. Modifications to the F-4G, to include weapon carriage and software changes to integrate HARM with the APR-38, have been developed, bench tested and flown in a series of live firings and captive carry flight missions. HARM Development Test and Engineering firings were completed in Oct 1980. This included a total of missile firings, from the F-4G and from the Navy A-7F aircraft. of these firings were a complete success, The missile demonstrated an average miss distance (closest point of approach) of feet as compared to the required thirty feet. A Department of Navy Systems Aquisition Review Council II B held in Nov 1980 evaluated test results of prototype misile firings, and approved proceeding to Navy pilot production in 1981. The Secretary of Defense certified HARMs readiness for pilot production to Congress in Jan 1981. Correction of the deficiencies found during Development Test and Evaluation were completed, and successfully evaluated in Navy Technical Evaluation firings and a limited captive carry effort.

2. FY 1982 Program: A Joint/Navy senior level program review approved release of long lead FY 1982 procurement funding in advance of Milestone III, to preclude creating a costly gap between the FY 1981 concurrent pilot production and FY 1982 full production program. The joint Air Force Initial Operational Test and Evaluation began in Nov 1981, concurrent with Navy limited pilot production. The joint test will be completed in time for the Defense Systems Acquisition Review Council III in September, 1982. The joint test program prior to Milestone III will evaluate missiles, avionics, peculiar ground support equipment and government furnished equipment against the full range of operational effectiveness and suitability requirements. The Air Force plans to conduct a second phase of the Initial Operational Test and Evaluation after the Milestone III decision. The second phase test objective is to evaluate the F-4G/High Speed Anti-Radiation Missile, which will utilize the capability of the F-4G/APR-38 avionics. The Air Force plans to procure 136 missiles in FY 1982.

3 FY 1983 Planned Program: The Air Force will conduct a Follow-on Operational Test and Evaluation to insure that any latent test issues that could arise in Initial Operational Test and Evaluation are incorporated and evaluated. A Pre-Planned Product Improvement effort will be initiated by the Air Force and Navy to optimize the cost-effectiveness of the High Speed Anti-Radiation Missile. This effort includes (1) joint service funding to qualify a second

source missile producer to competitively reduce unit cost and improve field reliability, (2) initiation of a government lot acceptance test effort to focus on quality assurance, (3) development of a feature for the missiles, and (4) reliability improvement for missile critical life items. Air Force plans to procure 206 missiles in FY 1983.

4. FY 1984 Planned Program: The Pre-Planned Product Improvement effort is continued. Air Force achieves an Initial Operational Capability in

5. (U) Program to Completion: Missile deliveries to Air Force inventory continue. The first competitive dual source missile buy is planned for FY 1986.

6. (U) Milestones:

				Date
A.	(U)	DSARC I		Oct 1972
B.	(U)	DSARC II		Jan 1977
C.	(U)	DSARC II A (additionally)		Feb 1978
D.	(U)	DSARC II B		Nov 1980
E.	(U)	Begin IOT&E	*(Jul 1981)	Nov 1981
F.	(U)	DSARC III	*(Apr 1982)	Sep 1982
G.	(U)	Air Force Deliveries begin	*(Sep 1983)	Nov 1983
H.		Air Force Initial Operational Capability		

* Date presented in Fiscal Year 1982 Descriptive Summary.

Explanation of Milestone Changes: The slip in start of the Initial Operational Test and Evaluation is due to the contractor delays in incorporating software changes to missiles, and weather delaying Navy Technical Evaluation firings. Slip in DSARC III is due to testing delays. The slip in delivery start date is a result of components.

7. (U) Resource: Not Applicable

8. (U) Comparison with FY 1982 Budget Data: Not Applicable

Budget Activity: Tactical Program, #4
Program Element: #27162F Tactical Air-to-Ground Missiles

Test and Evaluation Data

1. (U) Development Test and Evalua ion (DT&E): The AGM-88 High Speed Anti-Radiation Missile (HARM) is a joint Navy/Air Force project with the Navy as Executive Service. The Navy conducted Engineering Development under Program Element 64360N. Naval Weapons Center, China Lake was the lead organization. Texas Instruments was chosen as the Weapon System Integration Contractor. The Air Force monitored the Navy Development Test and Evaluation and also conducted eight of the eighteen live firings. Air Force Development Test and Evaluation addressed the integration of the High Speed Anti-Radition Missile with the F-4G Wild Weasel, which contains the APR-38 avionics suite. Since 1977, modification to the F-4G to integrate the High Speed Anti-Radiation Missile have been developed, bench tested, and flown in a series of captive flight missions. Computer software, developed to integrate the High Speed Anti-Radiation Missile with the APR-38 have been bench/ground tested; and evaluated in captive flight tests and High Speed Anti-Radiation Missile firings from the F-4G.

Prototype missiles and pilot production missiles were procured during Development Test and Evaluation. Prototype and pilot production hardware contain High Speed Anti-Radiation Missile capabilities which were developed during the extended phase of advanced development. Test results are shown in Navy Program Element 64360N Descriptive Summary.

Prototype Missiles - These missiles were being tested to evaluate performance of the contractor prototype design against a variety of target signatures in five operational scenarios. The prototype hardware was to be subjected to ground tests, captive flight tests and firing tests. Objectives included acquisition and tracking of characteristic target signatures in various operational scenarios, compatibility with the full electromagnetic environment, and verification of hazard free performance to aircraft and handling personnel. An indication of operational effectiveness and suitability was obtained. The modified F-4G/APR-38 avionics capability to control and monitor the High Speed AntiRadiation Missile was demonstrated. development test firings were completed, resulting in The average miss distance was feet (as compared to the required foot circular error probable). Although these were development tests, they were fired by operational test pilots from both services. A Department of the Navy Systems Acquisition Review Council II held in Nov 1980 evaluated test results of prototype missile firings, and approved proceeding to pilot production in 1981.

Pilot Production Missiles - Forty-five pilot production missiles have been allocated for both completion of Development Test in the Navy Technical Evaluation, and for the joint Air Force Initial Operational Test and Evaluation and Navy Operational Evaluation. Five of the forty-five pilot production missiles have been fired by the Navy to complete Navy Technical evaluation. The joint testing commenced in Nov 1981, and the balance of the forty pilot production missiles are allocated as follows. Twenty missiles are to be used for Navy Operational Evaluation, of which twelve will be fired. The Air Force will utilize the remaining twenty missiles for Initial Operation Test and Evaluation, and will fire twelve of the twenty missiles. The joint test will be completed in time for the Defense System Acquisition Review Council III in The test program prior to Milestone III will evaluate the pilot production missiles, avionics, Peculair Ground Support Equipment and government furnished equipment

Budget Activity: Tactical Program, #4
Program Element : #27162F Tactical Air-to-Ground Missiles

against the full array of specification, operational effectiveness, and operational suitability requirements. The Air Force plans to conduct a Second Phase of the Initial Operational Test and Evaluation after the Milestone III decision. The Second Phase test objective is to evaluate the F-4G/High Speed Anti Radiation Missile capability, which will utilize the unique and superior range known capability of the F-4G and APR-38 avionics suite. The Second Phase Initial Operational Test and Evaluation/Follow-on Test and Evaluation will be designed also to develop and refine tactics, and to provide data for further evaluation of operational effectiveness and suitability.

2. (U) Operational Test Evaluation: Operational testing on the High Speed Antiradiation Missile (HARM) built by Texas Instruments, Lewisville, Texas will be conducted as a joint Navy Operational Evaluation/Air Force Initial Operational Test and Evaluation program. Each service will separately evaluate the missile with its own aircraft and avionics, but will coordinate planning and share test results to eliminate duplication of effort. The purpose of the Initial Operational Test and Evaluation is to evaluate the operational effectiveness and operational suitability of the HARM to provide a basis for the first major production decision.

The dedicated portion of Air Force Initial Operational Test and Evaluation will be conducted in a two-phased approach from November 1981 to September 1982. Both phases will be conducted separate from developmental testing and will use pilot production assets integrated with production F-4G aircraft. In addition to a captive carry flight program to evaluate reliability of the missile (Phase One), a total of 30 missiles will be fired from Air Force F-4Gs and Navy A-7s. Twenty-four missile firings will establish the baseline in Phase One. During Phase Two, both services will fire a combined total of six missiles to validate a software enhancement update to the missile. Air Force testing will be conducted on test ranges at Nellis Air Force Base, Nevada; Pacific Missile Test Center, Point Mugu, California; Naval Weapon Center, China Lake, California; and White Sands Missile Range, New Mexico, as well as captive carry missions in USAFE. United States Air Force Tactical Air Command crews will fly these missions and missile maintenance checkout as well as loading criteria will be provided by Air Force personnel. System performance and reliability criteria are outlined in DCP-93B, which is presently under revision and service coordination.

Budget Activity: Tactical Program, #4
Program Element: #27162F Tactical Air-to-Ground Missiles

3. System Characteristics:

CHARACTERISTICS	MILESTONE II B THRESHOLD	MILESTONE III THRESHOLD	MILESTONE III GOAL *	DEMONSTRATED
Range:				
(Level Launch) Nautical Miles				
5,000 Foot Altitude				
15,000 Foot Altitude				
30,000 Foot Altitude				
Accuracy:				
Median of the Closest Point of Approach (in Feet)				
Frequency Coverage:				
(Gigahertz)				
Pulse				
Continuous Wave				
Technical:				
Length (Feet)				
Diameter (Inches)				
Weight (Pounds)				
Time to Target (Level launch at 10,000 feet, 0.8 Mach to target at 10 nautical miles) (Seconds)				

Budget Activity: Tactical Program, #4
Program Element: #27162F Tactical Air-to-Ground Missiles

CHARACTERISTICS	MILESTONE II B THRESHOLD	MILESTONE III THRESHOLD	MILESTONE III GOAL *	DEMONSTRATED
Mean Flying Hours Before Failure (Captive Carry over 1850 test hours, 1.8 flying hours/sortie, including 1.0 hour full electrical power) (Hours)	-			
Reliability, Missile Captive Carry				
Reliability, Missile Free Flight	-			

Budget Activity: Tactical Program, #4
Program Element: #27162F Tactical Air-to-Ground Missiles

* DCP-93 Goals - (Revision B in process)

** Includes Air Force and Navy firings through Development Test and Evaluation firings

*** Demonstration based on results of Joint Air Force and Navy Development Test and Evaluation firings through 17 Aug 80. Approved program operational and technical characteristics will be demonstrated during operational evaluation (Navy Operational Evaluation/Air Force Initial Operational Test and Evaluation).

**** Results to date continue to support the approved program goals,

***** Probability that HARM will be up and ready for launch after 20 captive carry flights of 1.8 hours duration per mission with full electrical power applied for one hour per mission. Relates to a Mean Flying Hours Before Failure threshold of

****** Given an up HARM system at launch, probability of successful launch, target guidance (including flex logic operation, if required) and proper fuze and warhead function within the specified Median of the Closest Point of Approach. Target is defined as any emitter having parametric characteristics similar (within missile RF and search area discrimination limits) to one of the threat listings handed-off by the avionics.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27247F
DoD Mission Area: TIARA for Tactical Land Warfare, #322

Title: Air Force TENCAP
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	299	299	285	281	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program has as its main objective the development of procedures, tactics, and interface equipment/software to facilitate tactical use of national intelligence systems within an operational framework.

(U) BASIS FOR FY 1983 RDT&E REQUEST: In 1977 Congress directed each service to establish a Tactical Exploitation of National Space Programs (TENCAP) office to improve military use of national systems. The FY 1982 funding and outyear programming provide continuing funding for this effort. Efforts will include evaluation and development of interfaces with national space programs and enhancement of our tactically deployed forces through tactical exercises and improved interfaces with the Intelligence Community. This will include necessary software development, equipment evaluation, and related developmental studies. The FY 1983 cost estimates for these activities are based on the FY 1981 completed activities and projections for continuity into FY 1983.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	300	300	300		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Operation and Maintenance	2,935	4,941	3,438	3,823	Continuing	Not Applicable

Note: The Operation and Maintenance funds are used to conduct essential tactical exercises.

Program Element: #27247F
DoD Mission Area: TIARA for Tactical Land Warfare, #322

Title: Air Force TENCAP
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This program was established by Congress to explore the tactical utility of national intelligence assets. Efforts accomplished under this program will provide for development, evaluation, and testing of tactics utilizing national intelligence resources. Efforts will include participation in tactical exercises, system interface software/hardware development, and related developmental studies.

(U) RELATED ACTIVITIES: Will require interface with national intelligence systems.

(U) WORK PERFORMED BY: Air Force management of this effort will be under the Air Force Deputy Chief of Staff for Plans and Operations.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: This information is available at higher security levels and a complete view of the program is available in the FY 1983 Intelligence Related Activities, Congressional Justification Book.

2. (U) FY 1982 Program: This effort will continue exercise evaluation, software development programs and equipment and procedure evaluation.

3. (U) FY 1983 Planned Program: On-going FY 1982 efforts will be continued. Efforts will be initiated for interface with various Air Force, other service and national intelligence programs to include studies, software modification and equipment evaluation. A continued involvement in tactical exercises will be pursued.

4. (U) FY 1984 Planned Program: On-going efforts will continue.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 27411 | Title: Overseas Air Weapons Control Systems
DOD Mission Area: Air Warfare Command and Control, #352 | Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1,000	2,291	3,486	3,429	Continuing	Not Applicable
2644	EIFEL/DISTEL I	200	200	100	100	Continuing	Not Applicable
2704	EIFEL/II	300	1,591	1,986	1,929	Continuing	Not Applicable
-	ACCS/ETACCS	500	500	1,400	1,400	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Under Project 2644, EIFEL/DISTEL I, the United States Air Force is adapting and procuring the German-developed EIFEL/DISTEL I system, an automated command and control system, for the United States Air Force operated Allied Tactical Operations Center at Sembach, Germany. Under Project 2704, EIFEL II, the United States Air Force will cooperate with the Federal Republic of Germany in the development of a follow-on system to augment EIFEL/DISTEL I. The European Theater Air Command and Control Study (ETACCS) has been established to analyze and coordinate the accomplishments of the NATO team working on the NATO Air Command and Control System (ACCS) and to develop US coordinated positions relative to ACCS issues.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Air Force Systems Command has been tasked to provide technical assistance to United States Air Forces Europe to support the EIFEL/DISTEL I system. Air Force Systems Command has also been tasked to monitor the German EIFEL II effort, work with United States Air Forces Europe in developing requirements and provide recommendations as to the degree of United States participation in EIFEL II. The validity of the FY 1983 cost estimate will depend on the degree of United States participation in EIFEL II. The ACCS/ETACCS cost estimate is based on a valid requirement to provide a US vehicle for supporting and interacting with the NATO ACCS Program.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	200	2,300	2,200		Continuing	Not
Procurement (Other)	12,200		300			Applicable

(U) OTHER APPROPRIATION FUNDS:

Procurement (Other)	12,200	-	300	300	Continuing	Not Applicable

Program Element: # 27411 | Title: Overseas Air Weapons Control System
DOD Mission Area: Air Warfare Command and Control, #352 | Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: EIFEL/DISTEL is a German-developed data management and command and control system which automates selected command and control functions. The system has been installed in the two North Atlantic Treaty Organization (NATO) Central Region Allied Tactical Operations Centers (ATOC) operated by the Federal Republic of Germany (FRG). The United States Air Force (USAF) will adapt and procure the present version of EIFEL/DISTEL for installation in the US-operated Central Region ATOC at Sembach, Germany. By procuring the EIFEL/DISTEL I system, the four ATOCs in the NATO Central Region will have common equipment, thus enhancing interoperability. The United States Air Force has agreed to cooperate with the Germans in a follow-on capability to the EIFEL/DISTEL I System, known as EIFEL II. A joint US/FRG study on EIFEL II is underway. The Air Force has been tasked to support the ACCS/ETACCS effort starting in FY 81. ETACCS is important to insure that the US objectives are included in the NATO ACCS.

(U) RELATED ACTIVITIES: The Air Force is presently studying approaches to unit level automation which will be required for various important tactical command and control programs. The EIFEL II program is one of the leaders in this area.

(U) WORK PERFORMED BY: United States Air Forces Europe (USAFE), Ramstein Air Base, Germany will manage the acquisition of the EIFEL/DISTEL I System with technical assistance provided by Air Force Systems Command (AFSC). Hardware and software will be acquired for the United States by the Federal Republic of Germany from the German Siemens Corp. The EIFEL II effort is being accomplished by the Air Force Systems Command. Mitre Corp will provide technical support in this effort. The Air Force role in ETACCS will be accomplished by AFSC with MITRE support.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The initial feasibility studies were completed and the Memorandum of Understanding signed in Dec 1980. In addition, plans were developed to adapt the EIFEL/DISTEL I System to meet the unique requirements of the ATOC at Sembach, Germany. Negotiations to procure the German-developed hardware and software were completed in the 4th qtr, FY81. Study activities and document translations were accomplished on EIFEL II. The ACCS/ETACCS effort was initiated.

2. (U) FY 1982 Planned Program: Procure and begin installation of the EIFEL/DISTEL I System. Complete joint study on EIFEL II. Continuation of ACCS/ETACC effort.

3. (U) FY 1983 Planned Program: Complete installation and testing of the EIFEL/DISTEL I System. EIFEL II development activities begin. Continuation of ACCS/ETACCS effort.

4. (U) FY 1984 Planned Program: Maintenance and minor modifications of the EIFEL/DISTEL I System. EIFEL II development activities continue. Continuation of ACCS/ETACCS effort.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1981 Budget Data: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 27412F
DOD Mission Area: Air Warfare Command and Control, #352

Title: Tactical Air Control System (TACS)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	13,761	1,195	5,422	5,455	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The tactical air forces require a highly developed, reliable, positive control system to fully exploit the inherent capabilities of tactical air power. The Tactical Air Control System (TACS) provides the means through which the Air Force Component Commander exercises control of his forces to accomplish his assigned mission. This program provides for major improvement to the existing manual TACS. Efforts in progress are designed to automate command, control, and communications processing functions; to develop electronic countermeasures; and to develop the System Trainer and Exercise Module (STEM) for Control and Reporting Center/Control and Reporting Post (CRC/CRP) personnel.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request provides for acquisition of the STEM and the Ultra Low Sidelobe Antenna (ULSA) and for the development of the Anti Radiation Missile Alarm Sensor (ARM Alarm). Budget estimates are based on current contract values (STEM, ULSA) and program office estimates (ARM Alarm and Modular Control Element) as of 1 Dec 1981.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	13,761	1,200			Continuing	Not Applicable
Procurement (Other)	8,385	19,891	19,070	20,661	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

		FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Procurement (Other)		8,645	22,304	60,151	Continuing	Not Applicable
(Quantity)	STEM	6				
	ULSA		27	15		
	ARM Alarm			52		
	MCE			12		

Program Element: # 27412F Title: Tactical Air Control System (TACS)
DOD Mission Area: Air Warfare Command and Control, #352 Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The 485L development and acquisition program is established to provide effective improvements to the Tactical Air Control System (TACS). The TACS consists of the men, materiel and procedures established to control tactical air operations. The tactical air forces require a highly developed, reliable, positive control system to fully exploit the inherent flexibility of tactical air power.

(U) Improvements to the TACS are evolutionary and are implemented through a series of procurements designed to increase system effectiveness incrementally while responding to the increasing enemy threat. The first of three phases, approximately 1965-1968, was an expedited buy of "off-the-shelf" equipment to provide a first-level capability for urgent, near-term contingency requirements. The second phase, approximately 1969-1972, provided improved equipment with state-of-the-art technology. Phases I and II were accomplished under the 407L Program. The third phase, approximately 1973-1987, provides automated and miniaturized equipments. Equipment to satisfy the capabilities required in Phase III is being developed and acquired under the 485L Program.

(U) Those improvements presently planned for development and acquisition are listed below:

(1) Netted Telephone Radio Interface Device (NTRID)

(2) System Trainer and Exercise Module (STEM)

(3) Ultra Low Sidelobe Antenna (ULSA)

(4) Anti Radiation Missile Alarm Sensor (ARM Alarm)

(5) Modular Control Element (MCE)

(6) Computer Assisted Force Management System (CAFMS)

(U) RELATED ACTIVITIES: This program interfaces with the Tactical Information Processing Interpretation Program, the Joint Interoperability of Tactical Command and Control Systems Program, and with efforts to improve European and Korean Command and Control Systems.

(U) WORK PERFORMED BY: Electronics Systems Division, Hanscom Air Force Base, MA, is responsible for this program. Rome Air Development Center, Griffiss AFB, NY, and the Tactical Air Command, Langley Air Force Base, VA, provide engineering and operational support. Major contractors include GTE Sylvania, Needham Heights, MA (System Trainer and Exercise Module) (STEM); Westinghouse Corp, Baltimore, MD (Ultra Low Sidelobe Antenna) (ULSA); and MITRE Corp., Bedford, MA, (Systems Engineering).

Program Element: #27412F | Title: Tactical Air Control System (TACS)
DoD Mission Area: Air Warfare Command and Control, #352 | Budget Activity: Tactical Program, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In 1981, the Netted Telephone to Radio Interface Device (NTRID) successfully completed plant and field testing. The Air Force will procure 30 NTRIDs - 20 for itself and 10 for the Marine Corps. Full scale development and in-plant testing continued for the System Trainer and Exercise Module (STEM) and the Ultra Low Sidelobe Antenna (ULSA). Equipment recently fielded under this program element includes the Frequency Shift Keyer; the AN/PRC-104, Lightweight Manpack Radio; the S-530, Electrical Equipment Shelter; and the AN/GSQ-120, Microwave Relay Set.

2. (U) FY 1982 Program: Begin receiving NTRID units. Complete STEM development and exercise production option. Complete ULSA development. Shelterize three Computer Assisted Force Management Systems.

3. (U) FY 1983 Planned Program: Take delivery of the last NTRIDs. Begin receiving STEMs. Exercise production option for ULSA. Award full scale development contract for the Anti Radiation Missile Alarm Sensor (ARM Alarm). The FY 83 RDT&E increase will fund the ARM Alarm effort while the increase in procurement funds will pay for more ULSAs.

4. (U) FY 1984 Planned Program: Accept final delivery of the STEM. Continue receiving ULSA. Continue development of ARM Alarm. If FY 82 and FY 83 reprogramming efforts are unsuccessful, begin development of the Modular Control Element.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison With FY 1982 Descriptive Summary: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27417F(64744F)
DoD Mission Area: Air Warfare, #352

Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	62,136	52,402	78,852	62,228	34,482	1,666,400

NOTE: RDT&E funds for FY 1978 and prior were included in PE 64744F, Airborne Warning and Control System. Large aircraft terminal development for the Joint Tactical Information Distribution System (PE 64754F) is funded in PE 27417F.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program has as its main purpose the development and acquisition of an effective survivable airborne surveillance system for command and control of tactical forces and strategic defense of the United States. The E-3A Airborne Warning and Control System will overcome ground based surveillance system deficiencies through its unique ability to provide extended all altitude surveillance and for the first time, the means to manage an air battle situation in real time. It will contribute significantly to a more effective integration of the capabilities of United States forces supporting United States, North Atlantic Treaty Organization or other worldwide requirements.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request will continue full scale development of additional radios, multipurpose consoles, and command consoles as well as continuing development of selected ECCM improvements. Development for the Mission Simulator Improvement Program will begin to provide much needed increases in training capability. Estimates are based on program office engineering and financial analysis of planned efforts for development and estimates of required support from other agencies.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	63,000	5[illegible],000	63,600	38,600	0	1,596,600
Procurement (Aircraft)*	272,000	0 **	552,800**	0	0	2,857,500

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
Procurement (Aircraft)*	270,000	257,900	[illegible]76,700	220,200	1,601,300	4,546,200
(Quantity)	(2)	(2)	(2)	(1)	(11)	(43)

*Includes initial spares.
**Amended FY 82 President's Budget rephased two aircraft from FY 83 to FY 82 and adjusted funding request accordingly.

Program Element: #27417F(64744F) Title: Tactical Airborne Command and Control System
DoD Mission Area: Air Warfare, #352 Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The E-3A Airborne Warning and Control System will support a variety of tactical air operations and the air defense of the Continental United States. It will overcome current deficiencies of present ground based systems (range, vulnerability, limited effectiveness against low altitude targets and susceptibility to electronic countermeasures). The capability to detect and track targets against ground clutter makes the E-3A effective against low-altitude targets. Since the radar is mounted on a high flying jet aircraft, increased surveillance volume and detection range are realized. Mobility, coupled with the awareness of potential threats, and the ability to command weapons in its own defense make the E-3A highly survivable.

The airborne platform is a Boeing 707 aircraft equipped with radar, communications, identification sensors, navigation units and data processor to provide an integrated presentation of the air situation on operator display consoles. Software changes in the central processor configure the E-3A for tactical or strategic defense missions. The Core E-3A is capable of detecting and tracking low flying aircraft targets in the presence of ground clutter, detecting bomber aircraft at a distance of nautical miles, detecting tactical aircraft up to nautical miles, computer tracking of up to targets, 6.2 hours on station time at 1000 nautical miles from base, and active interrogation of aircraft using a cooperative beacon in cryptological secure or standard modes. Increased Command and Control improvements as well as electronic counter-countermeasures improvements are planned for the E-3A to exploit its inherent capabilities and to keep pace with the evolving threat.

(U) The E-3A significantly enhances the combat effectiveness of air, ground and naval forces. Strategic defensive forces will utilize the E-3A, in conjunction with interceptor forces, for the wartime defense of the Continental United States and as an integral element of the mobile air defense force for contingencies requiring air defense outside the United States. Tactical forces will use the E-3A for command and control during the deployment of tactical air forces, and in accomplishing interdiction, rescue and airlift missions. Its flexibility and versatility will enable it to be deployed at any level of military action ranging from a show of force through general war. During these deployments, the means will exist, for the first time, to manage the air and sea battle.

(U) RELATED ACTIVITIES: The Overland Radar Technology Program (Program Element 63701F) proved the feasibility of overland radar in support of an airborne warning and control system. The conceptual portion of the E-3A program was funded under Program Element 63402F prior to December 1967. The North Atlantic Treaty Organization Airborne Early Warning and Control System (Program Element 64752F) was established in FY 1978 to fund United States share of the North Atlantic Treaty Organization development effort (subsequently changed to Program Element 01012F). The Foreign Military Sale of the E-3A to Saudia Arabia was approved in October 1981.

(U) WORK PERFORMED BY: The Air Force management is provided by the Electronic Systems Division, Hanscom AFB, Bedford, Massachusetts. The integration contractor is Boeing Aerospace Company, Seattle, Washington. The major subcontractors are: (1) Radar - Westinghouse Electric Corporation, Baltimore, Maryland; (2) Data Processor - International Business Machines, Owego, New York; (3) Displays - Hazeltine Corporation, Long Island, New York; (4) Ultra High Frequency radios (less transceivers) - Electronics Communications Incorporated, Saint Petersburg, Florida; (5) Identification Friend or Foe - Airborne Instruments Laboratory, Long Island, New York; (6) Navigation - Northrop, Los Angeles, California; (7) Very High Frequency radios - Collins Communications Systems, Cedar Rapids, Iowa; (8) Audio Distribution System - Hughes

Program Element: #27417F(64744F)
DoD Mission Area: Air Warfare, #352

Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs, #4

Aircraft Company, El Segundo, California; and (9) Joint Tactical Information Distribution System Digital Data Link - Hughes Aircraft Company, Fullerton, California. Government Furnished Equipment vendors are: (1) Engines - Pratt and Whitney Aircraft Division of United Aircraft Corporation, Hartford, Connecticut; (2) Ultra High Frequency Transceivers - Collins Communications Systems, Cedar Rapids, Iowa.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior accomplishments: Feasibility studies by Boeing, McDonnell Douglas, and Lockheed (each study using a different radar and airframe) led to the Air Force conclusion that an Airborne Warning and Control System was feasible and could be delivered in the 1970s. In FY 1967, contracts were awarded to Boeing and McDonnell Douglas for studies to examine the aerodynamics of the radar rotodome configuration, to determine the optimum configuration and to integrate the results of studies conducted under the Overland Radar Technology Program into a system study to establish a baseline design. The Contract Definition Phase of the program was initiated during CY 1969 and was completed with the selection of the Boeing Company as the system acquisition contractor in July 1970. The airborne warning and control system program and the contract with Boeing was arranged in three phases (Brassboard Radar Demonstration; Development, Test and Evaluation; and Production) with established performance milestones within each phase that were demonstrated with test results before the decision was made to proceed to the next phase.

(U) The Brassboard Radar Demonstration phase, initiated with Hughes and Westinghouse as competing radar subcontractors, was designed to verify the performance of the radars. The two radars (Hughes and Westinghouse) were installed in modified Boeing 707 aircraft and the competitive radar fly-off began in March 1972. The airborne warning and control system long lead avionics subsystem development to support the development, test and evaluation phase was initiated following successful ground testing of the radars.

(U) The competitive radar flight test programs were successfully completed in October 1972 with the selection of Westinghouse as the radar vendor. The Airborne Tracking Demonstration was initiated and accomplished early due to the early announcement of the winning radar vendor. After the successful completion of the Brassboard Radar demonstration phase in December 1972, the development, test and evaluation phase which included the System Integration Demonstration was initiated with utilization of the selected radar and other mission avionics to demonstrate the total airborne warning and control system function. The system integration demonstration avionics configuration, originally a single-thread system to resolve technical problems prior to a production request, was enhanced by the inclusion of additional equipment to permit the using commands, Tactical Air Command and Aerospace Defense Command, to conduct a parallel Initial Operational Test and Evaluation. This permitted the production decision to be supported by both technical feasibility and operational suitability data. In FY 1973, the Brassboard aircraft, used to test the non-selected radar, was upgraded to the Development Test and Evaluation prototype configuration for use as the first test aircraft. Additionally, the fabrication of two new test aircraft was started at this time.

(U) In FY 1974, the installation and checkout of the hardware and software in the System Integration Demonstration aircraft was completed and the first flight was accomplished in March 1974. The remainder of the FY 1974 system integration demonstration efforts were devoted to performance verification of subsystems as well as the fully integrated system configuration including both air vehicle and mission electronics. All critical design reviews for the fully configured E-3A Airborne Warning and Control System were completed. Initial equipment deliveries for the development, test and evaluation Avionics Integration Laboratory were received and installation was begun. Work continued on the three test aircraft initially funded in FY 1973.

(U) The systems integration demonstration flight test program, with active participation by the operating commands, was completed in November 1974. This, and other test flights during FY 1975, demonstrated the operational suitability of the E-3A while evaluating electronic compatibility/interference with other systems, survivability, interoperability/mutual enhancement with other Army, Air Force and Navy command/control and weapons systems and performance in electronic countermeasure environments. The results provided high visibility into the potential of the E-3A and confidence for the production release in March 1975.

(U) In addition to the systems integration demonstration tests, fabrication continued on the three operationally configured preproduction test aircraft with research and developments funds. Development of Time Division Multiple Access communications terminals and installation design were also started. A maritime surface surveillance modification to the radar was accomplished in support of demonstration goals for the April 1975 deployment. Flight crew training of Air Force personnel was initiated. Full scale production of the six E-3As authorized in FY 1975 began in March 1975. The first operational delivery occurred in March 1977.

(U) By December 1975, all of the mission avionics had been installed, checked out and integrated in the Avionics Integration Laboratory. Airworthiness flight tests to determine air vehicle flight loads, flutter characteristics and performance handling qualities began in August 1975 with the first test aircraft and were completed in October 1976. The second test aircraft with mission avionics equipment began flight tests in October 1975. The third test aircraft began flight tests in May 1976. These three aircraft and production system #1, which began flight tests in July 1976, were utilized to accomplish the objectives of the Core, or basic, configuration test program. Separate development, test and evaluation/initial operational test and evaluation test programs will be accomplished on enhancements to this Core configuration. These aircraft will be delivered to the operational force.

(U) The Development, Test and Evaluation on the Core configuration was completed in January 1977. This reflected a seven month compression over the previously planned test program made possible through utilization of data previously obtained, principally during the extensive testing conducted during FY 1975. Emphasis continued to be placed on using Air Force personnel to man the operating positions to validate the human factors aspects. Concurrent testing of navigation and communication subsystems, software and flight essential avionics qualification were conducted during radar performance/total system evaluation.

(U) Three operational evaluations of the E-3A were conducted. Two E-3As participated in each of three exercises; a joint Army-Air Force readiness exercise, a tactical exercise representative of the threat and magnitude of a European conflict, and a Continental United States air defense exercise. The E-3A underwent all-weather testing in the climatic hangar, and a reliability/maintainability demonstration

Program Element: #27417F(64744F) Title: Tactical Airborne Command and Control System
DoD Mission Area: Air Warfare, #352 Budget Activity: Tactical Programs, #4

(U) Development efforts continued on Time Division Multiple Access communications and Maritime Surface Surveillance enhancements with their associated software. These enhancements will increase the capability and flexibility of the Airborne Warning and Control System in its worldwide surveillance and control functions. Time Division Multiple Access communications, embodied in the Joint Tactical Information Distribution System, provides for jam-resistant high capacity information flow. The Maritime enhancement permits improved surveillance of ocean areas. The Avionics Integration Laboratory which has the same configuration as the production aircraft, continued to be used to evaluate complex operational and engineering situations that cannot be easily generated in flight testing.

(U) The approval, in December 1978, of a North Atlantic Treaty Organization Airborne Early Warning and Control program of 18 E-3A aircraft was based on a United States/North Atlantic Treaty Organization Standard configuration that would meet North Atlantic Treaty Organization operational requirements. This Standard configuration uses the United States developed Maritime radar and Joint Tactical Information Distribution System as a baseline and adds a large computer for increased track capacity and an HF radio and teletype capability developed by the North Atlantic Treaty Organization. During FY 1979, the Maritime and Joint Tactical Information Distribution hardware and software development efforts and testing were merged into a Standard configuration development plan. The Standard configuration was approved for production on the United States' E-3As starting in FY 1980 on an interleaved production line with North Atlantic Treaty Organization aircraft. Initial operational test and evaluation of the Standard configuration began in April 1981.

(U) During FY 1980, in addition to continuing the integrated development of the Standard configuration, initial efforts began to correct deficiencies identified during initial operational testing. To correct these deficiencies, increased command and control capabilities are to be added to fully realize the capabilities of the E-3A system. Also studies were begun to define the most cost effective electronic counter-countermeasures to incorporate into the E-3A to assure continued resistivity to the evolving threat environment.

(U) Flight testing of the United States/North Atlantic Treaty Organization Standard configuration with maritime radar, the Hughes Improved Joint Tactical Information Distribution System terminal and a larger computer was successfully concluded in late FY 1981. Full scale development began in July 1981 to integrate additional ultra high frequency radios, multipurpose consoles and a command console into the E-3A. This expanded command and control equipment will increase operational flexibility and capability. Electronic counter-countermeasures studies continued to evaluate the most promising new technologies needed to ensure the viability of the E-3A in the projected electronic countermeasures threat environment. Preliminary design and brassboard engineering development began to incorporate selected new technologies into the E-3A radar to assure its resistivity to the evolving electronic countermeasures threat.

2. (U) FY 1982 Program: The United States/North Atlantic Treaty Organization Standard configuration Initial Operational Test and Evaluation testing will be completed. Full scale development will continue on additional radios, additional multipurpose consoles and a command console. Preliminary design and brassboard engineering development will continue to incorporate selected new technologies into the E-3A radar to assure its resistivity to the evolving electronic countermeasures threat.

Program Element: #27417F(64744F)
DoD Mission Area: Air Warfare, #352

Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs, #4

3. (U) FY 1983 Planned Program: Full scale development will continue on additional radios, additional multi-purpose consoles and a command console. Flight testing starts for the expanded command and control configuration. Brassboard engineering development of selected electronic counter-countermeasure designs will begin validation phase. Development begins for the Mission Simulator Improvement Program that will provide much needed expansion in training capability, and thus increase the quantity and quality of mission crew training. Increased RDT&E funding results from an independent cost estimate for command and control improvements and associated test equipment and depot aerospace ground equipment, for the addition of the mission simulator improvement program, and for a reestimate of an electronic counter-countermeasure program. Decrease in procurement funding occurs because quantity decreased from three to two aircraft, subsequently offset somewhat by addition of advance procurement funds for one aircraft, and an Air Force Audit requiring funds in this account for trainers and aerospace ground equipment to be transferred to the RDT&E account.

4. (U) FY 1984 Planned Program: Development and flight testing for expanded command and control configuration will be completed. The development of mission simulator improvements will be completed. Validation of brassboard development of selected electronic counter-countermeasure designs will be completed in preparation for full scale development.

5. (U) Program to Completion: Conduct enduring air defense studies.

6. (U) Milestones:

	Date
A. (U) Engineering Development Contract Award	July 1970
B. (U) First Flight (Brassboard)	March 1972
C. (U) End of Flight Test of Brassboard	August 1972
D. (U) Start of Development Test and Evaluation	January 1973
E. (U) System Demo Flight Tests Begin	March 1974
F. (U) System Demo Test and Evaluation Completed	December 1974
G. (U) Start of Production	March 1975
H. (U) First Test Flight of First Development, Test and Evaluation Aircraft	August 1975
I. (U) Development Flight Test Complete (Core)	January 1977
J. (U) Interim Operational Capability (Core)	April 1978
K. (U) Maritime Radar Flight Test Complete	July 1980
L. (U) Standard Configuration Flight Test Complete	October 1981
M. (U) Command and Control Improvements Flight Test Complete	March 1984
N. (U) Electronic Counter-Countermeasures Validation Phase Complete	August 1984

7. (U) Resources: N/A

8. (U) Comparison with FY 1982 Budget Data: N/A

Program Element: #27417F(64744F) | Title: Tactical Airborne Command and Control System
DoD Mission Area: Air Warfare, #352 | Budget Activity: Tactical Programs, #4

Test and Evaluation Data

1. (U) Development Test and Evaluation

(U) The E-3A Development Test and Evaluation test program was combined with Initial Operational Test and Evaluation test objectives in as realistic an operational environment as possible. The prime development contractor is The Boeing Company. The overall ojectives of the test effort were to: (a) validate/verify E-3A performance in accordance with design specifications; (b) determine E-3A performance and capability to fulfill operational requirements, including inter-service interoperability demonstrations; and (c) verify Air Force capability to support the E-3A with standard operation maintenance, logistics and training units using prescribed procedures. The first phase of three development test and evaluation phases used a Brassboard engineering model and tested the airworthiness of the rotodome, demonstrated the feasibility of competing overland radar technologies (Hughes and Westinghouse) and demonstrated successful integration of radar targets and computer display equipment. This phase was flown from March through November 1972, and resulted in Westinghouse being selected to continue radar development.

2. (U) Operational Test and Evaluation

(U) The E-3A test program is being conducted as a combined development test and evaluation/initial operational test and evaluation.

Core E-3A Follow-on Operational Test and Evaluation (U)

(U) Follow-on Operational Test and Evaluation, initiated in January 1977, was conducted in two phases with operational crews using production aircraft, training equipment, and support equipment. Phase I, Follow-On Operational Test and Evaluation managed by the Air Force Test and Evaluation Center, was completed in February 1978. This phase was designed primarily to refine the operational suitability (reliability, maintainability, availability, and logistics supportability) assessment made during Initial Operational Test and Evaluation. Because Initial Operational Test and Evaluation assessments were constrained by the development, test and evaluation contractor-managed environment, Phase I Follow-on Operational Test and Evaluation provided the first opportunity for a detailed assessment of E-3A suitability under Air Force hand-on maintenance management. The operational effectiveness objectives addressed during Phase I Follow-on Operational Test and Evaluation were those not completed in Initial Operational Test and Evaluation, or those where the contractor had made equipment changes after Initial Operational Test and Evaluation and before production delivery. Test data were collected on a noninterference basis during the 552nd Airborne Warning and Control Wing primary function of training for attainment of Phase I Initial Operational Capability. No aircraft were dedicated to the test effort. Follow-on Operational Test and Evaluation flight data were gathered from training missions and during an E-3A deployment to Europe. This deployment, commonly referred to as "EUROTEST 77," provided the first opportunity to assess the logistics supportability of the E-3A in an overseas location. It also provided additional data on the integration of the E-3A into the existing North Atlantic Treaty Organization ground command and control system, and information on the E-3A radar compatibility within the European Central Region electromagnetic environment. The results of this first phase of Follow-on Operational Test and Evaluation were reported in the Air Force Test and Evaluation Center AWACS Follow-on Operational

Program Element: #27417F(64744F) Title: Tactical Airborne Command and Control System
DoD Mission Area: Air Warfare, #352 Budget Activity: Tactical Programs, #4

Evaluation Phase I Final Report, July 1978 Test results confirmed that the production E-3A can effectively and efficiently perform its prescribed mission and that the E-3A will greatly enhance the capability of the Air Force to conduct tactical air operations. However, several significant reliability and maintainability problems and deficient logistic support areas were identified for improvement. Phase II Follow-on Operational Test and Evaluation, managed by the Tactical Air Command, was initiated in March 1978 to refine Initial Operational Test and Evaluation and Phase I Follow-on Operational Test and Evaluation assessments with emphasis on tactics and procedures. The United States Air Force Tactical Fighter Weapons Center managed the Phase II Follow-on Operational Test and Evaluation for the Tactical Air Command with the test team collocated at the 552d Airborne Warning and Control Wing's main operating base, Tinker Air Force Base, OK. The test team, with representatives from the Tactical Air Command, the North American Air Defense Command and the Air Force Systems Command, conducted the test in conjunction with normal training and maintenance activities of the 552d Airborne Warning and Control Wing. No dedicated resources, beyond the test team, were used for the Phase II evaluation. Major test objectives included: evaluate corrective actions for previously identified deficiencies; refine E-3A tactics and provide information on procedures and doctrine; and verify and refine estimates of the production E-3A operational effectiveness and suitability.

(U) Phase II was completed during May 1980. Test reporting was accomplished in two parts. Part A of the final report covering the period of March 1978-May 1979 was published in May 1980 while Part B was published in October 1980. A multicommand radar maintenance evaluation lead by the Air Force Test and Evaluation Center was also conducted in parallel with the Phase II to evaluate the E-3A Built-in-Test/Fault-Isolate-Test capability to support daily maintenance activities. This test began in July 1978 and was completed in June 1980. A separate built-in-test/fault-isolate-test report was published in November 1980. During Part A, Phase II, the 552d Airborne Warning and Control Wing accumulated over 8,300 flying hours and 1,200 sorties, while participating in 24 major exercises. The test team participated in a cross section of these activities in support of Follow-on Operational Test and Evaluation objectives. Based on data collected through May 1979, preliminary Phase II findings support the conclusions of Initial Operational Test and Evaluation and Phase I Follow-on Operational Test and Evaluation that the production E-3A can effectively perform its prescribed mission. The following results/observations are provided. Tactics and procedures refinement/development: Physical arrangements for the North American Air Defense Command battle staff aboard the core E-3A as previously reported, are insufficient to effectively support E-3A mission crew and command element simultaneously. Additional communications and display consoles are required. Progress has been achieved through interaction between E-3A and functional tactical operations. Baseline procedures were formulated to exploit E-3A look-down capabilities in support of close air support, forward air control and rescue missions. E-3A air assault procedures were also developed, providing the commander of airlift forces a realtime presentation of airborne operations.

Tactical control procedures were developed as a result of E-3A interaction with the fighter community in counterair scenarios. This method of control was designed to enhance counterair operations by adjusting E-3A support to the capabilities and requirements of various fighter aircraft. Electronic Counter Countermeasures.

Early Warning and Surveillance: E-3A deep-look and look-down capabilities consistently extended detection and tracking of air targets beyond the coverage of ground based radars. During several exercises, , a factor directly

Program Element: #27417F(64744F) | Title: Tactical Airborne Command and Control System
DoD Mission Area: Air Warfare, #352 | Budget Activity: Tactical Programs, #4

related to E-3A orbit locations. Operational Suitability: Operational and hardware reliability were rated satisfactory and reflect a favorable trend. Although significant progress was made, contractor maintenance support is still required. Nonavailability of technical orders continues to delay establishment of a full repair capability. Deficiencies in the supply support posture, reported in Phase I, continued to affect the overall availability of mission-capable aircraft. Needed spares are subject to budgetary constraints and production lead times and remain a matter for top-level management. Excessive cannibalization and use of production line loaners will continue to be required for daily operations until inventories reflect true spare requirements.

E-3A Enhancements Initial Operational Test and Evaluation (U)

(U) Background. Decision Coordinating Paper 5, Revision 3, 5 March 1976, approved continued production of the E-3A, and the development of a selected set of system enhancements chosen to provide a fully effective worldwide force. The enhancements were to be developed as separate entities and integrated into the E-3A for testing as the enhancement items became available. In May 1976, the Deputy Secretary of Defense directed the Air Force to plan for an Office of the Secretary of Defense review of the E-3A enhancement program when the respective enhancement development efforts are essentially completed. He further stated that it is contemplated that the Defense Systems Acquisition Review Council would then review development and test status and consider the operational utility of the respective enhancements in light of an updated threat evaluation prior to committing the government to production. The purpose of operational testing of the enhancements is to provide an evaluation of the operational utility of each enhancement for the Defense Systems Acquisition Review Council review. In December 1978, North Atlantic Treaty Organization signed an agreement with the United States Government (as their agent) for the procurement of 18 E-3A aircraft. To support this commitment and the United States Standard configured E-3A aircraft, the Air Force received Office of Secretary of Defense approval for limited production authority for a maritime radar capability and a joint tactical information distribution system capability in E-3A Decision Coordinating Paper Number 5, Revision 4, 6 March 1980.

Past Enhancement Testing. Development Test and Evaluation/Initial Operational Test and Evaluation of an advanced development Joint Tactical Information Distribution System terminal (Waveform B) has been completed. Testing began during May-June 1978 with a preliminary evaluation of the Joint Tactical Information Distribution System time-division-multiple-access system onboard an E-3A. The purpose of this test was to determine Joint Tactical Information Distribution System communications coverage, E-3A system performance in a Joint Tactical Information Distribution System environment, and provide an initial estimate of the operational effectiveness/suitability of the time-division-multiple-access communication system planned for the E-3A under the Office of the Secretary of Defense approved enhancement program. This Development Test and Evaluation/Initial Operational Test and Evaluation effort provided an opportunity to test the concept of spread spectrum and frequency hopping as a transmission technique in a simulated operational environment. Major emphasis was placed on assessing the electronic counter-countermeasures capability of the system. Operational test results demonstrated electronic countermeasures resistivity and operational effectiveness potential of the Joint Tactical Information Distribution System terminal. However, until corrected, [

Results of this test were reported in the December 1978 Air Force Test and Evaluation Center E-3A Joint Tactical Information Distribution System Terminal Initial Operational Test and Evaluation

Program Element: #27417F(64744F) Title: Tactical Airborne Command and Control System
DoD Mission Area: Air Warfare, #352 Budget Activity: Tactical Programs, #4

Report. The United States Standard E-3A (Block 10) configuration was developed in two steps. Step I, an interim configuration (Block 05), incorporated enhancements sponsored by the United States Government, while Step II included enhancements sponsored by the North Atlantic Treaty Organization. The United States Standard E-3A is a Core E-3A plus maritime surveillance capability, a Joint Tactical Information Distribution System Hughes Improved Terminal, upgraded computer program functional group, and modified data analysis processor group. The development test and evaluation/initial operational test and evaluation of the North Atlantic Treaty Organization E-3A (Block 15) and the United States Standard E-3A was combined to the greatest extent possible. The maritime radar components and software were installed and checked out by the contractor in July 1980. However, the modified data analysis processor group and upgrade computer program functional group through which the maritime surveillance capability must be operated would not be qualified until September 1981. To lower the risk of going into production and to give the Office of the Secretary of Defense some assurance that the maritime radar would meet the operational requirements, a preliminary operational effectiveness assessment of the maritime radar modification was conducted by the Air Force Test and Evaluation Center from 15 July - 30 August 1980. This assessment was limited to determining if the E-3A radar with the maritime modification met specification requirements and operational performance thresholds. The results indicate that maritime equipped E-3As have the potential to provide a significant capability to conduct or augment combined air/maritime operation.

Results of this test were reported in the October 1980 Air Force Test and Evaluation Center E-3A Maritime Surveillance Capabilities Preliminary Operational Effectiveness Assessment Report. Although installation/contractor testing of an improved Joint Tactical Information Distribution System, Hughes Improved Terminal version was not planned of the E-3A until April 1981 and September 1981 respectively, Air Force Test and Evaluation Center obtained a preliminary Joint Tactical Information Distribution System, Hughes Improved Terminal hardware assessment by testing an early engineering model of the Hughes Improved Terminal included in the Joint Tactical Information Distribution System Adaptable Surface Interface Terminal from April to November 1980. Results of the test were reported in the March 1981 Air Force Test and Evaluation Center Joint Tactical Information Distribution System Adaptable Surface Interface Terminal Initial Operational Test and Evaluation Report. The Initial Operational Test and Evaluation of the United States Standard E-3A and the continental United States portion of the North Atlantic Treaty Organization Standard E-3A was conducted by the Air Force Test and Evaluation Center from September 15 to October 30, 1981. Primary flight operations were staged from Tinker Air Force Base, Oklahoma in support of test locations which included Alaska, California, Florida, Oklahoma and Washington. A total of eighteen test missions were flown in a variety of scenarios designed to test the Standard E-3A's upgraded computer, maritime surveillance radar, airborne operational computer program and Joint Tactical Information Distribution System terminal. The results of this Initial Operational Test and Evaluation will be reported in March 1982.

(U) Planned Enhancement Testing. The Block 20/25 configuration will be a retrofit program of the Block 01 (Core) and Block 10 (Standard) configured E-3As. Block 20 will consist of Block 01 plus the Joint Tactical Information Distribution System, computer modification, one high frequency radio, five ultra high frequency radios, three situation display consoles, and a command console enhancement. Block 25 will consist of Block 10 plus five ultra high frequency radios, three situation display consoles and a command console enhancement. Testing of these enhancements is expected to begin in 1983. Retrofit is expected in 1984. The Block 30/35 configuration will be a retrofit of selected electronic counter-countermeasure improvements into the Block 20/25 aircraft. Testing of these improvements is tentatively planned to begin in 1986.

Program Element: #27417F(64744F)
DoD Mission Area: Air Warfare, #352

Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs, #4

3. (U) Operational and Technical Characteristics

(U) Comparison: System Integration Demonstration (Test System 1)/Production

(U) GENERAL	TEST SYSTEM #1	E-3A/CORE	E-3A/STANDARD
Crew Size	11	17	17
Production or Production Prototype Systems			
Radar	NO	YES	YES
Navigation	YES	YES	YES
Data Processor	YES	YES	YES
Display	YES	YES	YES
Identification Friend or Foe	YES	YES	YES
On-Board Test Maintenance and Monitor	YES	YES	YES
Communications	PARTIAL	YES	YES

(U) HARDWARE

Consoles	4	9	9
Auxiliary Display Unit	1	2	2
Ultra High Frequency Radios	4	14	14
High Frequency Radios	1	2	3
Very High Frequency-Amplitude Modulation Radios	2	3	3
Very High Frequency-Frequency Modulation Radios	0	1	1

CAPABILITY

Radar Targets/Scan
Identification Friend or Foe Targets/Scan
Data Processing Track Capacity
Data Processing Simultaneous Intercept

Program Element: #27417F(64764F)
DoD Mission Area: Air Warfare, #352

Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs, #4

(U) Comparison: E-3A Requirements to Current Estimates

TECHNICAL CHARACTERISTICS	E-3A CORE REQUIREMENTS	DEMONSTRATED PERFORMANCE
Detection Range (0.9 Probability in 1 Minute)		
Bomber (Nautical Miles)		
Fighter (Nautical Miles)		
Crew Size		
System Track Capacity		
Simultaneous Intercepts		
Targets Position Accuracy (Nautical Miles)		
Time on Station, Orbit 1000 Nautical Miles from Base (hours)		

(U) RELIABILITY AND MAINTAINABILITY CHARACTERISTICS

Probability of Completing 9 hour Mission	0.88	.88
Maintenance Manhour/Flight Hour	28.0	25.5*
In Commission Rate	80%	95.7%
Probability of Fault Detection	95%	97%
Probability of Fault Isolation (To 3 Primary Units)	90%	95%
Turn Around Time	90% in 5.5 hours	90% in 4.8 hours
False Alarm (Probability of not Detecting Failure)	.08	.03

*Actual data experienced during FY 1981 for aircraft delivered to TAC.

(U) Design Requirements for E-3A Improvements

TECHNICAL CHARACTERISTICS	THRESHOLD	GOAL
Maritime Radar		
Maximum Detection at 250 Nautical Miles or Line-of-Sight		
Patrol Boat (Foot Waves)		
Destroyer (Foot Waves)		
Maritime Targets Position Accuracy (Nautical Miles/Degree)		
Maritime Targets Position Accuracy with Electronic Countermeasures (Nautical Miles)		
Maritime Targets Detection Range with Electronic Countermeasures (Nautical Miles)		
Maritime Target/Land Resolution (Nautical Miles)		

Program Element: #27417F(64744F) — Title: Tactical Airborne Command and Control System

DoD Mission Area: Air Warfare, #352 — Budget Activity: Tactical Programs, #4

TECHNICAL CHARACTERISTICS (cont.)	THRESHOLD	GOAL
Joint Tactical Information Distribution System		
Message Transfer Ratio (Percent)		
E-3A Data Base Transfer (Minutes)		
Electronic Counter Countermeasure Margin (Decibels)		
Net Initialization Time (Minutes)		
Net Entry Time (Minutes)		
Terminal Initialization Time (Minutes)		

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27423F
DoD Mission Area: Tactical Communications, #345

Title: Advanced Communication Systems
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	45,239	50,410	78,210	89,758	Continuing	Not Applicable
2277	SEEK TALK	41,266	48,907	77,321	88,781	198,800	481,300
2482	HAVE QUICK	2,460	0	0	0	0	8,900
2614	SINCGARS-V Integration	1,513	1,503	889	977	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:

The Air Force relies on UHF for its primary tactical command and control. Disruption of these communications could degrade the effectiveness of tactical forces SEEK TALK is an advanced technology program intended for all UHF voice communications and will provide jam resistance independent of the long term threat. HAVE QUICK is an interim program applying demonstrated technology and providing an urgently needed resistance to jammers while SEEK TALK is being developed. The Air Force will participate with the Army to plan for the integration of the Single Channel Ground and Airborne Radio System (SINCGARS) VHF jam resistant capability in those weapon systems requiring direct communications with Army forces. This is part of an overall program directed and coordinated by the Joint Chiefs of Staff.

(U) BASIS FOR FY 1983 RDT&E REQUEST: SEEK TALK will complete Full Scale Development and begin development of prototype equipment and begin development and operational testing. Development and operational testing will emphasize SEEK TALK as a system integrated into the Tactical Air Command and Control System and use the most advanced countermeasures technology available to the United States. SEEK TALK cost estimates have been validated by an Independent Sufficiency Review during October 1981. The Air Force will continue to participate in the Army's SINCGARS development and operational testing programs. A modification to Air Force VHF radios and aircraft antennas will be designed to insure interoperability with the Army.

Program Element: #27423F
DoD Mission Area: Tactical Communications, #345

Title: Advanced Communication Systems
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	44,600	51,800	3,200		Continuing	Not Applicable
PROCUREMENT						
2482 - HAVE QUICK						
(Aircraft)	25,500					
(Other)	18,700					
2277 - SEEK TALK						
(Other)			16,019			

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
PROCUREMENT						
2277 - SEEK TALK						
(Aircraft)			36,200 (79)	276,700 (360)	1,660,300	1,973,200
(Other)		12,256	10,472	28,672	676,600	729,000
2482 - HAVE QUICK			(50)	(52)		
(Other)	14,000					

(U) Initiates procurement (including nonrecurring and initial spares). During formulation of FY 1983 Program Objective Memorandum the overall SEEK TALK program was restructured and full 3,200 unit procurement cost through FY 1983 estimated. Modification Engineering Costs for specific aircraft and ground system were included in the RDT&E Estimate.

Program Element: #27423F | Title: Advanced Communication Systems
DoD Mission Area: Tactical Communications, #345 | Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Soviet doctrine for Radio Electronic Combat (REC) states that

it is apparent that the Air Force is facing an effective and rapidly increasing electronic countermeasures (ECM) threat.

This threat could prevent tactical forces from conducting effective operations in support of NATO, South Korea or friendly nations elsewhere in the world. This program is an initiative to provide jam resistant Ultra High Frequency (UHF), Very High Frequency (VHF) communications.

(U) CURRENT PROJECTS IN THIS PROGRAM:

Project Number:

2482 HAVE QUICK: This project is applying current technology to modify Air Force UHF voice radios. This modification will protect these communications from the

HAVE QUICK started production in FY 1980 and will protect the most critical aircraft communication during the time required to develop a more advanced technology (SEEK TALK) which will be less sensitive to rapidly evolving jamming technology. HAVE QUICK has been directed by the Joint Chiefs of Staff as the US standard for interoperability.

2277 (U) SEEK TALK: This project will develop, produce and implement an advanced technology jam-resistant UHF voice communication system less sensitive to the evolution of jamming technology. SEEK TALK will combine pseudo-random noise modulation and adaptive antenna techniques to provide a jam-resistant capability satisfying the urgent operational requirement. SEEK TALK started Full Scale Engineering Development in FY 1981 and will accomplish the preliminary modification engineering efforts necessary to deploy SEEK TALK in aircraft and ground platforms.

2614 (U) SINCGARS-V Integration: The Army Single Channel Ground and Airborne Radio (SINCGARS) program will replace all the tactical single channel voice VHF radios used by the Army. The Army provides these radios with a secure jam resistant capability. The Air Force is participating with the Army in the development of ground radios. The Air Force will develop modifications to current VHF radios to insure interoperability. The SINCGARS Integration project provides for Air Force planning of SINCGARS integration and development of Air Force unique equipment.

Program Element: #27423F
DoD Mission Area: Tactical Coummunications, #345

Title: Advanced Communication Systems
Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: The Air Force is participating in the Army Single Channel Ground and Airborne Radio System (SINCGARS) program, PE 63746A, as part of the Joint Chiefs of Staff validated Joint Operational Requirement. Requirements and technical approach are presently being explored with the Navy and Army for the purpose of insuring interoperability. Formal interoperability tasks are part of this program and techniques which are developed by the Air Force, as the Joint Chiefs of Staff lead service for the development of technical specifications, will be coordinated with similar techniques being developed by the other Services.

(U) WORK PERFORMED BY: The HAVE QUICK and SEEK TALK programs are managed by the Air Force Systems Command (AFSC), Electronic Systems Division, Hanscom AFB, MA. The advanced development phase of SEEK TALK has been contracted for and tested by the Rome Air Development Center, Griffiss AFB, NY. The MITRE Corporation, Bedford, MA, supports the Air Force as general systems engineer. Contractors include: Hazeltine Corporation, Greenlawn, NY; General Electric Company, Utica, NY; Sanders Associates Inc, Nashua, NH; TRACOR, Los Angeles, CA; Magnovox, Fort Wayne, IN; and Collins Radio, Cedar Rapids, IA.

(U) Program Accomplishments & Future Programs:

1. (U) FY 1981 and Prior Accomplishments: The HAVE QUICK program has completed Full Scale Development, Development Test and Evaluation, and Initial Operational Test and Evaluation. The HAVE QUICK production contract was awarded to Magnavox and an initial 2,000 units were procured. HAVE QUICK production continued with 2,400 units procured in FY 1981. Initial field installations of HAVE QUICK equipment began in February 1981. HAVE QUICK development, integration and qualification for the ground tactical command and control continue. Electromagnetic compatibility analysis of SINCGARS aircraft integration will continue. Alternatives for modifying existing Air Force Radios for SINCGARS were evaluated in detail with specific designs being developed after the Army design approach was chosen. Electronic counter countermeasures antenna design or modification for fighter aircraft to allow Single Channel Ground and Airborne Radio System (SINCGARS) installation were started. Related support and intelligence efforts continued and were paced by the Army's schedule. A consolidated study of Air Force integration alternatives to achieve interoperability with the Army Single Channel Ground and Airborne Radio System (SINCGARS) was completed. SEEK TALK completed development and fabrication of Advanced Development Model equipment and has completed contractor testing by General Electric and Hazeltine Corporations. SEEK TALK completed detailed government development and operational test and evaluation of Advanced Development equipment. This test program provided detailed technical analyses and a detailed operational assessment. SEEK TALK began Full Scale Engineering Development with initial design activities being completed. Additional efforts to minimize aircraft integration cost, develop special test equipment and other support efforts continued.

2. (U) FY 1982 Program: The production and deployment of HAVE QUICK equipment will be completed and made fully operational. Air Force participation in the Army SINCGARS program will continue. Specification design efforts for modification of Air Force radios will be completed. Antenna design for the integration of SINCGARS into airborne applications will continue. SEEK TALK will continue Full Scale Development of the overall system design, fighter terminals, ground command and control units, and support equipment. Design and Integration Engineering to incorporate SEEK TALK into the F-16, F-15, OV-10, A-10, E-3A and ground command and control systems will begin. A DSARC II will be conducted in June 1982 to assess SEEK TALK development and planned production programs.

Program Element: #27423? Title: Advanced Communication Systems
DoD Mission Area: Tactical Communications, #345 Budget Activity: Tactical Programs, #4

3. (U) FY 1983 Planned Program: Design of SINCGARS modifications will be completed subsequent to the planned January 1983 Army Production Decision. Test and Evaluation of these radio and antenna modifications will begin. The fabrication of SEEK TALK Full Scale Development equipment will be completed. This equipment will be used to conduct Design Test and Evaluation (DT&E), Initial Operational Test and Evaluation (IOT&E) and reliability qualification testing. DT&E and IOT&E will be conducted for OV-10s, F-16s, Forward Air Control Posts and Tactical Air Control Parties. These tests support a scheduled January 1984 Production Decision and Approval for Service Use. FY 1983 procurement funding fully funds procurement of the initial 100 air and ground systems including associated support equipment. During this period the prime contractor will procure strategic long lead materials and expand the production capability established during Full Scale Development. These efforts will allow inclusion of SEEK TALK into the FY 1983 F-16 procurement avoiding retrofit of those aircraft and allows achievement of an FY 1985 Initial Operational Capability required by the Tactical Air Forces. Integration engineering into the remaining 25 weapon system types will begin in a phased program.

4. (U) FY 1984 PLANNED PROGRAM: The Low Rate Initial Production (LRIP) program will begin with production approval planned for January 1984. The LRIP Equipment will form the basis of the FY 1985 Initial Operation Capability. During Full Scale Development the prime contractor will qualify a second source. The production programs planned to be competitive. Integration engineering of SINCGARS into remaining platforms will continue. During FY 1981 the SEEK TALK Research Development Test and Evaluation Program was expanded in scope to include modification engineering for the E-3A, A-10, PRC-113, QRC-206, F-15, and F-4. An effort to develop a combined Class II and Class V modification for the F-16, OV-10, TPS-43 and MRC-107 was added to the FY 1983 and FY 1984 program. A total of $162,902 thousand was added to the FY 1983 and FY 1984 estimates to cover program scope changes and initiate a leader follower plan for production.

5. (U) PROGRAM TO COMPLETION: Integration engineering and production of SEEK TALK will continue. Using Very High Speed Integrated Circuit (VHSIC) technology a small man portable model of SEEK TALK will be designed. VHSIC technology will also be applied to preplanned product improvements to SEEK TALK to reduce future production and integration costs.

6. (U) Milestones: See project 2277 narrative.

Project: #2277
Program Element: #27423F
DoD Mission Area: Tactical Communications, #345

Title: SEEK TALK
Title: Advanced Communication Systems
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: As a result of United States (US) experience in Southeast Asia and it is apparent that the Air Force is facing a rapidly increasing electronic countermeasures (ECM) threat. This threat

The Air Force SEEK TALK program will develop and implement an air-air and air-ground-air ultra high frequency (UHF) voice communications capability that will permit the Tactical Air Forces (TAF) to fulfill their mission despite hostile enemy communications jamming. SEEK TALK is being developed in response to TAF Required Operational Capability (ROC) 321-75 and the CORONET CLEAR study. SEEK TALK will use pseudo-random noise conferencing modulation and adaptive antenna nulling to provide resistance to hostile jamming.

(U) The pseudo-random noise conferencing modulation will be provided by the development of a spread spectrum modem that retains the desirable features of the present amplitude modulated (AM) radio. The specific features desired include: voice input and output, reasonable intelligibility, a minimum of knobs and switches, unlimited simultaneous transmissions, conferencing capability and simultaneous reception of multiple signals. Several of these requirements are unique to the TAF voice air-ground-air communications systems and have not been addressed in previous jam resistant communications research and development programs. The modem will be capable of providing these requirements in an ECM environment.

(U) The adaptive antenna array task will be pursued concurrent with the spread spectrum modem development. The adaptive null steering antenna processor development will equalize the power of all jamming and communication signals received (power equalization) to improve the antenna pattern in the direction of desired signals and places nulls in the direction of interfering signals. The adaptive antenna processor will be designed to operate in a power equalization mode with the conventional AM radio signal (providing interoperability with conventional UHF communications) and with the spread spectrum modem to place a null in the direction of the interfering signals.

(U) SEEK TALK will retain compatibility with existing UHF radio equipment, communication security equipment (KY-58 VINSON) and HAVE QUICK to insure interoperability with the other systems.

(U) The SEEK TALK program structure contains four phases, emphasizing competition. These phases (Concept Design, Concept Validation, Full Scale Engineering Development, and Production) will emphasize system life cycle cost and maintain competition by systematically reducing the number of contractors at the end of each phase. The Air Force is continuing to address joint service and NATO interoperability as high priority issues through the Joint Chiefs of Staff and Office of the Secretary of Defense directed architecture studies.

(U) RELATED ACTIVITIES: Requirements and technical approach are presently being explored with the Navy and Army for the purpose of insuring interoperability. Formal interoperability tasks are part of this program and techniques which are developed by the Air Force, as the Joint Chiefs of Staff lead service for the development of technical specifications will be coordinated with similar techniques being developed by the other Services. Prior to FY 1980, this project was funded under PE 63727F, Advanced Communication Technology. SEEK TALK special test activities are managed by the Naval Research Laboratories, Bolling AFB, Washington DC.

Project: #2277
Program Element: #27423F
DoD Mission Area: Tactical Communications, #345

Title: SEEK TALK
Title: Advanced Communication Systems
Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: The SEEK TALK program is managed by the Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA, with technical phases of the programs being contracted and tested by the Rome Air Development Center, Griffis AFB, NY. The MITRE Corporation, Bedford, MA, supports the Air Force as systems engineer. Contractors include: Hazeltine Corporation, Greenlawn, NY; General Electric Company, Utica, NY; Sanders Associates Inc., Nashua, NH; ARINC Research Inc., Annapolis, MD; Calspan Inc., Buffalo, NY; Motorola Inc., Scottsdale, AZ; and TRACOR, Los Angeles, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1981 and Prior Accomplishments: SEEK TALK system requirements and threat studies have been completed. Four competing system Concept Design studies were completed including interface designs for other Service equipment. The Concept Validation phase began in March 1979 with contractual awards for the fabrication of three competing Advanced Development designs. Electromagnetic system design vulnerability analysis, compatibilities analysis and aircraft integration studies were started and will continue through production decision. The Advanced Development Model test program began in January 1982. This test program will include detailed develoment, design vulnerability and operational testing. System design vulnerability analysis, electromagnetic compatibility analysis and aircraft integration studies will continue. Revised threat assessments and other supporting efforts will be started. Full Scale Engineering Development will begin with production design studies due to be completed in early FY 1982. Fabrication of Advanced Development equipment and contractor flight testing was completed in FY 1981.

2. (U) FY 1982 Planned Program: SEEK TALK Full Scale Engineering Development production design and integration efforts will be completed. Engineering prototype equipment will be fabricated and qualification testing of this equipment will will be started. Detailed, in-depth development and vulnerability testing will be accomplished with the most advanced jamming technology available. System vulnerability electromagnetic compatibility, threat and integration studies will continue. A Defense System Acquisition Review Council (DSARC) II will be conducted in June 1982 to assess the SEEK TALK development and planned production programs.

3. (U) FY 1983 Planned Program: Design of SINCGARS modifications will be completed subsequent to the planned January 1983 Army Production Decision. Test and Evaluation of these radio and antenna modifications will begin. The fabrication of SEEK TALK Full Scale Development equipment will be completed. This equipment will be used to conduct Design Test and Evaluation (DT&E), Initial Operational Test and Evaluation (IOT&E) and reliability qualification testing. DT&E and IOT&E will be conducted for OV-10s, F-16s, Forward Air Control Posts and Tactical Air Control Parties. These tests support a scheduled January 1984 Production Decision and Approval for Service Use. FY 1983 procurement funding fully funds procurement of the initial 100 air and ground systems including associated support equipment. During this period the prime contractor will procure strategic long lead materials and expand the production capability established during Full Scale Development. These efforts will allow inclusion of SEEK TALK into the FY 1983 F-16 procurement avoiding retrofit of those aircraft and allows achievement of an FY 1985 Initial Operational Capability required by the Tactical Air Forces. Integration Engineering into the remaining 25 weapon system types will begin in a phased program.

4. (U) FY 1984 PLANNED PROGRAM: The Low Rate Initial Production (LRIP) program will begin with production approval planned for January 1984. The LRIP Equipment will form the basis of the FY 1985 Initial Operation Capability. During Full Scale Development the prime contractor will qualify a second source. The production programs planned to be competitive. Integration engineering of SINCGARS into remaining platforms will continue.

Project: #2277	Title: SEEK TALK
Program Element: #27423F	Title: Advanced Communication Systems
DoD Mission Area: Tactical Communications, #345	Budget Activity: Tactical Programs, #4

5. (U) PROGRAM TO COMPLETION: Integration Engineering and production of SEEK TALK will continue. Using Very High Speed Integrated Circuit (VHSIC) technology a small man portable model of SEEK TALK will be designed. VHSIC technology will also be applied to preplanned product improvements to SEEK TALK to reduce future production and integration costs. Total planned SEEK TALK procurement of 8,200 systems and support equipment for the Tactical Air Forces will be installed into 32 different platforms. Production and installation of SEEK TALK equipment will continue through 1993.

6. (U) Milestones:

Event	Date
Concept Phase	Feb 1978-Sep 78
Validation Phase	
Design and Fabrication	Mar 1979-Dec 1980
Development Testing	Jan 1981-Oct 1981
Operational Testing	May 1981-Oct 1981
Full Scale Engineering Development	
Design and Fabrication	Jan 1981-Jul 1983
Development Testing	Jul 1983-Dec 1983
Initial Operational Testing	Jul 1983-Dec 1983
Production Decision	Jan 1984
Production	
Low Rate Initial Production	Jan 1984-2Q 1985
Full Production	2Q 1985-2Q 1992
Initial Capability	3Q 1985

7. (U) Resources:

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
PROCUREMENT						
2277 - SEEK TALK						
(Aircraft)			36,200 (79)	276,700 (360)	1,660,300	1,973,200
(Other)		12,256	10,472 (50)	28,672 (52)	676,600	729,000

(U) Initiates procurement and nonrecurring for 100 initial SEEK TALK Low Rate Initial Production airborne and ground units; plus support equipment.

Project: #2277
Program Element: #27423F
DoD Mission Area: Tactical Communications, #345

Title: SEEK TALK
Title: Advanced Communication Systems
Budget Activity: Tactical Programs, #4

8. (U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Cost
RDT&E	4[illegible],600	5[illegible],800	3,200		Continuing	Not Applicable
PROCUREMENT						
2482 - HAVE QUICK						
(Aircraft)	25,500					
(Other)	18,700					
2 - SEEK TALK						
(Other)			16,019			

(U) During formulation of the FY 1983 Program Objective Memorandum the SEEK TALK program was restructured to include Full Scale Development and Integration Engineering for many of the 32 separate platforms it will be incorporated into. The scope of procurement estimates were increased to 8,200 units for the Tactical Air Forces. Refinements of Full Scale Development to include production line incorporation into the F-16, integration into the F-15 and E-3A increased the FY 1982 estimate by $5,[illegible]00 thousand. The FY 1983 Design Test and Evaluation and Initial Operational Test and Evaluation program has been increased in scope, integration engineering for the F-15, E-3A and A-10 increased the FY 1983 estimate by $77,200 thousand.

Budget Activity: Tactical Programs, #4
Program Element: 27423F, SEEK TALK Advanced Communications Systems

Test and Evaluation Data

1. (U) Development Test and Evaluation: The purpose of SEEK TALK is to add jam resistant voice communication capability to the existing Air Force UHF voice radios used in Tactical Air Operations. Antenna null steering and spread spectrum techniques will be employed to achieve this purpose. Antenna null steering arrays can selectively reduce the level of jamming signals coming from multiple axes relative to the receiver. Spread spectrum capability is obtained by employing a National Security Agency developed Anti-Jam Code Module which provides a direct-sequence, pseudo-random spread-spectrum waveform

(U) The SEEK TALK program has been divided into two phases, Concept Validation and Full Scale Development (FSD). The Concept Validation phase has been completed as a competitive program beginning with four contractors for Conceptual Design. Two contractors built Advanced Development Models (ADM) which were used for Concept Validation Design Test and Evaluation (DT&E).

(U) The FSD Phase is divided into three phases: Phase I began second quarter fiscal year 1981 with the award of competitive contracts to General Electric Company, Aerospace Electronic Systems Department, Utica, New York, and Hazeltine Corporation, Greenlawn, New York, and will continue through to the end of the Critical Design Review. Prior to the beginning of Phase II, a single contractor will be selected to continue with SEEK TALK. Phase II will include the fabrication, in-plant testing, and performance verification of the prototype preproduction SEEK TALK equipment. Phase III will be devoted to a government Development Test and Evaluationo (DT&E) program with support from the FSD contractor. For the Phase III effort, the equipment will be installed and tested on the F-16 and OV-10 aircraft, TPS-43E radar, and the MRC-107 jeep. The A-10 will be tested during the later stages of DT&E as the first of the follow-on platform installations.

(U) Hazeltine Corporation and General Electric both built ADM equipment. The ADM equipment was functionally but not physically similar to proposed production units. Both contractors' ADM equipment underwent detailed laboratory performance verification and vulnerability testing at the Rome Air Development Center (RADC). Testing on the RADC Newport Antenna Range was conducted on a pedestal mounted A-10. Concept Validation DT&E flight tests were conducted at Eglin Air Force Base by the 4950th Test Wing, and RADC.

ADM testing was completed at Eglin Air Force Base in fourth quarter FY 81 and validated the SEEK TALK concept.

Budget Activity: Tactical Programs, #4
Program Element: 27423F, SEEK TALK Advanced Communications Systems

Electromagnetic compatibility testing was conducted between the SEEK TALK Advanced Development Models (ADM) and the Army GRC-103 UHF radio relay in fourth quarter fiscal year 1981 and first quarter fiscal year 1982.

(U) Following source selection, the SEEK TALK contractor will provide 25 preproduction units (identical to production units) to support Phase III Full Scale Development (FSD) testing. Phase III FSD testing is scheduled to begin in fourth quarter fiscal year 1983 and will include Rome Air Development Center (RADC) Newport Antenna Range and Eglin Air Force Base flight testing by the government. The 3246th Test Wing is the responsible test organization for Phase III while the Naval Research Lab, RADC, Human Medical Research Lab, Electronic Security Command and Electronic Systems Division are participating test organizations.

(U) The major Phase III test objectives are to verify SEEK TALK technical performance, including performance in a representative threat environment, and insure design risks have been minimized. The critical technical issues that will be addressed by FSD testing are spread spectrum modem performance, adaptive array performance, jam resistance, reliability, maintainability, and availability.

will be needed to evaluate FSD system performance. SEEK TALK contractors will design and build test instrumentation for the Eglin testing. Computer reduction of test data will be required due to the large quantity of data generated by the flight test.

(U) Reliability, maintainability, availability, and thorough environmental testing were not evaluated during ADM but are key test objectives of FSD Development Test and Evaluation (DT&E).

2. (U) Operational Test and Evaluation: The Air Force Test and Evaluation Center (AFTEC) conducted an Operational Effectiveness Assessment (OEA) of ADM equipments from May to August 1981 in conjunction with RADC DT&E. An AFTEC test team, based at Eglin Air Force Base, Florida, was augmented by temporary duty personnel from the Tactical Air Warfare Center (TAWC), Headquarters Tactical Air Command (TAC) and RADC. During January-March 1981, the AFTEC test team monitored the bench, laboratory, anechoic chamber, and Newport Antenna Range tests performed by RADC. The operational objectives during this portion of the testing focused on the SEEK TALK communications and jam-resistance capabilities.

(U) During April-June 1981, AFTEC observed the technically-oriented DT&E flight tests at Eglin Air Force Base, as well as conducted a series of operationally-oriented flight tests using the T-39 test aircraft and ground stations. The operational objectives of the flight tests, a portion of which was conducted in the presence of jamming, included an estimate of the potential enhancements to various Tactical Air Force missions.

(U) Due to the acceleration of the SEEK TALK program, contracts for the design of FSD prototypes were awarded to two contractors in January 1981. Selection of one contractor to fabricate the preproduction terminals and support a

Budget Activity: Tactical Programs, #4
Program Element: 27423F, SEEK TALK Advanced Communications Systems

1983 Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) is planned for February 1982. An Air Force Test and Evaluation Center (AFTEC) managed IOT&E of the preproduction equipment will be conducted from July to December 1983 and address both operational effectiveness and operational suitability. However, long lead decision is planned during fiscal year 1983 before the IOT&E is completed.

(U) For the 1983 IOT&E, the AFTEC test team at Eglin Air Force Base will be expanded to include Tactical Air Command (TAC), Air Force Logistics Command (AFLC), and Electronics Security Command (ESC) representatives. All of the operational testing will be conducted at Eglin Air Force Base using F-16 and OV-10 aircraft and representative surface command and control facilities. Close air support and defensive counter-air (air defense) missions will be simulated using the SEEK TALK equipment. In addition to quantifying the enhancements to these missions, other factors such as communications performance, synchronization adequacy, jam resistance, electromagnetic interference, timing distribution, hardware reliability, mobility and supportability will be evaluated.

(U) Significant test milestones are:

Event/Activity	Start	Complete
Operational Effectiveness Assessment (OEA) of Advanced Development Models (ADM) Equipments	May 81	Aug 81
Full Scale Development (FSD) Fabrication Decision	Feb 82	
Full Production Decision (long lead items)		Jun 82
IOT&E of FSD Equipments	Jul 83	Dec 83
Production Decision		Jan 84
IOT&E Final Report		Feb 84

3. Systems Characteristics. To validate SEEK TALK system technology, performance goals were established for ADM testing. Rome Air Development Center (RADC) conducted the ADM test as the responsible test organization. Data generated by the ADM test was computer reduced by the 4950th Test Wing at Wright-Patterson Air Force Base and analyzed by RADC. Reliability, maintainability, and availability were not evaluated during ADM testing and the respective production goals below are for the Tactical Airborne Segment.

Budget Activity: Tactical Programs, #4
Program Element: 27423F, SEEK TALK Advanced Communications Systems

Characteristic	ADM Goal	Demonstrated	Production Goal
Adaptive Antenna Array Gain			
Spread Spectrum Modem Gain			
Reliability	N/A	N/A	611 MTBF
Maintainability (ORG)	N/A	N/A	.20 hours
(INT)	N/A	N/A	1.00 hours
Availability	N/A	N/A	.99992

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27431F (64701F) (27415F) (64751F)

Title: Tactical Air Intelligence System (TAIS) Activities

DOD Mission Area: Surveillance and Reconnaissance, #342

Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2,944	9,066	8,253	7,811	Continuing	Not Applicable
2387	Intra-Theater Imagery Transmission System (IITS)*			1,091	979		7,470
2390	WS-430B Enhancement						3,100
2394	Operational Application of Special Intelligence Systems (OASIS)**		8,666	7,062	6,832	16,209	61,865
2514	Imagery Interpretation (II)	500					10,400
2516	Display and Control/Storage and Retreival (DC/SR)		200	100			43,200
2539	System Integration and Program Support	879					20,100
2604	United States Air Forces in Europe Tactical Air Intelligence System (UTAIS) Architecture	1,565	200				2,500

* $2,200 thousands in FY 81 and $500 thousands in FY 82 was funded in PE 64751F (total R&D costs through FY 82 is $5,400 thousands); IITS transferred to PE 27431F beginning in FY 83.

** $6,300 thousands in FY 81 was funded in PE 27415F; OASIS transferred to PE 27431F beginning in FY 82.

Program Element: # 27431F (64701F) (27415F) (64751F)

Title: Tactical Air Intelligence System (TAIS) Activities

DOD Mission Area: Surveillance and Reconnaissance, #342

Budget Activity: Tactical Programs, #4

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The tactical forces are faced with a critical deficiency in their capability to rapidly and accurately process, interpret, and disseminate information from various intelligence collection systems. The purpose of this program is to develop and acquire mobile, land-based processing, interpretation, exploitation and dissemination systems for use by tactically deployed general purpose forces. TAIS Activities is an intelligence program element that includes three development projects: Display and Control/Storage and Retrieval, Operational Application of Special Intelligence Systems and Intra-Theater Imagery Transmission System (transferred to this Program Element in Fiscal Year 1983 from Program Element 64751F).

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds to correct deficiencies in the Display and Control/Storage and Retrieval Segment of the Tactical Information Processing and Interpretation System. The funds would also provide for continued OASIS software development to receive, integrate, distribute, and display intelligence and operational data in a timely manner and in a useable format. Additionally, an upgrade of the existing OASIS information processing systems hardware will continue. Finally, the funds will be used to correct any deficiencies discovered during initial operational use of the production Intra-Theater Imagery Transmission System and provide communications engineering support. These estimates were developed by the Air Force Systems Command Program Offices with the assistance of MITRE and the contractors based on experience on previous efforts in these projects and similar projects.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: (PE level only)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	2,900	9,300	7,200		Continuing	Not Applicable
Procurement (Other)			2,934			8,434

(U) OTHER APPROPRIATION FUNDS:

Project Number	Title	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	Procurement (Other) (3080) (Quantity)						
2387	Intra-Theater Imagery Transmission System (IITS)		6,281 (27)	4,516 (41)	3,661 (32)	7,719 (60)	22,177 (160)
2394	Operational Application of Special Intelligence Systems (OASIS)					7,700	12,700
2514	Imagery Interpretation (II)			3,400			3,400
2516	Display and Control/Storage and Retrieval (DC/SR)	-		1,400 (2)			7,770 (2)

Program Element: # 27431F (64701F) (27415F) (64751F)

DOD Mission Area: Surveillance and Reconnaissance, #342

Title: Tactical Air Intelligence System (TAIS) Activities

Budget Activity: Tactical Programs, #4

Project Number	Title	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	Operation and Maintenance (3400)						
2394	Operational Application of Special Intelligence Systems (OASIS)	3,875	4,000	5,400	4,800	8,000	40,100
2514	Imagery Interpretation (II)	1,521	2,670				4,951

Program Element: #27431F

Title: Tactical Air Intelligence System (TAIS) Activities

DOD Mission Area: Surveillance and Reconnaissance, #342

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The tactical forces in the field have continually been faced with a critical deficiency in their capability to rapidly and accurately interpret information collected by reconnaissance aircraft and in their timely handling and distribution of all intelligence products. While methods of collection have generally kept pace with technological advances, the capability to rapidly exploit the information remains constrained by slow, inaccurate manual methods. To overcome the deficiencies, Program Element 64701F, Tactical Information Processing and Interpretation (TIPI) System Development, was initiated as a Joint Air Force, Army, Marine Corps program with the Air Force as Executive Agent. TIPI Research, Development, Test, and Evaluation funds were transferred to this Program Element as of Fiscal Year 1979. The TIPI system applies automatic data processing techniques to enhance exploitation and collation. This automation will assist in providing finished intelligence to a deployed commander in a useable time frame. The TIPI program objective was to develop air transportable facilities that provide for processing, reproducing and interpreting aerial reconnaissance and surveillance products, collating with intelligence from all other sources, reporting on enemy force activities, preparing and distributing target materials, and supporting mission planning. The equipment will be shelterized and modularized so that appropriate numbers and types can be used at any location depending upon size and nature of the mission. The system is composed of functionally independent segments that will be interoperable and capable of interfacing with other systems. The Operational Application of Special Intelligence Systems project provides evolutionary improvements, in both hardware and software, to the United States Air Forces in Europe's Tactical Fusion Center in the command and control center for the Allied Air Forces Central Europe. The Intra-Theater Imagery Transmission System program, which transfers to this Program Element in FY 1983, will develop a system to electrically transceive high priority reconnaissance imagery to commanders, mission planners and strike crews thus eliminating the current time consuming requirement to courier the imagery. Timely imagery support will enhance ordnance and tactics selection, as well as target orientation for the strike crews.

(U) RELATED ACTIVITIES: The TIPI program will provide mobile land based facilities only and is complimentary to Navy programs which provide similar capabilities aboard ships. The program is managed by a jointly manned Program Office. Certain related but peculiar Marine Corps and Army requirements are funded and managed by the Marine Corps and Army. Each Service will budget separately for production, but the procurements will be centrally managed by the Program Office. The Photo Interpreter Report and Edit Station, to be used in Air National Guard Enhanced WS-430B segment, was developed in Program Element 64750F, Intelligence Equipment, Project 2716. The Tactical Digital Facsimile transceiver which is to used in the Intra-Theater Imagery Transmission System is being developed for the Joint Tactical Communications Program by the Navy under Program Element 28020N, Project XO 723-CC. Research, Development, Test and Evaluation funds to develop the Air Force Enemy Situation Correlation Element (ENSCE), a facility to perform multisource correlation and provide near-real-time targeting data and battlefield status information to tactical field commanders were contained in Program Element 64321F, Joint Tactical Fusion Program.

(U) WORK PERFORMED BY: Air Force management is provided by Electronic Systems Division, Hanscom AFB, MA, supported by Rome Air Development Center, Griffiss AFB, NY, and Aeronautical Systems Division, Wright-Patterson AFB, OH. Contractors are: General Electric Corporation, Daytona Beach, FL - System Integration Service; Radio Corporation of America, Burlington, MA - Display and Control/Storage and Retrieval; Mead Laboratories, Dayton, OH - Enhanced WS-430B; Martin Marietta, Denver, CO and Systems Development Corporation, Santa Monica, CA - Operational Application of Special Intelligence Systems; and Litton Amecon Corporation, Melville, NY - Tactical Digital Facsimile transceiver. The MITRE Corporation, Bedford, MA provides technical support.

Program Element: #27431F

DOD Mission Area: Surveillance and Reconnaissance, #342

Title: Tactical Air Intelligence System (TAIS) Activities

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments:

(U) Intra-Theater Imagery Transmission System (IITS) (Project 2387) - A study of the imagery dissemination requirements of all services was completed in 1975. The full scale engineering development program for the Intra-Theater Imagery Transmission System was cancelled by the Air Force in May 1978 in favor of using the Joint Tactical Communications Program's Tactical Digital Facsimile transceiver to form the basis for an Intra-Theater Imagery Transmission System. Funds were transferred to the Navy to purchase eight Tactical Digital Facsimile terminals to be used for Intra-Theater Imagery Transmission System integration and testing. Design of interface equipment assemblies to integrate Tactical Digital Facsimile transceiver, modems and encryption equipment into a prototype Intra-Theater Imagery Transmission System was completed. The Initial Operational Test and Evaluation of the prototype Intra-Theater Imagery Transmission System was conducted in Europe during August and September 1981 (all work done under PE 64751F).

(U) WS-430B Enhancement (Project 2390) - The Imagery Processing (Enhanced WS-430B) segment contains the equipment to develop and reproduce reconnaissance film. This segment will not be a new development but will be a modified and updated version of the existing WS-430B Photo Processing and Interpretation Facility. Engineering development of WS-430B shelters selected for prototyping was initiated in FY 1977. Tests were initiated on an automatic photographic chemical mix module and a packaged waste water treatment system. This type of commercial equipment is planned for use in the Enhanced WS-430B. Shelterization of one Advanced Tactical Processor to provide a large roll film processing capability for Pacific Air Forces (PACAF) was completed in FY 1977 and delivered to PACAF in January 1978. In August 1978, the WS-430B Enhancement contract for prototype development was awarded to Mead Laboratories of Dayton, OH. A Development Test and Evaluation was conducted at Bergstrom Air Force Base, TX and the prototype development contact was completed in FY 1981.

(U) Operational Application of Special Intelligence Systems (OASIS) (Project 2394) - A program office was established, two preliminary requirements studies and the Program Management Plan were completed, and a software development facility was established at the National Security Agency in 1977. In 1978, a development contract was let with Martin-Marietta; a second software development facility, linked to the first facility, was established at Electronic Systems Division and hardware, software and operational procedures of the Tactical Fusion Center were baselined. In addition, a terminal and a processor were installed in the Combat Operations Intelligence Center to eventually provide a data interface with the Tactical Fusion Center. Between 1979 and 1981, software and hardware developments to enhance the basic data distribution system and incoming reports processing were completed. In 1981, software development of message handling enhancement was initiated. Installation of the incoming reports processing was completed in 1981 and installation of the basic data distribution system enhancements was initiated. In 1980, the software development facility at the National Security Agency was phased out. A revised Program Management Plan was published in April 1981.

Program Element: #27431F

DOD Mission Area: Surveillance and Reconnaissance, #342

Title: Tactical Air Intelligence System (TAIS) Activities

Budget Activity: Tactical Programs, #4

(U) Imagery Interpretation (II) (Project 2514) - The II segment is comprised of three shelters containing automated equipment and communications to enable a photo interpreter to rapidly and accurately extract and disseminate information from tactical reconnaissance imagery. The segment completed development and testing in December 1974. The production decision was made in January 1975. On 28 February 1975, an II prototype was deployed to Zweibrucken Air Base, Federal Republic of Germany, for formal demonstrations and training. In May 1977, the production contract was awarded to Texas Instruments. The follow-on contract for production of additional II segments was awarded to Texas Instruments in September 1978 to complete Air Force requirements and satisfy initial Army requirements. In December 1978, a decision was made that the II would also provide Tactical Electronic Reconnaissance (TEREC) processing and data link capability. Three Air Force and two Marine Corps segments were delivered in FY 19[illegible]. Six Army segments were delivered in FY 1981. Software and hardware updates to the computer memory circuits, common chassis design, power supply, and input-output devices that will provide state-of-the-art computer circuits and maintenance functions for faster and easier fault isolation were developed. Tactical Electronic Reconnaissance tape processing software changes and hardware additions were developed or identified for incorporation into the three Air Force segments already delivered. Production of the remaining Air Force segments continued.

(U) Display and Control/Storage and Retrieval (DC/SR) (Project 2516) - The DC/SR is a six shelter segment containing the automated equipment and analysts' consoles necessary to enable intelligence personnel in a Tactical Air Control Center to correlate intelligence data from all sources and to perform intelligence analysis, threat assessment, collection management and target planning in a timely manner. Development and testing was completed in October 1975. During the testing, the computer response time was too slow to satisfy the Tactical Air Command requirement and a complete software and hardware analysis was performed. The software was simplified and hardware improvements were initiated to decrease the response time. The DC/SR was deployed to the Brave Shield XV Exercise in October 1976 and software/hardware improvements accomplished in FY 1976 were satisfactorily demonstrated. During October 1977, the DC/SR participated in the Bold Eagle Exercise at Hurlburt Field, FL. Eight DC/SR displays were successfully integrated into the Tactical Air Control Center during the exercise. During FY 1978, the second DC/SR procurement package was released to RCA of Burlington, MA. The second DC/SR was delivered in January 1980. Program Management responsibility was transferred from Air Force Systems Command to Air Force Logistics Command in 1981. Correction of residual program management responsibility transfer discrepancies is continuing.

(U) System Integration & Program Support (Project 2539) - For the Tactical Information Processing and Interpretation (TIPI) system to operate as an efficient, integrated intelligence processing system, management attention was directed to inter-system interoperability; commonality of support equipment, data bases, development/production requirements; and interoperability with other tactical and strategic systems required by the using command and higher headquarters direction. To aid the TIPI Program Office in these efforts, the services of an industrial system integration and checkout contractor were obtained. For ten years, system integration and checkout tasks were performed by General Electric Corporation, Daytona Beach, FL, thereby ensuring an integrated approach to the conduct of appropriate technical analysis, support of program reviews, and provision of test support. This project was completed at the end of FY 1981.

Program Element: #27431F

DOD Mission Area: Surveillance and Reconnaissance, #342

Title: Tactical Air Intelligence System (TAIS) Activities

Budget Activity: Tactical Programs, #4

(U) United States Air Force in Europe Tactical Air Intelligence System (UTAIS) Architecture (Project 2604) - A contract was awarded to BETAC Corporation on 22 October 1980 to perform a study which was the start of a systematic layout of the UTAIS to determine the proper architecture and overall improvements necessary to the major segments and driving functions in the European Command and Control environment. The initial effort was to concentrate on the Combat Operations Intelligence Center as the central segment and prepare a Request for Proposal to start improvement on the other segments in the architecture. A reassessment of the program was made during FY 1981, and a decision was made to limit the program to preparation of a functional system description of the current UTAIS. Work on this effort continued throughout FY 1981.

2. (U) FY 1982 Program:

(U) Intra-Theater Imagery Transmission System (IITS) (Project 2387) - Eight prototype transceivers will be turned over to United States Air Forces in Europe to use as an interim operational capability. The program office will develop an integration design and plan for fielding the production transceivers to the Tactical Air Forces (work performed under PE 64751). Order first increment of receivers. Provide Rapid Deployment Joint Task Force (RDJTF) with compatible commercial equivalent system.

(U) WS-430B Enhancement (Project 2390) - All RDT&E effort has been completed and program management responsibility will be transferred from Air Force Systems Command to Air Force Logistics Command. A contract for the modification of current WS-430B's will be awarded by Air Force Logistics Command.

(U) Operational Application of Special Intelligence Systems (OASIS) (Project 2394) - Complete installation and checkout of the basic distribution system enhancement. Continue development of message handling enhancement. Begin development of capability to provide internetting of Tactical Fusion Center and Combat Operations Intelligence Center general purpose communications interface. Begin Tactical Fusion Center operator station upgrade.

(U) Imagery Interpretation (II) (Project 2514) - Delivery of final four Air Force Imagery Interpretation segments, with Tactical Electronic Reconnaissance (TEREC) tape processing and data link capability. Incorporation of TEREC tape processing capability in other three Air Force segments.

(U) Display and Control/Storage and Retrieval (DC/SR) (Project 2516) - Program management responsibility transfer residual discrepancies will continue to be corrected. A program to replace several aging and potentially unsupportable components will be developed. This program will allow the system to remain operationally and logistically supportable in the 1990s.

3. (U) FY 1983 Planned Program:

(U) Intra-Theater Imagery Transmission System (IITS) (Project 2387) - Order second increment of transceivers. Continue communications engineering support to accommodate newly fielded communication systems.

Program Element: #27431F

DOD Mission Area: Surveillance and Reconnaissance, #342

Title: Tactical Air Intelligence System (TAIS) Activities

Budget Activity: Tactical Programs, #4

(U) Operational Application of Special Intelligence Systems (OASIS) (Project 2394) - Complete the message handling enhancement. Continue work on the Tactical Fusion Center/Command and Control Information Systems enhancement, Combat Operations Intelligence Center interface, and operator station upgrade. Begin development of capability to process enemy ground order-of-battle information and receive information from selected sources of ground element information.

(U) Display and Control/Storage and Retrieval (DC/SR) (Project 2516) - Continue correction of program management responsibilty transfer discrepancies in conjunction with logistical supportability recovery plan activities.

(U) The difference in total program cost is the transfer of Project 2387 from PE 64751F, Intra-Theater Imagery Tranmission System to this Program Element.

4. (U) FY 1984 Planned Program:

(U) Intra-Theater Imagery Transmission System (IITS) (Project 2387) - Receive first production transceivers. Order third increment of transceivers. Continue communications engineering support.

(U) Operational Application of Special Intelligence Systems (OASIS) (Project 2394) - Complete work on Tactical Fusion Center/Command and Control Information System enhancement, Combat Operations Intelligence Center interface, operator station upgrade and ground order-of-battle/information processing. Begin enhancement of capability for air order-of-battle processing and receipt of hostile and friendly air situation data from selected sources.

5. (U) Program to Completion: This is a continuing program.

(U) Intra-Theater Imagery Transmission System (IITS) (Project 2387) - Continuing orders through FY 1986 and fielding through FY 1988.

(U) Operational Application of Special Intelligence Systems (OASIS) (Project 2394) - Complete previously initiated enhancements and continue modifications to software to provide analysts computer tools, increased information exchange and operator interaction between the Combat Operations Intelligence Center and the Tactical Fusion Center, and data exchange between the Tactical Fusion Center and the Command and Control Information System. The mainframe computer will be replaced in FY 1985 and FY 1986.

6. (U) Milestones:

	Milestone	Date
A.	Display and Control/Storage and Retrieval Inital Operational Test and Evaluation	31 Oct 75
B.	Imagery Interpretation Production Contract Award	29 May 77
C.	Delivery of Second DC/SR	Jan 80
D.	United States Air Forces in Europe Tactical Air Intelligence System Architecture Contract Award	Oct 80

Program Element: #27431F

Title: Tactical Air Intelligence System (TAIS) Activities

DOD Mission Area: Surveillance and Reconnaissance, #342

Budget Activity: Tactical Programs, #4

E.	Enhanced WS-430B Prototyping Complete	Dec 80
F.	Enhanced WS-430B Development Test and Evaluation	31 Jan 81
G.	Operational Application of Special Intelligence Systems Installation of Incoming Reports Processing Enhancement	30 Sep 81
H.	Intra-Theater Imagery Transmission System Prototype Development Test and Evaluation	31 Oct 81
I.	Operational Application of Special Intelligence Systems Installation of Basic Distribution System Enhancement	Nov 81
J.	Delivery of Final Imagery Interpretation Segment	Feb 82
K.	Operational Application of Special Intelligence Systems Installation of Message Handling Enhancement	Apr 83
L.	Operational Application of Special Intelligence Systems Installation of Information Exchange Enhancement	Jul 84

Project: #2394

Program Element: #27431F(#27415F)

DOD Mission Area: Surveillance and Reconnaissance, #342

Title: Operational Application of Special Intelligence Systems

Title: Tactical Air Intelligence System (TAIS) Activities

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: An integrated, responsive command and control system is of paramount importance in assuring the security, effective control, and economical employment of United States Air Force forces identified for, or assigned to, the North Atlantic Treaty Organization. [

In his wartime role, the Commander-in-Chief, United States Air Forces in Europe, will exercise command of the Allied Air Forces Central Europe from the Static War Headquarters in a hardened bunker at Boerfink, Federal Republic of Germany. In this capacity, the commander requires processed, correlated, and integrated information from selected intelligence and operational sources to: (1) assess the status of friendly forces, enemy forces, and the battle situation; (2) support decisions concerning allotment of air resources in the European Central Region; and (3) provide specific guidance for the employment of critical resources. The Tactical Fusion Center, was established to provide information required to meet these needs. As installed, it provides only a partial solution. The existing computer system provides limited intelligence data to the Tactical Fusion Center and supports only certain tasks, although it has the capacity to perform many more functions. Current interfaces with Battle Staff and theater information systems are basically manual. Software will be developed and equipment procured under this program to enable the computer system to receive and process a broader spectrum of the required data, and provide the information required by the Commander-in-Chief, United States Air Forces in Europe, for effective command and control of air operations.

RELATED ACTIVITIES: The Tactical Fusion Center was established under the [ ] program. The baselined computer system, a Digital Equipment Corporation Dual System 10, was provided by the National Security Agency, under the KALEIDOSCOPE program, in 1977. Other related Air Force activities include Program Element 64750F Project 1955, Air Force Support to DoD Indications and Warning; Program Element 31335F, Automated Data Processing General Defense Intelligence Program Support; Program Element 31339F, Intelligence Communications and Defense Special Security System; and Program Element 64321F, Joint Tactical Fusion Program. Initial development work for the Operational Application of Special Intelligence Systems program was conducted under Program Element 27415F USAFE Command and Control System.

(U) WORK PERFORMED BY: Air Force management is provided by a Program Management Office at the Electronic Systems Division Hanscom AFB, MA, with system engineering/technical direction support being provided by the MITRE Corporation, Bedford, MA. Martin-Marietta, Denver, CO, is the prime contractor and System Development Corporation, Santa Monica, CA, is a subcontractor. Preliminary information studies were performed by TRW, Redondo Beach, CA, and Radio Corporation of America, Burlington, MA.

Project: #2394

Title: Operational Application of Special Intelligence Systems

Program Element: #27431F(#27415F)

Title: Tactical Air Intelligence System (TAIS) Activities

DOD Mission Area: Surveillance and Reconnaissance, #342

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A Program Office was established and two preliminary studies completed in 1977. One studied the information flow and sizing requirements, and the other air and missile order-of-battle require The Program Office completed a comprehensive Program Management Plan in March 1977. The software development facility at the National Security Agency was established to effect changes to the baseline computer system. The development contract was let on 26 January 1978 with Martin-Marietta. A software development facility linked to the National Security Agency Facility was established at Electronic Systems Division to develop and test modifications for the Operational Tactical Fusion Center. The Tactical Fusion Center was technically baselined. Operational procedures were refined an performance data was baselined for the Center's communication and automated data processing equipment. Baseline functional and product specifications for the original software were prepared. Graphics generating and disseminating terminals were installed in the Tactical Fusion Center and the North Atlantic Treaty Organization area and a network processor was installed in the Combat Operations Intelligence Center to eventually provide an interface with the Tactical Fusion Center. In 1979, development of software updates and corrections to procedural handling of incoming reports commenced. Also begun in 1979 was an enhancement of the basic data distributing system to include a display and information preparation capability, the data sanitization review and release capability; the data base maintenance and manipulation function; and the distribution of data to the closed circuit TV system. This work continued through 1980 and 1981. In September 1980, the software development facility at the National Security System was phased out. Installation of the incoming reports enhancement was accomplished in 1981 and installation of the basic data distribution system enhancement began Message handling software developments to provide the Tactical Fusion Center communications capabilities via the widest possible range of standard and general service communications, both secure and non-secure, were also begun. A revised Program Management Plan was published in April 1981.

2. (U) FY 1982 Planned Program: Complete installation and checkout of the basic distribution system. Continue development of message handling enhancements. Begin development of a systems capability that will provide for a two-way data exchange between the Tactical Fusion Center Computer and the NATO Command and Control Information Systems (CCIS). Begin developing the necessary hardware and software to establish a basic general purpose communications interface between the Combat Operations Intelligence Center and the Tactical Fusion Center. Begin replacement or upgrade of the current operator consoles to a totally integrated analyst and communications functional environment.

3. (U) FY 1983 Planned Program: Complete installation and checkout of a message handling enhancement. Continue work on the Tactical Fusion Center/Command and Control Information Systems enhancement, Combat Operations Intelligence Center initial interface, and the console upgrade/replacement. Begin work on interconnection with selected sources of hostile ground element information in conjunction with providing the data processing support necessary to maintain and manipulate both dynamic and static files on hostile ground element information.

Project: #2394

Program Element: #27431F(#27415F)

DOD Mission Area: Surveillance and Reconnaissance, #342

Title: Operational Application of Special Intelligence Systems

Title: Tactical Air Intelligence System (TAIS) Activities

Budget Activity: Tactical Programs, #4

4. (U) FY 1984 Planned Program: Complete work on the initial Tactical Fusion Center/Combat Operations Intelligence Center interface, the data exchange with the Command and Control Information System enhancement, operator station upgrade and ground order-of-battle/information processing. Begin a similar program to receive data from selected sources of hostile air situation data, and possibly overall air situation data, and then provide the data processing capability to maintain and manipulate this data.

5. (U) Program to Completion: It will complete previously initiated enhancements and implement additional enhancement that will provide algorithmic support tools to the operator/analyst, with a primary emphasis on the information review and analysis responsibilities of the Tactical Fusion Center; develop operationally tailored software necessary to assure mutually supportive information exchange and operator interaction between the Tactical Fusion Center and the Combat Operations Intelligence Center; and, provide operational tailoring and specific display development capability for the basic data distribution system within the Tactical Fusion Center. In FY 1986 and 1987, the Digital Equipment Corporation Dual System 10 baseline computer will be replaced.

6. (U) Milestones: Not Applicable

7. (U) Resources ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E		8,666	7,062	6,832	16,209	61,865
Procurement (Other)					8,000	13,000

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional To Completion	Total Estimated Costs
RDT&E	6,300	9,139	6,797			39,100
Procurement (Other)	76					4,900

Budget Activity: Tactical Programs, #4
Program Element: #27431F, Tactical Air Intelligence System Activities

Test and Evaluation Data:

1. (U) Development Test and Evaluation: The Tactical Information Processing and Interpretation System contains functionally independent segments. Each segment is developed, tested, and produced according to the segment schedule, under the management of Electronic Systems Division, Hanscom AFB, MA. WS-430B Enhancement, Project 2390, the Imagery Processing Segment, development contract was awarded to Mead Laboratories, Dayton, OH in August 1978. In 1976, the Imagery Processing segment development was cancelled to reduce system cost. In place of the Imagery Processing segment, the existing WS-430B, Photo Processing and Interpretation Facility will be enhanced. The enhancement will not involve extensive developmental costs because state-of-the-art processing, printing quality control, and pollution abatement equipment will be integrated into the required WS-430B's. The enhancement will extend the WS-430B's service life and provide modernized equipment to meet the Tactical Air Forces' requirements for an Imagery Processing segment. A prototype Enhanced WS-430B was assembled and tested in a Development Test and Evaluation at Bergstrom Air Force Base, TX from December 1980 through January 1981. No further Development Test and Evaluation is planned for the WS-430B.

(U) The Display and Control/Storage and Retrieval segment, Project 2516, contains automated equipment and analyst's stations to provide the Combat Intelligence Center with a capability to rapidly correlate, analyze, and assess intelligence inputs. The prime contactor was System Development Corporation of Santa Monica, CA, and the subcontractor was Radio Corporation of America, Burlington, MA. Development Test and Evaluation was accomplished from June 1975 through September 1975 at Langley Air Force Base, VA.

(U) The Imagery Interpretation segment, Project 2514, contains automated equipment and communications which enable the photo interpreter to rapidly and accurately extract and disseminate information from tactical reconnaissance imagery. The prime contractor is Texas Instruments, Dallas, TX. An extended Development Test and Evaluation was conducted from August 1974 through December 1974 at Langley Air Force Base, VA. The purpose of this test was to train user personnel, resolve problems identified during the Initial Operational Test and Evaluation, evaluate the rigid auxiliary shelter, evaluate the Imagery Interpretation segment and Intelligence Data Handling System interface, and determine the capabilities of the Imagery Interpretation segment to perform additional photo interpretation. Test results were satisfactory on all items. Numerous software changes were necessary to more fully automate the exploitation of imagery without coded data blocks. Also, some software and hardware modifications were required to increase target location accuracy. The testing was completed prior to production decision and the Imagery Interpretation segment production contact was awarded in May 1977.

Budget Activity: Tactical Programs, #4
Program Element: #27431F, Tactical Air Intelligence System Activities

(U) The Operational Application of Special Intelligence Systems (OASIS) Program, Project 2394, will provide hardware and software to automate currently limited, manual capabilities of the United States Air Forces in Europe's Tactical Fusion Center. The program will contain a series of system upgrade packages consisting of new or modified software and/or hardware. Each of these upgrade packages is developed, tested and implemented according to the package schedule. Development Test and Evaluation performed by OASIS Program Office and contractor personnel, in general, will be performed in the contractor's production facility, the Electronic Systems Division's Systems Development Facility, and/or the National Security Agency Systems Development Facility. Final stages of Development Test and Evaluation will be conducted in-theater by OASIS Program Office and contractor personnel, to verify that the delivered equipments have not been damaged in shipment, that installation of all software and/or hardware was properly done, and that the upgrade package is capable of proper operation when interfaced with the operational system and is ready for Initial Operational Test and Evaluation to be performed by United States Air Forces in Europe personnel. A single development contract was competitively awarded to Martin Marietta, Denver, CO on 28 January 1978. Systems Development Corporation, Santa Monica, CA is the major subcontractor for software. The MITRE Corporation, Bedford, MA provides system engineering/technical direction support to the Electronic Systems Division OASIS Program Office, Hanscom AFB, MA.

(U) The Intra-Theater Imagery Transmission System (IITS), Project 2387, will provide the capability for tactical reconnaissance units to disseminate high priority imagery products to command and control and attack/strike forces in a timely manner. The Intra-Theater Imagery Transmission System will use the Tactical Digital Facsimile transceiver (AN/UXC-4/TACFAX) being developed by the Navy under Program Element 28010N, Project XO 723-CC, through the Joint Tactical Communications Program Office. Litton Amecon Corporation, Melville, NY is the development contractor for the Tactical Digital Facsimile transceiver. Air Force program management is provided by Electronic Systems Division, Hanscom AFB, MA with technical support from MITRE Corporation. A Joint Test Element, including an Air Force Test and Evaluation Center test team, under a Navy-assigned Joint Test Director, observed and monitored a combined Development Test and Evaluation and Initial Operational Test and Evaluation of the TACFAX at Ft Huachuca, AZ from April through July 1981. This testing revealed major deficiencies in the Tactical Digital Facsimile transceiver, in the areas of reliability, maintainability supportability and system design. The Joint Tactical Communication Program Office will determine a program, to include retesting, necessary to resolve system deficiencies.

(U) The Intra-Theater Imagery Transmission System underwent a limited Development Test and Evaluation conducted by Electronic System Division and MITRE Corporation to verify the proper integration of the TACFAX into the unique Intra-Theater Imagery Transmission System communications terminal configuration. The Initial Operational Test and Evaluation of an eight terminal Intra-Theater Imagery Transmission System will be conducted in a United States Air Forces Europe environment by the Tactical Air Warfare Center during August through November 1981.

2. (U) Operational Test and Evaluation: The WS-430B Enhancement program is managed by the Air Force Systems Command's Aeronautical Systems Division. The prototype development contract was awarded to Mead Technology Laboratories, Dayton, OH in August 1978. The Initial Operational Test and Evaluation was completed in February 1981. While the

Budget Activity: Tactical Progeams, #4
Program Element: #27431, Tactical Air Intelligence System Activities

prototype system met or exceeded most requirements, the overall test rating was classified as marginally acceptable due to the following deficiencies: dry silver processing of duplicate negatives, light intensity of the MARK II R5 printer, Tacoma titler limitations, and minor human factor problems. Once the identified deficiencies are corrected, the WS-430B Enhancement will be fully acceptable. These deficiencies will be corrected during the programmed system enhancement. Specific corrections include: use of regular silver film (vice dry silver film) for duplicate negatives, replacement of the MARK II printer with a MARK IV printer, manual titling of infrared film or use of 3411 film in the Tacoma titler, improved venting to remove odors from dry silver processors and silver recovery units, and addition of fluorescent lights in all major work areas. There are no future Operational Test and Evaluation plans.

(U) The Display and Control/Storage and Retrieval Initial Operational Test and Evaluation was completed at Langley Air Force Base, VA in September 1975. The purpose of the Initial Operational Test and Evaluation was to evaluate the operational effectiveness, logistics supportability, and maintainability of the Display and Control/Storage and Retrieval. The test concluded that the Display and Control/Storage and Retrieval did not provide adequate automated support to tactical intelligence functions because of excessive computer response time, an overly large and inefficiently structured data base, and inadequate software utility. Deficiencies were corrected by software and hardware improvements. In logistics supportability and maintainability, this test concluded that ample spares should be procured to provide adequate replacement parts during the life of the Display and Control/Storage and Retrieval. However, Air Force Logistics Command has never been able to purchase the necessary spares. Air Force Logistics Command stated in July 1981 that the Display and Control/Storage and Retrieval as currently configured would not be supportable past 1983. Air Force Logistics Command, Air Force Systems Command, and Tactical Air Command are proposing a modernization project to upgrade the Display and Control/Storage and Retrieval and allow logistics support into the 1990's. There is no future Operational Test and Evaluation testing planned.

(U) An Operational Test and Evaluation of the Imagery Interpretation segment was conducted at Bergstrom Air Force Base, TX from 3 January 1973 through 3 May 1973. The Development Test and Evaluation/Initial Operational Test and Evaluation was a joint Air Force/Marine Corps effort directed by the Air Force Systems Command's Electronic Systems Division and United States Air Force Tactical Air Warfare Center. The purpose of this test was to determine the effectiveness of the Imagery Interpretation segment in a simulated operational environment. Guidance relative to operational conditions was obtained from Pacific Air Forces, Tactical Air Command, and United States Air Forces in Europe. United States Air Force Tactical Air Warfare Center conducted the testing. A test schedule was drawn up to simulate the task loadings resulting from a tactical reconnaissance squadron flying at a rate of 1.2 sorties per assigned aircraft. Test personnel were drawn from operational units and received contractor operator training. The Operational Test and Evaluation results showed that this segment had more capability than was envisioned when the concept was originated. The test also indicated that a three-shelter Imagery Interpretation segment could support all missions flown by a tactical reconnaissance squadron in a 24-hour period. The test results show that some deletion and modification to hardware, software, and operating procedures were necessary. Some of these included adding an additional supervisor's station in the Auxiliary shelter, including the computer maintenance console with each segment and making some modifications to the system software. Upon completion of Initial Operational Test and Evaluation, recom-

Budget Activity: Tactical Programs, #4
Program Element: #27431F, Tactical Air Intelligence System Activities

mended engineering changes were made and the Imagery Interpretation system underwent an extended Development Test and Evaluation/Operational Test and Evaluation at Langley Air Force Base, VA from 12 August 1974 to 31 December 1974. The Development Test and Evaluation was conducted by the Electronic Systems Division, while the Initial Operational Test and Evaluation was conducted by the United States Air Force Tactical Air Warfare Center. The purpose of this test was to train user personnel, resolve problems identified during Initial Operational Test and Evaluation, and evaluate changes made since initial testing at Bergstrom Air Force Base, TX. In addition, the Imagery Interpretation segment's ability to do third-phase interpretation was tested. The Imagery Interpretation segment hardware was relatively trouble free and experienced no failures that delayed meeting scheduled test objectives. The segment was found to be fully capable of third-phase imagery exploitation.

(U) After successful completion of the extended Development Test and Evaluation/Operational Test and Evaluation, the Imagery Interpretation prototype was deployed to United States Air Forces in Europe and integrated into the operations of the 26th Tactical Reconnaissance Wing at Zweibrucken Air Base GE.

(U) Budgeting action resulted in delay of production contract award until May 1977. As a result of the production delay, the contractor was forced to place new models of equipment into the shelters. In addition, in 1978, the United States Air Forces in Europe, the Pacific Air Forces, and Tactical Air Command representatives decided to incorporate Tactical Electronic Reconnaissance (TEREC) ground processing functions into the Imagery Interpretation segment. Contracts were let with Texas Instruments for software changes and hardware additions to provide Tactical Electronic Reconnaissance mission tape processing and data link capabilites. The first three of the seven Imagery Interpretation segments will process Tactical Electronic Reconnaissance tapes; the last four segments will process tapes and receive Tactical Electronic Reconnaissance data link.

(U) A two-phase Follow-on Operational Test and Evaluation of the Imagery Interpretation segment, directed by Tactical Air Command, is being conducted by the United States Air Force Tactical Air Warfare Center. The start of Phase I, originally scheduled for First Quarter of Fiscal Year 1981, was delayed due to unavailability of spares support. Phase I is being conducted in two parts. The first part, completed in July 1981, identified software problem reports which are being corrected under contractor warranty. The second part, scheduled for January and February 1982, will complete all imagery related system testing.

(U) Phase II will address the Tactical Electronic Reconnaissance tape processing capability of the Imagery Interpretation segment. This capability was evaluated by United States Air Forces in Europe in October 1980, and identified deficiencies are being worked as part of an Engineering Change Proposal which was approved in September 1981. Phase II testing is being delayed until completion of the Engineering Change Proposal, and the testing location will be changed to Bergstrom Air Force Base, TX to eliminate the impact on United States Air Forces in Europe operational requirements. This phase of the test will complete Operational Test and Evaluation of the Imagery Interpretation segment.

(U) The Operational Application of Special Intelligence Systems program is providing automated enhancements to

Budget Activity: Tactical Programs, #4
Program Element: #27431F, Tactical Air Intelligence System Activities

the United States Air Forces in Europe Tactical Fusion Center by providing an automated interface between the Tactical Fusion Center computer system and the North Atlantic Treaty Organization Command and Control Information System, providing additional input sources to the Tactical Fusion Center and enhanced automated receipt and processing of near-real-time inputs, and providing internal enhancements to the Tactical Fusion Center computer, voice, and analyst subsystems. United States Air Forces in Europe is currently writing an Operational Test and Evaluation Plan which will outline a three-phase testing operation and define objectives. Separate annexes will be developed for each of the separate enhancement areas delivered by the Operational Application of Special Intelligence Systems program. The three phases will include: (1) an initial review of Development Test and Evaluation results to identify deficiencies and determine retest requirements; (2) a designated 30-day period following development testing to exercise the system under normal operation and document operational deficiencies; and, (3) use during scheduled exercises to fully test the operational capabilities of the four enhancements currently projected for delivery to United States Air Forces in Europe. These enhancements are: Incoming Reports Processing; Tactical Fusion Center/Users Interface, Part I; Tactical Fusion Center/Users Interface, Part II; and, Message Handling Enhancement. The Incoming Reports Processing has been delivered and United States Air Forces in Europe is currently conducting the first two phases of operational testing noted above.

(U) The Intra-Theater Imagery Transmission System provides a secure means for the electronic transmission and reception of selected, time-sensitive, annotated intelligence and targeting materials to the tactical user as well as the theater command and control functions. The Intra-Theater Imagery Transmission System will integrate the Tactical Digital Facsimile transceiver with communications security and interface devices. Existing Defense Communication System Automatic Voice Network system, tactical switched voice systems of the United States forces, and the postal, telephone and telegraphic systems of the allied countries will serve as the transmission medium. The Initial Operational Test and Evaluation of the Intra-Theater Imagery Transmission System is being conducted by the United States Air Force Tactical Air Warfare Center in conjunction with the REFORGER 81 exercise. The United States Air Forces in Europe prototype system is composed of eight terminals located in Germany and the United Kingdom, at Ramstein Air Base, GE (2), Spangdahlem Air Base GE (1), Zweibrucken Air Base, GE (1), North Atlantic Treaty Organization Operational Support Center, Kalkar GE (1), Schierstein, GE (1), Royal Air Force Base Lakenheath, UK (1), and Royal Air Force Base Alconbury, UK (1). The Initial Operational Test and Evaluation began on 14 August 1981 and is scheduled to be completed by 1 November 1981. At the termination of the Initial Operational Test and Evaluation, the prototype system will be turned over to United States Air Forces in Europe for an Interim Operational Capability. The final system will consist of 160 production Tactical Digital Facsimile transceivers fielded by United States Air Forces in Europe, Pacific Air Forces, Strategic Air Command, Tactical Air Command, Air Force Reserves and Air National Guard units. The first production transceiver is scheduled for delivery in FY 84, with delivery scheduled for completion in FY 88. The Operational Test and Evaluation of the Tactical Digital Facsimile transceiver is the responsibility of the United States Navy Operational Test and Evaluation Force and is being conducted under the Joint Tactical Communications Program. Tactical Digital Facsimile transceiver testing is addressed in the data sheets for the Joint Tactical Communications Program (Program Element 28010F).

Budget Activity: Tactical Programs, #4
Program Element: #27431F, Tactical Air Intelligence System Activities

3. (U) System Characteristics:

(U) The WS-430B Enhancement characteristics and performance are:

Characteristic	Objective	Demonstrated
Image Processing	250 feet of film per hour per processor	1785 feet of film per hour per processor.
Pollution Abatement	Reduce quantity; reduce residual chemical levels	66% reduction is biological oxidation demand; 70% reduction in chemical oxidation demand; 75% reduction in use of fixer and water; and, 100% reduction in use of solution.
Quality Control	Improve chemical management of development solutions	Use of automatic silver level sensor permitted automatic replenishment to maintain exact solution.
Dry Printing	Provide dry printing reproduction capability	Equipment satisfactory for second generation reproduction.
Photo Interpreter Report and Exit Station	Provide effective and rapid means to transmit intelligence reports	For Reconnaissance Exploitation Report (RECCEEXREP) reporting met timeliness objective of 23 minutes and surpassed 70% accuracy objective by 1-26%; for Initial Photo Interpretation Report (IPIR) surpassed timeliness objective of four hours by at least two hours and 75% accuracy objective by 25%.

Budget Activity: Tactical Programs, #4
Program Element: #27431F, Tactical Air Intelligence System Activities

Shelter Update	Provide efficient use of available space	Decreased number of shelters by 33% while adding three new shelter functions, maintaining throughput requirements, and improving work-station efficiency.

(U) The Display and Control/Storage and Retrieval Initial Operational Test and Evaluation revealed major deficiencies in the Display and Control/Storage and Retrieval generally attributable to unacceptable response time of the automated data processing. The objectives of the Initial Operational Test and Evaluation were to determine suitability of automated data processing in the area of intelligence data handling. The Initial Operational Test and Evaluation test results justified this automation with the provision that response time be improved. This was accomplished through improvement of the software and the doubling of the computer density memory from 128 thousand to 256 thousand words. No Operational Test and Evaluation is planned for the future.

Performance	Objective	Demonstrated
Simple query	1 minute	1 minute
Simple update	1 minute	1 minute
Input messages per 24 hours	1000	1000
Output messages per 24 hours	750	646
Plots per 24 hours	20	20
Digital data base (character capacity)	62 million	62 million
Reliability (Mean Time Between Failure)	400 hours	379 hours
Maintainability (Mean Time to Return)	30 minutes	22 minutes
Availability	.999	.999

Budget Activity: Tactical Programs, #4
Program Element: #27431F, Tactical Air Intelligence System Activities

The OASIS Incoming Reports Processing enhancement characteristics, objectives, and demonstrated performance in the Systems Development Facility (SDF) at Hanscom AFB, MA and the overseas operational facility are given below. Efforts are currently underway to analyze differences between the performance in the System Development Facility and the operational facility. Appropriate changes to the software will be implemented to improve the operational system performance.

Characteristic	Objective	Demonstrated SDF	Demonstrated Overseas
TACREP Throughput			
TACREP Display on Alphanumeric Terminal			
TACREP Display Graphic Light Pen A - Side Amplification			
TACREP Display Graphic Light Pen A - Technical Details			
Technical Details Display			
Automatic Update (ALERTS/ SIDE AMPS/PLOTS)			To be determined

(U) The Tactical Digital Facsimile tranceiver (TACFAX) portion of the Intra-Theater Imagery Transmission System demonstrated the following capabilities during combined Development Test and Evaluation/Initial Operational Test and Evaluation.

Characteristic	Objective	Threshold	Demonstrated
Usable message percentage	95%	95%	68%
MTBF (mean time between failure)	2500 hr	833 hr	17.3 hr
MTTR (mean time to repair)	30 min	30 min	16 min
MAX corrective maintenance time	60 min (90%)	60 min (90%)	60 min (90%)
Percentage repairable at org level	20 min/day plus 60 min/mo	20 min/day plus 60 min/mo	Frequent cleaning necessary (no value)
Operational Availability	0.95	0.95	0.67

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #28008F

DOD Mission Area: Counter Air, #221

Title: Operational Utility Evaluation (OUE) of The Advanced Medium Range Air-to-Air Missile (AMRAAM)

Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs 1/
	TOTAL FOR PROGRAM ELEMENT	1,500	3,088				15,888
2756	OUE Simulation	1,500	3,088				15,988

1/ Includes funding under Program Elements 64201F (Aircraft Avionics Equipment Development), 63370F (AMRAAM), and 27133F (F-16).

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is structured in response to Office of Secretary of Defense direction contained in Decision Coordinating Paper (DCP) #174, January 1979, developed as a result of deliberation during the Advanced Medium Range Air-to-Air Missile (AMRAAM) Milestone I review. This DCP directed an Operational Utility Evaluation (OUE) of the AMRAAM concept consisting of necessary analysis, man-in-the-loop simulation, and flight testing using methodology similar to the 1974 Joint Air Force/Navy Air Intercept Missile/Air Combat Evaluation Validation (AIM/ACEVAL). The OUE will provide information on the utility and pilot workload impact of an AMRAAM concept missile on the F-15/F-16 with various avionics suites, electronic countermeasures, threat scenarios, and engagement environments. The effectiveness of the AMRAAM concept will be assessed relative to the alternative system, the AIM-7M Sparrow.

(U) BASIS FOR FY 1983 RDT&E REQUEST: FY 1983 and 1984 funding was originally requested under Project 2757, OUE Instrumentation, to develop and integrate aircraft radar, infrared, and countermeasures data interfaces with the Utah Test and Training Range (UTTR) Time - Space - Position - Indicator Range Instrumentation System in order to preserve the option to conduct an OUE flight test. Separate funding under PE 78019F, Utah Test and Training Range, was also requested to provide the required range upgrades for a flight test that might be conducted. These funds were deleted during the formulation of the FY 1983 budget cycle due to lack of support for the necessity to conduct a flight test in addition to the on-going simulation and other higher priority program fund requirements.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	7,000 2/	3,200	6,100		TBD 3/	TBD 3/

2/ Funded under Program Element 64201F (Aircraft Avionics Equipment Development).

Program Element: #28008F

DOD Mission Area: Counter Air, #221

Title: Operational Utility Evaluation (OUE) of the Advanced Medium Range Air-to-Air Missile (AMRAAM)

Budget Activity: Tactical Programs, #4

3/ To be determined (TBD). Program element included funds to preserve an option to conduct an OUE flight test.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) DETAILED BACKGROUND AND DESCRIPTION: The Operational Utility Evaluation (OUE) has the objective of establishing the utility of an AMRAAM class weapon when employed in various realistic simulated air combat environments. The program was directed by the Office of the Secretary of Defense (OSD) through the AMRAAM Decision Coordinating Paper. This effort will study the effects of various missions, electronic countermeasures, multiple-target-track avionics, identification ranges, weather and communications jamming on operational utility and pilot usability. Under Project 2756 (OUE Simulation), an analysis phase will investigate possible influences of an AMRAAM type missile in engagements previously flown during the Air Intercept Missile/Air Control Evaluation Validation (AIM/ACEVAL). In the simulation phase of the same project, the Air Force man-in-the-loop simulation will evaluate the utility of an AMRAAM class missile on the F-15 and F-16 fighters employed against simulated enemy fighters and fighter bombers during combat air patrol and fighter sweep missions. Successful completion of Project 2756 will provide an assessment of the utility and effectiveness of an AMRAAM missile relative to the current alternative system, the AIM-7M semiactive radar guided Sparrow. Based on the results of the OUE ground simulation, the requirement for and extent of any flight simulation testing will be established.

(U) RELATED ACTIVITIES: The AMRAAM Utility Evaluation is related to the AMRAAM development and acquisition program being conducted under PE 63370F (Validation) and PE 64314F (Full Scale Development).

(U) WORK PERFORMED BY: Government: Tactical Fighter Weapons Center Operations Analysis, Nellis Air Force Base, NV; Air Force Test and Evaluation Center, Kirtland Air Force Base, NM; Commander, Operational Test and Evaluation Force, Naval Air Station (NAS), Norfolk, VA; Naval Air Development Center, NAS Patuxent River, MD; Contractors: McDonnell Douglas Corporation, St Louis, MO; VEDA Corporation, Las Vegas, NV.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In January 1979, the Air Force was directed to present a plan to the Office of the Secretary of Defense for the accomplishment of an operational concept test entitled the Operational Utility Evaluation of AMRAAM. The plan was forwarded in May 1979, and in August 1979 the Air Force was directed to begin work on the analysis and simulation phase. Contract go-ahead to Veda Corporation for analysis and McDonnell Douglas Corporation for aerial combat simulation was given in May 80. Analysis data base tapes were constructed on selected Air Intercept Missile/Air Combat Evaluation Validation (AIM/ACEVAL) engagements and runs were accomplished. Simulation hardware was integrated to provide four F-15 or F-16 cockpit simulations. Prototype control stations for eight threat aircraft were developed and proofed. Dynamic earth-sky and weather simulations were developed and multiple-target-track radars were integrated for the F-15 and F-16. Simulator verification began in March 1981 and formal testing began in June 1981. Formal test periods were completed in June 1981 and September 1981 for the F-15 and in August 1981 for the F-16.

Program Element: #28008F

DOD Mission Area: Counter Air, #221

Title: Operational Utility Evaluation (OUE) of the Advanced Medium Range Air-to-Air Missile (AMRAAM)

Budget Activity: Tactical Programs, #4

2. (U) FY 1982 Program: Three simulator test periods will be accomplished, the final F-15 formal test period in October 1981 and one period each for the F-15 and F-16 in December 1981 and January 1982 respectively to investigate excursions to the basic scenarios. This will complete the man-in-the-loop aerial combat simulation. Results will be prepared for presentation at the AMRAAM Milestone II.

3. (U) FY 1983 Planned Program: The planned effort will not be conducted, since funds for the development and integration of aircraft instrumentation with the High Accuracy Multiple Object Tracking System at the Utah Test and Training Range (UTTR), as well as range upgrade funding within PE 78019, to preserve the option for a flight test have been deleted.

4. (U) FY 1984 Planned Program: None planned.

5. (U) Program to Completion: The program will be completed in FY 1982.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 28010F
DOD Mission Area: Tactical Communications, #345

Title: Joint Tactical Communications (TRI-TAC)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	18,512	26,899	52,875	22,661	Continuing	Not Applicable
2260	Communications Nodal Control Element	9,612	11,100	23,869	7,985		
2264	Digital Nonsecure Voice Terminal	1,600	600	—	—		
2266	Digital Troposcatter Terminal	1,800	1,500	—	—		
2267	Test	2,300	3,700	3,800	4,100		
2270	Support	3,200	3,700	3,800	2,976		
2804	Communications System Control Element	—	6,299	14,406	7,600		
2852	C^3 UPGRADES	—	—	7,000	—		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is the development of secure anti-jam digital communications equipment for use in a tactical environment. Equipment developments center around trunking and switching equipment, system control facilities, local distribution equipment, terminal devices, and interface equipment. The effort seeks to achieve economy through joint participation and centralized acquisition of tactical equipment.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This program will continue the support of the Full Scale Development of the Communications System Control Element (CSCE) and correction of deficiencies (found in testing) and upgrade the Communications Nodal Control Element (CNCE). The CSCE and CNCE are elements of the Tactical Communications Control Facility (TCCF) Program. The Digital Troposcatter Terminal will begin production starting in FY 1982. The Air Force will continue support of the TRI-TAC Joint Test Facility at Ft. Huachuca, AZ. The cost estimates were provided by the Program Office at Electronic Systems Division.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	16,700	29,100	35,700		Continuing	Not Applicable
Procurement (Other)	39,328	119,091	78,619			

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Other)	39,328	118,551	137,422	147,290	Continuing	Not Applicable
(Spares)	(1,727)	(1,790)	(16,000)	(16,300)		

Program Element: #28010F
DOD Mission Area: Tactical Communications, #345

TITLE: Joint Tactical Communications (TRI-TAC)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Joint Tactical Communications Program (TRI-TAC) is a Department of Defense directed joint service effort to develop and acquire communications equipment for the tactical forces. The program addresses tactical communications requirements in the areas of trunking and switching, systems control facilities, local distribution equipment, terminal devices, and interfaces. The efforts seek to achieve economy through joint participation and centralized acquisition of tactical equipments. The program includes certain systems analyses, cost effectiveness studies, and research and development to integrate service requirements and TRI-TAC developed concepts and equipments. Improvements are required in communications switching and high speed transmission capabilities to achieve high speed, digital, secure comunications in the 1980's. The Air Force effort is known as the Combat Theater Communications Program (CTCP). The Air Force effort includes full scale development of the Communications Nodal Control Element (CNCE) and the Communications System Control Element (CSCE). The CNCE and CSCE provide technical control and system management functions for the TRI-TAC switching and transmission equipment. The Digital Troposcatter Terminal (TROPO), which is in full scale development, will provide long range wideband communications in a tactical environment. The Digital Nonsecure Voice Terminal will provide terminal capability for voice where secure voice is not required. This device is in the full scale development phase.

(U) RELATED ACTIVITIES: Program Element 28010F is conducted by all the Services under the overall direction of the office of Deputy Undersecretary of Defense, Command, Control, Communications and Intelligence, and the guidance of the TRI-TAC Office, Fort Monmouth, NJ. It is related to programs within the Defense Communications System which are more "strategic communications" oriented and to programs within National Security Agency for communications security resources. The objective is to ensure sufficient coordination to prevent duplication of effort and to permit standardization of interfaces where feasible.

(U) WORK PERFORMED BY: The Air Force Systems Command manages the Air Force portion of this program through the Electronics Systems Division, Hanscom AFB, MA, and Rome Air Development Center, Griffiss AFB, NY. Current contractors include: Martin-Marietta Corporation, Orlando, FL (TCCF); Raytheon, Sudbury, MA (TROPO); ECI, St. Petersburg, FL/ Magnavox, Atronics General (DNVT); Analytical Systems Engineering Corporation, Burlington, MA (Support); and MITRE Corporation, Bedford, MA (Support).

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Development contract for the Tactical Communications Control Facility was awarded in May, 1975, and the contract for the Digital Troposcatter Terminal was awarded in June, 1976. The Communications Nodal Control Element and the Troposcatter system have just completed testing.
A validation contract for the Digital Nonsecure Voice Terminal was completed in 1978. The Air Force has provided support (Project 2267) for the TRI-TAC Joint Test Facility at Ft. Huachuca, AZ. Project 2270 provides engineering support for the Combat Theater Communications Program at Hanscom AFB, MA. One Communications Nodal Control Element (one of three) and one digital troposcatter radio were delivered to the Joint Test Facility at Ft. Huachuca, AZ in May, 1979 to begin Service testing. The contractor delivered the remaining two Digital Troposcatter Terminals in May, 1979. Service testing was completed in October, 1980. Developmental testing/operational testing of the CNCE began in June, 1980, and was completed in October, 1981.

Program Element: #28010F
DOD Mission Area: Tactical Communications, #345

Title: Joint Communications (TRI-TAC)
Budget Activity: Tactical Programs, #4

2. (U) FY 1982 Program: Production contract for the Digital Troposcatter Terminal (TROPO) is expected to be awarded in early 1982. The Digital Nonsecure Voice Terminal began testing in November, 1981. The CNCE finished testing in October, 1981, and RDT&E will continue on the expanded capacity version (Variant). Full Scale Development contract for the Communications System Control Element is planned to be awarded in January, 1982. Congressional and Air Force actions resulted in a $2.5M decrement in FY 1982.

3. (U) FY 1983 Planned Program: The CNCE will enter production concurrent with the correction of deficiencies found in testing and completion of the Variant design. Production decision will be made jointly by the Air Force and Army. The TROPO will continue in production. The Digital Nonsecure Voice Terminal production contract is scheduled to be awarded in July, 1982. Change this year due to OSD Program Budget Decision and Air Force actions resulting in a total addition of $20.1M to the program in FY 1983 to fully fund the Communications Nodal and Communications System Control Elements in this year.

4. (U) FY 1984 Planned Program: The Full Scale Development (FSD) of the Communications System Control Element will continue with emphasis on the development of applications software. The Troposcatter Terminal, Communications Nodal Control Element, and Digital Nonsecure Voice Terminal will continue in production.

5. (U) Program to Completion: The Communications System Control Element will continue FSD into FY 1986. All other items currently in the overall Air Force program will complete development by the mid 1980's.

6. (U) Milestones:

Communications Nodal Control Element	DATE
Contract Award	May 1975
Preliminary Design Review - Hardware	Dec 1975
Preliminary Design Review - Software	Aug 1976
Critical Design Review - Hardware	Apr 1977
Critical Design Review - Software Part I	Aug 1977
Part II	Jan 1978
Contractor Development Testing	Sep 1977 - Dec 1978
Variant Development	Jul 1979 - Dec 1982
Software Delivery	Jun 1980
Service Testing Began	Aug 1980
Service Testing Completed	Oct 1981
Production Begins	Dec 1982

Program Element: #28010F
DOD Mission Area: Tactical Communication, #345

Title: Joint Tactical Communications (TRI-TAC)
Budget Activity: Tactical Programs, #4

Communications System Control Element	
RFP Release	Nov 1981
Contract award	Jan 1982
Digital Troposcatter Terminal	
Contract Award	Jun 1976
Preliminary Design Review	Feb 1977
Critical Design Review	Aug 1977
Delivery	May 1979
Service Testing Complete	Oct 1980
Production Decision	Apr 1981
Production Begins	Dec 1982
Digital Nonsecure Voice Terminal	
Validation Phase Contract Award	Jun 1976
Validation Effort Complete	Sep 1977
Developmental Suitability Testing	Sep 1977-Sep 1978
Full Scale Development Contract Award	Jul 1980
Service Testing	Nov 1981-Mar 1982
Production Begins	Jul 1982

7. (U) Resources: Not Applicable

Project: #2260
Program Element: #28010F
DOD Mission Area: Tactical Communications, #345

Title: Communications Nodal Control Element
Title: Joint Tactical Communications (TRI-TAC)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Communications Nodal Control Element (CSCE) and Communications System Control Element (CNCE) are elements of the Tactical Communications Control Facility (TCCF -- formerly project 2260 but now 2260 is Nodal Control, and Systems Control is broken out with new project number, 2804) Resources at a communications node will be assigned, monitored, controlled and managed for users by the CNCE. The hardware and the software within the Nodal Control will provide support to the TTC-39 family of switches being developed by US Army.

(U) RELATED ACTIVITIES: The Nodal Control is an element of an integrated tactical communication system and is related to all other elements of the TRI-TAC system.

(U) WORK PERFORMED BY: The full scale development of the CNCE continues on contract with Martin-Marietta of Orlando, FL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A contract was awarded in May 1975 to Martin Marietta Corporation, Orlando, FL, for the full scale development of the Nodal Control. Preliminary design review for the hardware on the CNCE was completed in December 1975. The full scale development effort has continued with emphasis on the applications software development. Contractor development testing of the Type III (single shelter) unit early FY 1978. Developmental testing of the type I (dual shelter) CNCE begin in Aug, 1980, and continued until October, 1981.

2. (U) FY 1982 Program: The CNCE Variant developmental program (expanded capacity version) will begin.

3. (U) FY 1983 Planned Program: The CNCE Variant will complete full scale development, and production will begin.

4. (U) FY 1984 Planned Program: Continue in production.

5. (U) Program to Completion: Production will continue with initial production deliveries in September, 1985.

6. (U) Milestones: See PE level summary.

Project: #2260

Program Element: #28010F

DOD Mission Area: Tactical Communications, #345

Title: Communications Nodal Control Element

Title: Joint Tactical Communications (TRI-TAC)

Budget Activity: Tactical Programs, #4

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	9,612	11,100	23,869	7,985	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Budget Data: Not previously broken out as separate project.

Project: #2804
Program Element: #28010F
DOD Mission Area: Tactical Communications #345

Title: Communications System Control Element
Title: Joint Tactical Communications (TRI-TAC)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Communications System Control Element (CSCE) and Communications Nodal Control Element (CNCE) are elements of the Tactical Communications Control Facility (TCCF -- originally project number 2260. 2260 now shows the Nodal Control and a new project, 2804, has been established to show the Systems Control Element. The Systems Control is management oriented and will provide real time monitoring and data base maintenance of communication network status and near real time control over the allocation and use of resources within a portion of a deployed tactical communications network.

(U) RELATED ACTIVITIES: The Systems Control is an element of an integrated tactical communication system and is related to all other elements of the TRI-TAC system.

(U) WORK PERFORMED BY: Sole source developmental contract will be awarded to Systems and Applied Sciences, Riverdale, Md, in December, 1981.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A contract was awarded in May 1975 to Martin Marietta Corporation, Orlando, FL, for the validation phase of the Systems Control. This contract was terminated in 1978, and a joint service working group was formed to write a detailed specification for the Systems Control. This specification was completed in FY 81, and a small-business (8A set aside) contractor was chosen to perform the developmental effort (see above).

2. (U) FY 1982 Program: The Systems control will begin in Full Scale Development to produce six units for the US Army. This development will be in two phases beginning with a software prototype/demonstration phase.

3. (U) FY 1983 Planned Program: Continue in Full Scale Development.

4. (U) FY 1984 Planned Program: Same as FY 1983 program.

5. (U) Program to Completion: Full scale development of the Systems Control should be completed in FY 1986.

6. (U) Milestones: See previous chart.

Project: #2804
Program Element: #28010F
DOD Mission Area: Tactical Communications, #345

Title: Communications System Control Element
Title: Joint Tactical Communications (TRI-TAC)
Budget Activity: Tactical Programs, #4

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	--	6,299	14,406	7,600	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Budget Data: Not broken out separately last year, was part of project 2260

Project: #2852
Program Element: #28010F
DOD Mission Area: Tactical Communications #345

Title: C^3 Upgrades
Title: Joint Tactical Communications (TRI-TAC)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This project continues Facility Support Element support for Air Force Developed Equipment at Ft Huachuca, Az.; begins the TROPO Path Prediction study; purchases troposcatter and other system's peculiar support equipment, begins work toward the development of a TRI-TAC System User's Manual; starts tasks associated with a Short Range Wideband Radio program; provides additional effort for the CNCE Variant development; and continues fiber optics efforts including ESD/MITRE interface with the RADC programs and ESD participation on the TRI-TAC configuration control board for fiber optics.

(U) RELATED ACTIVITIES: This project provides the test support at Ft Huachuca, Az, as directed by OSD, provides required user manuals for the production equipment, and other activities as described above; all of the activities are related to all other elements of the TRI-TAC system.

(U) WORK PERFORMED BY: MITRE, development/production contractors, Government labs, and other TBD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Minimal efforts to support tropo path prediction and fiber optics. Note: The activities described above begin in FY 83.

2. (U) FY 1982 Program: Same as above.

3. (U) FY 1983 Planned Program: Begin to provide efforts described in 'DESCRIPTION' above.

4. (U) FY 1984 Planned Program: Same as FY 1983 program.

5. (U) Program to Completion: Continue efforts described above.

6. (U) MILESTONES: N/A

7. Resources: ($ in thousand)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	--	—	7,000	—	Continuation	N/A

8. Comparison with FY 1982 Budget Data: Project was established as a new start for FY 1983

Budget Activity Tactical Programs, #4
Program Element #28010F, Joint Tactical Communications (TRI-TAC)

Test and Evaluation

1. (U) Development Test and Evaluation: The Joint Tactical Communications (TRI-TAC) program is a joint Service program with each Service responsible for the development of assigned equipment. The United States Air Force has been assigned four items: the Tactical Communications Control Facility is a major item. This report presents the overview. Each Service and National Security Agency is also responsible for the development, test and evaluation of equipments tasked by the Department of Defense. Individual test plans including interface parameters are coordinated with the TRI-TAC Office. Initial developmental testing will be conducted in-plant by the developing contractor. Developmental Testing and Evaluation will include hardware integration testing, Communications Security, integration, reliability and maintainabity, and acceptance testing of peripheral equipment. Joint developmental and initial operational testing of Air Force developed TRI-TAC equipments was initiated in June, 1979 by the Joint Test Organization at Fort Huachuca, Arizona. The contractor for the Communications Nodal Control Element of the Tactical Communications Control Facility is Martin-Marietta, Orlando, FL. The contractor chosen for the Communications System Control Element is Systems & Applied Sciences Corporation, Riverdale, MD. The Raytheon Co., Sudbury, MA is the prime contractor for the Digital Troposcatter Terminal. The contractors for the Digital Nonsecure Voice Terminal are Magnavox and E-Systems.

2. (U) Operational Test and Evaluation: TRI-TAC test and evaluation is being conducted as a multiservice combined development test and evaluation/initial operational test and evaluation program. The acquisition service/ agency has overall responsibility for operational test and evaluation of each of the TRI-TAC equipments. Full-scale engineering development models of each TRI-TAC equipment will be operated and maintained by Army, Navy, Marine Corps, and Air Force personnel during initial operational testing. These personnel are selected from the using commands and agencies on the basis of specialty codes expected to be used during operational equipment deployment. Testing will be conducted primarily at Fort Huachuca, Arizona, with some interface testing planned at the Naval facility in San Diego, California.

(U) The Air Force Test and Evaluation Center has operational test and evaluation responsibility for the Digital Nonsecure Voice Terminal, Digital Troposcatter Radio Terminal (AN/TRC-170), and the Tactical Communications Control Facility. The Tactical Communications Control Facility comprises the Communications Nodal Control Element and the Communications System Control Element.

(U) The Digital Nonsecure Voice Terminal full-scale development contract awards were made in July 1980 to General Atronics Corporation (Magnavox) and E-Systems, Incorporated. Joint developmental/operational testing is scheduled for the period November, 1981 through January, 1982. Initial operational test planning was coordinated with the United States Army Operational Test and Evaluation Agency, United States Naval Operational Test and Evaluation Agency, United States Marine Corps Operational Test and Evaluation Activity, National Security Agency, Defense Communications Agency, and United States Air Force using and supporting commands. Production contract is scheduled for June, 1982.

Budget Activity Tactical Programs, #4
Program Element #28010F, Joint Tactical Communications (TRI-TAC)

Test and Evaluation

(U) The Initial Operational Testing and Evaluation of the AN/TRC-170 was completed in October, 1980, and the Air Force Test and Evaluation Center report TRI-TAC AN/TRC-170 ( )(V) Tropo IOT&E Report was dated December 1980. The Air Force Test and Evaluation Center recommended a favorable production decision provided that minor discrepancies are corrected to improve reliability and antenna mobility, and that instrumentation be incorporated into the development models and the system be retested before delivery of production equipment to the field.

(U) The Communications Nodal Control Element initial operational test plan was coordinated with all service test agencies, the National Security Agency, the Defense Communications Agency, and the Air Force using and supporting commands. Joint developmental/operational testing began in June, 1980, and was completed October, 1981. Army System Acquisition Review and Joint Production Review are scheduled for late 1982, and contract award is scheduled for December, 1982.

(U) The Communications System Control Element program has been restructured and redefined. Contract award for full scale development is scheduled for February, 1982 and the contract will provide for the development of six units for the Army. The Air Force does not at the present time have a stated requirement for this system. Test planning will commence in mid 1982.

(U) The United States Army Operational Test and Evaluation Agency has operational test and evaluation responsibility for the AN/TYC-39 message switch, AN/TTC-39 circuit switch, digital group multiplexer, mobile subscriber equipment, mobile record traffic terminal, and net radio interface. Air Force Technical Evaluation Center is participating in testing and test planning for those TRI-TAC equipment items which are programmed to enter the Air Force Inventory. There was no Air Force participation planned for the Net Radio Interface or Mobile Subscriber initial operational testing.

(U) Four AN/TYC-39 message switches were tested from February, 1979, through May, 1980. During the test, the AN/TYC-39 showed the potential to provide a significant improvement in message throughput, decreased operator workload, and message traffic accounting. Defense Systems Acquisition Review Council milestone III was in March, 1980, and recommended production of the AN/TYC-39. The Air Force Technical Evaluation Center report was dated October, 1979. Production contract was awarded in September, 1980. (GTE Sylvania).

(U) Four AN/TTC-39 circuit switches were tested from 13 November, 1979, to 20 May, 1980. Although deficiencies were discovered, the July, 1980, Defense Systems Acquisition Review Council milestone III recommended production. Because the software tested in the AN/TTC-39 was not the software to be procured, additional testing was planned from November, 1980, to February, 1982, to test the operational software. The Air Force Test and Evaluation Center report is dated August, 1980. Production contract was awarded in September, 1980. (GTE Sylvania).

Budget Activity Tactical Programs, #4
Program Element #28010, Joint Tactical Communications (TRI-TAC)

Test and Evaluation

(U) Digital Group Multiplex equipment is currently being tested as integral parts of other individual TRI-TAC equipments. In addition, a separate Digital Group Multiplex Initial Operational Test was conducted by the Army and the Marine Corps from September through November 1980. Those elements of the Digital Group Multiplex family planned for Air Force use showed a potential to be operationally effective; however, their operational suitability was deficient. The production decision was in July 1981. The Air Force Test and Evaluation Center report TRI-TAC Digital Group Multiplex (DGM) IOT&E Air Force Evaluation Report was dated May 1981.

(U) The National Security Agency has test and evaluation responsibility for all communications security items being procured in the TRI-TAC programs. Except for the communications security equipment associated with the Advanced Narrowband Voice terminal, separate periods of initial operational testing and evaluation are not planned. The communications security equipment items are being tested in conjunction with intraoperability, interoperability, and communications security tests conducted during initial operational testing and evaluation of the parent equipment (e.g., AN/TYC-39, Nodal Control, Advanced Narrowband Digital Voice Terminal, etc.).

(U) The United States Marine Corps Operational Test and Evaluation Activity has operational test and evaluation responsibility for the Unit Level Switch program. The Unit Level Switch comprises three equipment items: an AN/TTC-42 Unit Level Circuit Switch, an SB-3865 switchboard, and an AN/GYC-7 Unit Level Message Switch. There are no Air Force plans to procure the AN/GYC-7. The AN/TTC-42 and SB-3865 will be simultaneously tested at the Fort Huachuca test bed. The Air Force Test and Evaluation Center is participating in initial operational test plan development with the Marine Corps Testing Agency, and Initial Operational Test & Evaluation is currently scheduled for November, 1982 through March, 1983. A production decision is scheduled for June, 1983.

(U) The Tactical Digital Facsimile initial operational testing and evaluation was conducted from April, 1981, through July, 1981 with the Air Force Test and Evaluation Center participating in the testing at Ft Huachuca, AZ. Test results indicated that operational performance was not satisfactory, and reliability, maintainability, and availability still require improvement. This program is being restructured by the Navy.

(U) The Advanced Narrowband Digital Voice Terminal is in the full scale engineering development phase. The Air Force Test and Evaluation Center will participate in operational test plan development with the United States Naval Operational Test and Evaluation Agency. Initial operational testing and evaluation is scheduled from November, 1983 through April, 1984. Initial operational testing and evaluation of the communications security equipment associated with the Advanced Narrowband Digital Voice Terminal is scheduled from August 1982 to May, 1983. A production decision is scheduled for July, 1984.

Budget Activity Tactical Programs, #4
Program Element #28010F, Joint Tactical Communications (TRI-TAC)

Test and Evaluation

3. (U) System Characteristics:

EQUIPMENT	DESCRIPTION
Tactical Communications Control Facility (Consists of Communications Nodal Control Element, Communications System Control Element)	• Provides automated technical control facilities for - Node Control & Management - Line conditioning & interface - Performance monitoring - Rerouting - Record keeping - Directory control
Troposcatter Terminals	• Family of modular digital Tropo terminals Power / Range • Type 1 10 Kilowatts 200 miles • Type 2 1.5 Kilowatts 100-200 miles • Type 3 .66 Kilowatts 0-100 miles • Data Rate 2.048 Megabits/second
Digital Nonsecure Voice Terminal	• Digital Telephone • Continuously variable slope delta modulation • 4 wire common battery • Electrically compatible with TRI-TAC secure telephone

<u>FY 1983 RDT&E DESCRIPTIVE SUMMARY</u>

Program Element: #35887F
DOD Mission Area: Multimission, Technology & Support, 374

Title: Electronic Combat Intelligence Support
Budget Activity: Tactical Program, 4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	EC Intelligence Support	0	1400*	2623	1817	CONT	N/A

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: EC Intelligence Support RDT&E funds will support Electronic Warfare (EW) Data Base development and threat Simulator Validation. The EW Data Base supports USAF development and reprogramming of Electronic Countermeasures (ECM) and threat radar warning receivers.

BASIS FOR FY 1983 RDT&E REQUEST: The USAF is procuring EC systems (EF-111, F-4G Wild Weasel, COMPASS CALL) which require detailed radar parametric intelligence information to be effective. In addition, the

Testing these new systems and training aircrews requires validated threat radar simulators. This program element provides the funds for the EW Data Base development and threat simulator validation.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	0	1400	1200		CONT	N/A
Operation and Maintenance	0	1075	1534		CONT	N/A
Procurement (Other)	0	313	315		CONT	N/A

(U) OTHER APPROPRIATION FUNDS:

	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Operation and Maintenance	1100	1200	1700	CONT	N/A
Procurement (Other)	304	313	292	CONT	N/A

* Funded under Simulator Development PE 64735.

Program Element: #35887F Title: Electronic Combat Intelligence Support
DOD Mission Area: Multimission, Technology & Support, 374 Budget Activity: Tactical Programs 4

DETAILED BACKGROUND AND DESCRIPTION: The USAF has a current which can be reprogrammed to display/jam current threat radar systems. The Electronic Warfare Data Base at the Foreign Technology Division at Wright-Patterson AFB, Ohio will provide the intelligence information/analysis to support this investment in EW reprogrammable equipment. In addition funds will provide in support of the Command, Control, Communications Countermeasures (C^3CM) Data Base to be developed at the Electronic Security Command at Kelly AFB, Texas. The C^3CM Data Base will support such aircraft as the EF-111, F-4G Wild Weasel and COMPASS CALL with detailed radar and communications parametric intelligence information required for them to accomplish their missions. In order for newly developed Electronic Countermeasures Equipment to be effective, we must test these systems. The Threat Simulator Validation program insures that our threat radar system simulations currently under development and those already fielded are accurate replicas. This is accomplished by comparing the most current intelligence data (Intelligence Data Input Package) with the simulator under design or fielded. These simulators are used in OT&E, DT&E, and in the Air Force Electronic Warfare Evaluation Simulator (AFEWES).

RELATED ACTIVITIES: This Program Element supports all Electronic Combat intelligence requirements. It interfaces with PE 28021F Electronic Combat Support in development of the FY 82 PE title SIMVAL was changed to Electronic Combat Intelligence Support and expanded to include EW Data Base, C^3CM data base and a classified program.

(U) WORK PERFORMED BY: The Foreign Technology Division (FTD) at Wright-Patterson AFB is responsible for the EW Data Base development using in-house and contract resources. Current Electronic Warfare Integrated Reprogramming (EWIR) Data Base development is being accomplished by Planning Research Corporation (PRC) field office at Dayton, Ohio. FTD is also responsible for the threat simulator validation program for new simulators under development. This work is currently accomplished by Applications Research Corporation (ARC), Dayton, Ohio.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: This PE did not exist in FY 1981; however, the Threat Simulator Validation effort at FTD was funded under development PE's 64735F and 64738F. Funds to accomplish the initial C^3CM Data Base development were transferred to PE 35887F (800K).

2. FY 1982 Program: PE 35887F actually came into being with 3400 funds for Air Force Electronic Warfare Center (AFEWC) validation of operational simulators and the 3600 funds for FTD validation of new simulators in acquisition was zeroed. The FTD validation effort was funded under PE 64735F Range Improvement Program because of its importance to Testing and Training.

3. FY 1983 Planned Program: Planned program funds increased from 1400K to 2647K. This increase was a result of the efforts to build an EW data base and C^3CM data base to support reprogrammable EW/ECM systems. This increase in

funds will provide for data base management system development to insure all sub-files within the EW Data Base are compatible and fund initial communications parametric analysis in support of the C^3CM Data Base. The previously planned 1400K funds the validation of 20 simulators.

4. FY 1984 Planned Program: Programmed funds will continue to develop the EW Data Base files and work toward communications capability for daily update of data elements. In addition the following simulators are scheduled for validation.

5. Program to Completion: Continue to validate the new simulators as they are acquired. Current rate is about 6-10 per year. Continue development of the EW Data Base to include and automate the process of Intelligence Data Input Package (IDIP) production at FTD.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #41115F
DOD Mission Area: Intratheater Airlift, #228

Title: C-130 Airlift Squadrons
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	9,000	14,944	688	486		25,118
	STOL Performance Improvements	9,000	14,944				23,944
	Modular Aerial Spray System			688			688
	Air Droppable Airfield Lighting				486		486

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The utility and flexibility of military forces are related directly to their strategic and tactical mobility. C-130 forces not only provide delivery of combat forces directly into an objective area both during and subsequent to the assault phase of an operation. They rapidly deliver sustaining supplies and equipment by either airlanding and offloading or by other delivery modes such as airdrop or LAPES (Low Altitude Parachute Extraction System). RDT&E of incremental product improvement to those C-130 aircraft engaged in missions other than tactical airlift is also provided in this program element.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program will provide engineering development and test of modular aerial spray equipment for the C-130. The current DOD aerial spray capability is maintained by the Air Force Reserve flying the C-123K. This is the only U.S. capability for controlled spray application over large areas and has both peacetime and wartime missions. The C-123K aircraft are programmed for phase out and the development of this equipment for the C-130 will ensure continuation of this important national capability.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	9,000	15,000				24,000

Program Element: # 41115F
DOD Mission Area: Intratheater Airlift, #228

Title: C-130 Airlift Squadrons
Budget Activity: Tactical Programs, #4

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Aircraft) (PE #27241F)*		27,000		75,200	342,800	445,000
(Quantity--MC-130H)		(2, Longlead)		(2)	(10)	(12)
Procurement (Base Maint and Support Equip)(PE #41115F)				1,600		1,600
(Quality)				(2,529)		

*Includes Initial Spares

Program Element: # 41115F
DOD Mission Area: Intratheater Airlift, #228

Title: C-130 Airlift Squadrons
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: STOL IMPROVEMENTS. Two dozen C-130s have been modified over the past several years with equipment which makes them uniquely qualified for a range of special operations. One shortfall remaining is the ability to operate out of short, austere landing fields. This project will test and refine short takeoff and landing (STOL) technology options which can be incorporated on USAF special operations C-130 aircraft. These include both aerodynamic and avionic options. The aerodynamic changes are anticipated to significantly reduce stall speeds and enhance stability, control and flying qualities at the lower flying speeds associated with STOL operations. Tests of an integrated flight director/autopilot and sensor display system is also planned. MODULAR AERIAL SPRAY SYSTEM. The only United States capability for controlled application of aerial spray over large areas resides in C-123K special purpose aircraft maintained and operated by the Air Force Reserve. These aircraft have reached the end of their useful life and a replacement must be found. This project will design and test a modular aerial spray system to fit on the C-130. If successful, this system will eliminate the complex tankage and plumbing system found on the C-123K and will result in a system much easier to maintain and far less costly to acquire. TACTICAL AIRFIELD LIGHTING. Present and future tactical airlift operations require operations into austere areas. To conduct operations in these austere areas MAC combat control teams (CCTs) must exercise terminal control and provide reliable and effective aids for acquisition of Landing Zones, Drop Zones and Extraction Zones during combat airlift missions. This project will design the packaging and accomplish pre-production engineering for electroluminescent (EL) lighting systems currently undergoing development testing. The EL lights are brighter, lighter, and easier to handle than current tactical airfield lighting equipment and will lead to safer night tactical airlift operations.

(U) RELATED ACTIVITIES: Aircraft procurement funds for long lead materials have been included in the FY 1982 amended budget for a follow-on program identified as MC-130H, PE #27241F. The MC-130H program provides for twelve aircraft to satisfy recently revealed shortfalls in the size and capability of our special operations force. NASA is providing technical assistance to determine if the air flow pattern surrounding the C-130 aircraft is suitable for the aerial spray mission.

Program Element: # 41115F

DOD Mission Area: Intratheater Airlift, #228

Title: C-130 Airlift Squadrons

Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: Air Force Systems Command's Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio is responsible for the manage of the STOL improvement program. Principal contractors are: Lockheed-Georgia Company, Marietta, Georgia; International Business Machines, Federal Systems Division, Owego, New York; and Texas Instruments, Incorporated, Dallas, Texas. Warner Robins Air Logisitics Center (WRALC) is responsible for the management of the aerial spray program. The aerodynamic feasibility study will be done under contract by Lockheed Georgia Company with assistance from NASA and the US Park Service. It is anticipated that hardware design will also be accomplished by Lockheed under contract to WRALC. The tactical airfield lighting system effort will be managed by the Productivity, Reliability, Availability, and Maintainability (PRAM) office of Aeronautical Systems Division.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Completed flight test of the aerodynamic changes and obtained parametric performance data. Tested a non-integrated avionics package. Designed an integrated flight director/autopilot and sensor display system.

2. (U) FY 1982 Planned Program: Install and test the integrated, self-contained landing avionics. Refine and conduct additional aerodynamic tests. Late in this fiscal year, the temporary modifications to the aircraft will be removed and the test aircraft returned to normal airlift operations.

3. (U) FY 1983 Planned Program: Design and build a portable modular aerial spray unit that will fit in a C-130 aircraft. Conduct a very limited flight test to verify the ability of the C-130 to act as a spray platform using this modular equipment.

4. (U) FY 1984 Planned Program: Design packaging and accomplish production engineering for Landing Zone (LZ), Drop Zone (DZ) and Extraction Zone (EZ) portable lighting. Procure lights and place in the operational inventory.

5. (U) Program to Completion: Not Applicable.

6. (U) Milestones: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #41118F
DOD Mission Area: Airlift, #261

Title: C-141 Squadrons
Budget Activity: Tactical Programs, #4

(U) RESOURCES (BUDGET LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	7,000		1,282	1,948	1,729	11,959
2854	C-5/C-141 AIR REFUELING PART TASK TRAINER			1,282	1,948	1,729	4,959

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The C-141 provides rapid worldwide airlift of personnel and supplies in support of DOD and national missions. Tanker support for training is limited and the Military Airlift Command does not have aircrew training devices for air refueling qualification and continuation training of the airlift pilot force. The air refueling part task trainer will ensure that the airlift force remains fully ready to perform its mission.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Source selection, contract award and preliminary design review for the Air Refueling Part Task Trainer will be accomplished.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Project 2854:						
Procurement (Aircraft)				1,400	19,200	20,600
(Quantity)				(1)	(6)	(7)
RDT&E (Program Element #41118F)			1,282	1,948	1,729	4,959
Procurement (Aircraft) (Program Element #41119F)				1,500	19,800	21,300

Project: 2854
Program Element: #41118F
DOD Mission Area: Airlift, #261

Title: C-5/C-141 Air Refuel Part Task Trainer
Title: C-141 Squadrons
Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Use of aircraft for Military Airlift Command (MAC) C-5 and C-141 pilot air refueling (AR) training is expensive and requires dedicated support by the Strategic Air Command tanker force. Tanker support for training is limited, and MAC does not have aircrew training devices for AR qualification and continuation training of the airlift pilot force. Even if C-5 and C-141 flight simulators were adequately equipped, there is insufficient machine time available to satisfy AR training requirements. This project will provide a synthetic training device that provides the fundamental visual, audio, flight control, and buffet cues necessary for realistic AR training. It uses a common cockpit for both the C-5 and C-141 and will allow simulated air refueling with both KC-135 and KC-10 tankers.

(U) RELATED ACTIVITIES: Cost for this development and procurement is shared with PE 41119F, C-5 Squadrons.

(U) WORK PERFORMED BY: The design and development will be managed by the Aeronautical Systems Division of Air Force Systems Command.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Planned Program: Not Applicable

3. (U) FY 1983 Planned Program: Project will commence with source selection and contract award. Development will progress to the point where a preliminary design review will be conducted by the government System Program Office (SPO).

4. (U) FY 1984 Planned Program: Development will continue. Critical Design Review (CDR) is planned for early in FY 1984. Production of the initial test article will be completed during this fiscal year.

5. (U) Program to Completion: The initial unit will enter test in FY 1985. Orders for units two (2) through seven (7) will be placed in FY 1985. All units will be delivered and training will commence in mid FY 1986.

Project: 2854
Program Element: #41118F
DOD Mission Area: Airlift, #261

Title: C-5/C-141 Air Refuel Part Task Trainer
Title: C-141 Squadrons
Budget Activity: Tactical Program, #4

6. (U) Milestones:

	Date
A. MAC SON 03-79 Validated	February 1980
B. Contract Award	October 1982
C. Critical Design Review	November 1983
D. Start Test	November 1984
E. Ready for Training	March 1986

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #41119F
DOD Mission Area: Airlift, #261

Title: C-5 Squadrons
Budget Activity: Tactical Programs, #4

(U) RESOURCES (BUDGET LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	10,935	15,541	8,077	3,997	3,229	177,829*
410A	C-5A WING MODIFICATION PROGRAM	10,935	15,541	6,795	1,549		170,620
2854	C-5/C-141 AIR REFUEL PART TASK TRAINER			1,282	1,948	1,729	4,929
	ADMINISTRATIVE AND COMMAND SUPPORT				500	1,500	2,000**

* Includes $250K for FY 80 Congressionally Mandated Mobility Study

** The $500,000 shown in FY 84 and the $1,500,000 under the Additional to Completion columns for Adminstration Command Support was placed in PE 41119F in error. These 3600 funds are earmarked for civilian pay of those Air Force Systems Command personnel directly associated with the new procurement of C-5Bs. These funds will be transferred to the proper program element, PE 65806F, during the 84 POM exercise.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The C-5A provides rapid worldwide airlift of personnel and supplies in support of DOD and national missions. It represents the only aircraft in the strategic mobility force capable of airlifting large "outsize" cargo. The Wing Modification will insure the future availability of the C-5 force by providing wing life compatible with the remaining life of the non-wing structure of the aircraft. Tanker support for training is limited and the Military Airlift Command does not have aircrew training devices for air refueling qualification and continuation training of the airlift pilot force. The air refueling part task trainer will ensure that the airlift force remains fully ready to perform its mission.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Damage tolerance testing of the fatigue test wing through the third lifetime of testing of 90,000 cyclic test hours will be accomplished in this fiscal year. The Follow-On Test and Evaluation flight test program will be completed by May 1982 and the results will be reported. Source selection, contract award and preliminary design review for the Air Refueling Part Task Trainer will be accomplished. Cost estimates for the Wing Modification were validated by an Independent Cost Assessment completed in October 1979 in support of Milestone III and are based upon a negotiated contract with Lockheed-Georgia Company.

Project: #410A
Program Element: #41119F
DOD Mission Area: Airlift, #261

Title: C-5A Wing Modification
Title: C-5 Squadrons
Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The C-5A aircraft cannot achieve its design service life of 30,000 hours with its current wing. The safe limit of the current wing has been assessed as 7100 Representative Mission Profile hours. Discovery of inherent design and materials deficiencies in the C-5A wing structural components date back to the first failure of the static test article in 1969, and a second failure in 1971. In addition, experience gained from testing of two fatigue test articles inidicates that the wing service life is far short of its design goal. In 1972, an Independent Review Team of highly qualified engineering talent was formed to examine all aspects of the C-5 structure. After a year's study, it concluded that, except for the wing, the C-5 structure should be capable of attaining 30,000 hours of service life. The team provided a range of options to increase the life of the aircraft and, from these options the Air Force selected the current modification program which has evolved to total replacement of the center, inner, and outer wing boxes which are the load carrying structural component of the wing. The approach in the design of the new structure is to reduce stress levels by the addition of necessary material. The material to be used in the new boxes is a different alloy possessing greater fracture toughness. By installing the longer life wing, the availability of the C-5A to the strategic mobility forces is assured beyond the year 2000.

(U) RELATED ACTIVITIES: The C-5A force is being managed by the Military Airlift Command and by San Antonio Air Logistics Center to assure that wing life limits will not be reached prior to the scheduled modification program input dates. This effort involves individual aircraft flying time management, payload limitations and mission profile restrictions.

(U) WORK PERFORMED BY: The design and development testing is being managed by the Aeronautical Systems Division of Air Force Systems Command. A contract for the design and testing was awarded to the Lockheed-Georgia Company, Marietta, GA in December 1975. A production contract for the fabrication and installation of the replacement wing components for the 76 unmodified aircraft was awarded to Lockheed-Georgia Company in July 1980. AVCO of Nashville, TN, was a major subcontractor for the fabrication of the two test "kits" and will fabricate major sections of the production components.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In December 1975 a contract was awarded to the Lockheed-Georgia Company for the design of the wing modification for the C-5A aircraft. Options for the fabrication and testing of two prototype wing modification kits were exercised in January 1977 with the release of long lead materials for the kits. The wing modification design was completed in June 1978. Fabrication of the two test kits was completed in October 1979. The fatigue article was fully assembled in July 1979 and the strain survey was successfully completed in August 1979. Cyclic testing of the fatigue article started in August 1979. Work was completed in May 1980 to install the second kit into the flight test aircraft and flight testing began in August 1980. The fatigue test reached the first lifetime of cyclic testing (30,000 hours) in May 1980 and testing continued throughout the end of the year. A combined Development Test and Evaluation/Initial Operational Test and Evaluation flight test was completed at the end of October 1980. No major deficiencies were discovered in this test phase. Phase I Follow-On Test and Evaluation was conducted between February 1981 and June 1981. During this test phase, the test aircraft was based at Dover AFB, Delaware, and flew airlift missions throughout the world. The second lifetime of cyclic testing (60,000 hours) was completed in June 1981. Cyclic testing continued through the end of the year.

Project: #410A
Program Element: #41119F
DOD Mission Area: Airlift, #261

Title: C-5A Wing Modification
Title: C-5 Squadrons
Budget Activity: Tactical Program, #4

2. (U) FY1982 Planned Program: Cyclic testing to the third lifetime (90,000 cyclic test hours) will be completed by June 1982. This will complete the damage tolerance testing portion of the fatigue test program. Follow-on Operational Test and Evaluation of the flight test aircraft will be complete in May 1982. Kit fabrication will continue and production line operation for the installation of the first increment of five kits will begin in February 1982 when the first aircraft is delivered to Air Force Plant Number Six operated by Lockheed-Georgia Company. Estimated costs have decreased a total of $6,359,000 this fiscal year. RDT&E decrease is attributable to ahead of schedule condition of the fatigue test program. Production estimate change is attributed to inflation adjustment.

3. (U) FY 1983 Planned Program: The remainder of the fatigue test program consisting of residual strength testing, teardown inspection and test report will be completed. Kit fabrication will continue with 34 kits in progress and five aircraft in the production line at the beginning of the year. The first delivery will occur in March 1983. By the end of the fiscal year eight aircraft will have been delivered and 12 aircraft along with 44 kits will be in work.

4. (U) FY 1984 Planned Program: Kit fabrication will continue with the final twenty four (24) modification kits placed on order this fiscal year. By the end of this period twenty six (26) aircraft will have been delivered and twelve (12) aircraft along with fifty (50) kits will be in work.

5. (U) Program to Completion: Fabrication and installation of the seventy six (76) production kits will complete the Wing Modification Program for all 77 of the inventory C-5 aircraft. The RDT&E costs for the program are less than originally estimated because the fatigue testing was more successful than envisioned and will be completed substantially ahead of schedule. Total procurement cost estimates have decreased $14.0 million due to inflation adjustments. Adjustment of $26.8 million in the Operation and Maintenance Appropriation (Program Element #72207F) is also attributable to inflation.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	11,000	15,900	13,700		12,000	188,650
Procurement	166,700	192,500	190,700		243,400	881,000

(U) OTHER APPROPRIATION FUNDS:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Project 410A:						
Procurement (aircraft)	163,500	186,500	190,200	239,100		865,300
(Quantity)	(12)	(18)	(18)	(24)		(76)
Operations and Maintenance (Program Element #72207F)		53,100	96,800	101,100	199,100	450,100
(Install quantity)		(5)	(15)	(18)	(38)	(76)
Project 2854:						
Procurement (Aircraft)				1,500	19,800	21,300
Procurement (Aircraft) (Program Element #41118F)				1,400	19,200	20,600
(Quantity)				(1)	(6)	(7)
RDT&E (Program Element #41118F			1,282	1,948	1,729	4,959

Budget Activity: Intertheater Airlift, #261
Program Element: #41119, C-5 Squadrons

Test and Evaluation Data:

1. (U) Development Test and Evaluation: A contract was awarded in December 1975 to Lockheed-Georgia company, Marietta, GA, for the design, fabrication, test and evaluaton of a modification to the wings of the C-5A which will provide a 30,000 hour wing life after modification. The design phase included an extensive component test program to develop and verify design concepts, material selection, fastener selection and configuration. These efforts conducted by the contractor with support from the Air Force Materials Laboratory and the Air Force Flight Dynamics Laboratory included component strength tests, fatigue tests and damage tolerance evaluations. Members of Air Force Scientific Advisory Board met on 12 December 1977 as the Division Advisory Group to review the design and component test program results. The Group concluded that the new design as substantiated by the component test program provided much lower stress levels, improved fastener systems, superior materials selection in the areas of fracture toughness and stress corrosion resistance, and a number of design improvements in known critical areas. Their overall assessment revealed a conservative design with low technical risk and that the full scale ground tests were well designed to assess the projected service life. The Airlift Systems Program Office, Aeronautical Systems Division of Air Force Systems Command, is the program manager. the development test and evaluation phase began in January 1977 with the release of long lead material to fabricate two complete sets of test wings using production tooling. The testing of the Wing Mod design is composed of two portions, i.e., structural tests and flight tests.

(U) Contractor conducted and Air Force monitored structural testing was initiated in August 1979 with the completion of a strain survey. This test verified the analysis model predicted stresses by actual stress measurement and provided additional corroboration that the stresses in the new design are significantly below those of the unmodified wing. Cyclic tests designed to demonstrate the life improvement characteristics of the redesigned components began immediately upon completion of the strain survey. The spectrum applied to the full fatigue article (X-991) is a flight-by-flight representation of the design usage. Two minor structural defects were discovered during the first lifetime of testing. These deficiencies were a crack in the radius of two aft splice fittings discovered at 29,750 test hours and cracks in four upper lobe frame clips discovered at 30,000 test hours. Both defects have been corrected by redesigning the parts and they are now installed and undergoing test on the fatigue article.

(U) Concurrency addressed by a Deputy Secretary of Defense April 1976 Memo has been minimized by restricting production kit fabrication until the first of two lifetimes of fatigue testing has verified the fatigue characteristics of the modified wing. Achievement of one lifetime or 30,000 cyclic test hours of testing was successfully completed in May 1980, and was a prerequisite to the actual fabrication of new hardware, that began in August 1980. On 1-2 July 1980, the Scientific Advisory Board reviewed the first lifetime of fatigue testing results. They concluded tha the program and performance of the test article was excellent. This milestone provides strong confidence in the utility of the modification to be produced and installed, and to achieve the 30,000 flying requirement.

(U) During the second lifetime of cyclic testing, specific requirements for crack propagation testing were developed. The second lifetime of testing (60,000 cyclic test hours) was completed in 5 June 1981. The test

Budget Activity: Intertheater Airlift,
Program Element: #41119F, C-5 Squadrons

article was inspected and no natural cracks were found. Five hundred randomly selected fasteners in the wing structure were removed and flaws were created to simulate manufacturing flaws. The purpose of these flaws was to induce cracking to observe crack propagation in the test article as cyclic testing proceeds. At 75,000 cyclic test hours all the induced flaws will be examined for evidence of cracking.

(U) Because the wing modification design retained the general aerodynamic and subsystem configuration of the structurally deficient wing, an abbreviated flight test program was planned as explained in the next paragraph. Although completion of the Development Test and Evaluation portion of the flight test coincides with fabrication go-ahead for the first increment of producton kits, C-5 force modification has been approved based on successful fatigue testing.

2. (U) Operational Test and Evaluation: In August of 1980, the Operational Test and Evaluation of the C-5 wing modification began using one aircraft. Testing was performed in three distinct phases: Combined Development Test and Evaluation (DT&E/OT&E), Phase I Follow-on Operational Test and Evaluaton (FOT&E), and Phase II FOT&E.

(U) Combined DT&E/OT&E was accomplished at the Lockheed-Georgia plant between 1 August 1980 and 30 October 1980. The Responsible Test Organization (RTO) for this phase of test was the Air Force Flight Test Center. The Air Force Test and Evaluation Center (AFTEC) test team, composed of individuals from AFTEC, the Military Airlift Command (MAC), and Air Force Logistics Command (AFLC), piggy-backed on the efforts of the Flight Test Center. The aircraft was maintained by the contractor, and no major deficiencies were discovered during this phase.

(U) Phase I FOT&E was conducted between 1 February 1981 and 6 June 1981. The aircraft was based at Dover AFB, Delaware, and flew airlift missions throughout the world. Data were collected on a total of 410 flight hours and the maintenance necessary to achieve them. Although AFTEC managed this phase of test, MAC maintenance personnel maintained the aircraft and it was flown by operational MAC aircrews. Only nine minor service reports were submitted against the aircraft for discrepancies discovered during Phase I. The reduction of data collected during test is in progress. The AFTEC final report will be published when this reduction and necessary analysis are completed.

(U) Phase II FOT&E began at Dover AFB, Delaware, on 7 June 1981. This MAC managed phase of test is ongoing. Testing is expected to be completed in May of 1982.

(U) The following OT&E test objectives were developed for the test of the modified wing:

(U) Determine if the modified aircraft's performance characteristics will permit accomplishment of planned mission.

(U) Determine the response of aircraft to pilot control inputs, with automatic lift distribution control system on and off, during normal and emergency operations of all planned missions segments, to include aerial refueling, crosswind landings, and no flap landings.

Budget Activity: Intertheater Airlift #261
Program Element: #41119F, C-5 Squadrons

(U) Determine if operational crews can safely control the aircraft during all segments of planned missions under normal and emergency conditions, observing operational limits and recommended procedures.

(U) Determine the effect of interrupted or modified subsystems on maintainability, reliability, availability, logistics supportability, and operations and support cost elements.

3. (U) System Characteristics: The configuration of the modification includes new center, inner and outer wing boxes with internal structural changes. The exterior configuration remains essentially unchanged. The leading edge slats, ailerons, spoilers, trailing edge flaps, wing tips, and pylons from the old wing are to be reused. The design approach is to lower the stress levels in the wing by a redesign which will "upsize" (add material to) the structural members. The new boxes will be fabricated from the aluminum alloy 7175T73511 which offers improved fracture toughness and corrosion resistant characteristics over the original 7075T6511 alloy in the present wing.

(U) The following comparison details selected operational and technical characterics of the C-5 aircraft: (1) operated in accordance with the C-5A flight manual limiting routine operation to 80% of the structural limitations; (2) operations based on 100% of the current wing structural limitations for the C-5A; and (3) operations based on 100% structural limitations of the C-5 aircraft after Wing Modification. Range and payload capabilities will be demonstrated during the flight test program. The fatigue article testing will verify wing life characteristics. Internal wing subsystems will be evaluated to insure that reliability, availability, and maintainability of these components are not reduced due to the modification using the latest data from the unmodified aircraft as the standard.

CHARACTERISTICS	FLIGHT MANUAL	UNRESTRICTED C-5A	WING MOD C-5	DEMONSTRATED
Cruise Speed (MACH)	.77	.77	.77	YES
Maximum Ramp Weight	732,500	769,000	840,000†	TBD
Max Takeoff Weight (2.5G)	712,500	728,000	769,000	TBD
Max Takeoff Weight (2.25G)†	728,000	764,500	837,000	TBD
Average Operating Weight Empty	354,000	354,000	372,500	YES
Maximum Payload (2.5G)	144,000	159,900	197,500	TBD
Maximum Payload (2.5G)†	204,900	204,900	242,500	TBD
Max Zero Fuel Weight (2.5G)	498,000	513,900	570,000	TBD
Max Zero Fuel Weight (2.25G)+	558,900	558,900	615,000	TBD
Fuel Capacity	318,100	318,100	332,500	YES
Wing Service Life (Hours)	7,100**	7,100**	30,000††	YES

* Exceeds 80% Structural Limitations (Non-Routine)
† Wartime (restricted) Operation.
** Based on Representative Mission Profile Hours; actual peacetime flying time will average approximately 9800 flight hours
†† Post Wing Modificaton flying hours.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #41314F
DOD Mission Area: Intertheater Airlift, #261

Title: European Distribution System
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT			2,557			2,557
2883	Aircraft			1,257			1,257
2884	Logistics Command, Control and Communications (Log C3)			1,300			1,300

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The European Distribution System (EDS) provides an assured capability to distribute critical fighter aircraft spare parts and engines in Europe. EDS is a logistics system which consists of forward stocking of wholesale spares; assured logistics command, control and communications (e.g. assured inter/intra-theater logistics communications, a control point, enhanced Automatic Data Processing (ADP)) for distribution decisions; and assured airlift (e.g. 18 small, commercial off-the-shelf airlift aircraft) to distribute fighter aircraft spare parts and engines. Air Force and RAND Corporation analysis indicated that up to 304 additional fighter aircraft would be available daily in Europe if an assured capability to distribute existing critical spares parts and engines were available in a wartime situation.

(U) BASIS FOR FY 83 RDT&E REQUESTS: Funds included are for the development of a modified skid, rail dolley system to load and transport built up fighter aircraft engines on the aircraft procured for EDS and to develop the communications architecture and supporting software to effect the distribution of critical theater spares.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable. This is a FY 1983 new start.

(U) OTHER APPROPRIATION FUNDS	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
AIRCRAFT PROCUREMENT*			6,500	37,600		44,100
(Quantity)			(2)	(16)		(18)

*includes initial spares

Program Element: #41314F
DOD Mission Area: Inter Theater Airlift, #261

Title: European Distribution System
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Logistics support of United States Air Force fighter aircraft forces is an Air Force responsibility. United States Air Force Europe currently does not have a distribution system that provides the necessary elements to assure the timely wartime theater distribution of critical spare parts and other high priority logistical assets. Recent RAND Corporation and Headquarters United States Air Force studies indicate that there is a direct linkage between the assured, responsive movement of critical spare parts and sortie production. The analysis indicates that up to 304 fighter aircraft can be made available daily during the first 30 days of a major European conflict by providing assured, responsive movement of available theater spares. The European Distribution System (EDS) was established to correct this deficiency. EDS is a logistics systems approach which will provide responsive, assured wartime/peacetime distribution of critical items in Europe for fighter aircraft forces. The program provides for the forward stockage of wholesale spares; assured logistical communications for distribution actions; a control point to identify, make and implement distribution decisions; and an organic, 18 aircraft squadron of small, off-the-shelf commercial cargo aircraft. EDS will be operational in Fiscal Year 1984.

(U) RELATED ACTIVITIES: None

(U) WORK PERFORMED BY: The Air Force Logistics Command will be the program manager for the European Distribution System. Aeronautical Systems Division will procure the aircraft and Electronic Systems Division will provide the R&D effort for Logistics Command Control and Communications (Log C^3)

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable.

2. (U) FY 1982 Program: Not Applicable.

3. (U) FY 1983 Planned Program: Procure 2 small cargo aircraft and develop and implement Log C^3. RDT&E funds are for the development of a modified skid, rail dolley system to load and transport built-up fighter aircraft engines on the aircraft procured for EDS and to develop the communications architecture and support software to effect the distribution of critical theater spares.

4. (U) FY 1984 Planned Program: Procure 16 small cargo aircraft and construct three small warehouse facilities (5000 square feet each) for wholesale spares in Europe.

5. (U) Program to Completion: Program completed in FY 84.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63431F Title: Advanced Space Communications
DoD Mission Area: Common User Communications #363 Budget Activity: Intelligence and Communications #5

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	31,021	66,151	52,349	53,934	Continuing	Not Applicable
1227	Terminal Segment Technology	8,000	12,500	8,000	11,000	Continuing	Not Applicable
2028	Space Segment Technology	13,700	37,200	32,400	30,200	Continuing	Not Applicable
2029	System Analyses/Demonstration	9,321	16,451	11,949	12,734	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This element is the only Air Force program for advanced development of satellite communications system concepts, techniques, and technologies. The program identifies, develops, demonstrates, evaluates, and transitions to operational systems the satellite and airborne terminal technology necessary to support global command control and data relay communications. The requirement is to provide communications that survive in electronic jamming and nuclear blackout environments.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program will concentrate on the techniques, technologies, and concepts for providing future military satellite communications system solutions for the Department of Defense's strategic and tactical mobile forces. Requirements of these forces are projected to be provided by MILSTAR and future upgrades to the Defense Satellite Communications System. The FY 1983 program and budget have been structured to allow evaluation of competing system approaches for future satellite solutions and to concentrate on the development of the microwave and optical frequency technologies that will allow these future satellite solutions to be survivable in combat jamming and nuclear blackout environments. The cost estimates are derived from parametric analysis and past years' experience with similar technology development efforts.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	37,000	51,500	63,400	-	Continuing	Not Applicable
Procurement	Not Applicable					

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63431F Title: Advanced Space Communications
DoD Mission Area: Common User Communications #363 Budget Activity: Intelligence and Communications #5

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force is responsible for the development of the Department of Defense's military satellite communications systems. The architecture for future systems to meet the Department of Defense's evolving satellite communications requirement is developed by the Defense Communications Agency/Military Satellite Communications System Office with active participation by the Services. Near term specific satellite systems within this architecture are developed in the Air Force under separate Program Elements. This Program Element (63431F) develops and demonstrates the techniques, technologies, and concepts for the next generation satellite communications systems. Future generation systems present unique technology challenges to enable high capacity military communications to survive under the stress of sophisticated electronic jamming environments. Even low capacity communications are a major problem considering the size terminal that can be installed on a bomber or an Armored Personnel Carrier. These technology challenges are pursued in this program element under three projects.

The first Project (1227) concentrates on the development of the technologies required for providing aircraft with cost effective satellite terminal capabilities. Technologies included are solid state and traveling wave tube amplifiers, parabolic dish and low profile aircraft antennas, and modulators/demodulators capable of jam resistant modulation and efficient access control. The terminal developments are field tested to confirm expected operation performance. Atmospheric propagation effects measurements are accomplished in conjunction with these field tests.

The second Project (2028) concentrates on the development of the technologies required for future generation communication satellites. Included are systems for supporting Nuclear Capable Forces, High Volume/High Data Rate Command/Control requirements and the tactical/mobile users. Associated technologies include microwave solid-state amplifiers, nulling and multibeam antennas, satellite processors and satellite data-relay subsystems.

The third Project (2029) accomplishes system analyses from which future airborne, ground, and space requisite technologies can be identified. The primary concentration of these system analyses will be future military satellite communications system solutions for the strategic and tactical/mobile forces. This last project also includes the integration of multiple technologies for ground-based or orbital testing.

(U) RELATED ACTIVITIES: The technologies and concepts developed in this program will be transitioned to operational systems for implementation. These systems are represented by the Air Force Satellite Communications Program (PE 33601F), the Defense Satellite Communications System (PE 33110F), and in the future by a new system (MILSTAR) to support both the strategic and tactical/mobile forces. Satellite communications system planning and technology development are coordinated within the Air Force among other communication technology development program elements and with Army and Navy companion efforts: Navy - Navy Satellite Communications, Project 0728, Extremely High Frequency Satellite Communications (PE 33109N); Army - Tactical Satellite Communications Systems (PE 33142A, Project D456).

WORK PERFORMED BY: This program and Projects 2028 and 2029 are managed by Air Force Systems Command, Space Division, Los Angeles, CA. Project 1227 is managed by Rome Air Development Center, Griffiss AFB, NY. Facilities supporting these efforts include: the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; the Electronic Systems Division, Hanscom AFB, MA; and the Air Force Weapons Laboratory, Albuquerque, NM. Supporting commands include Air Force Communications Command, Scott AFB, IL, for operational planning and Electronic Security Command, Kelly AFB, San Antonio,

Program Element: #63431F Title: Advanced Space Communications
DoD Mission Area: Common User Communications #363 Budget Activity: Intelligence and Communications #5

TX, for postulating The Advanced Space Communications program involves approximately eighty current or planned separate contracts. Major contractors are: McDonnell Douglas Aircraft Corporation, St. Louis, MO, for the space laser communications program; TRW Systems Group, El Segundo, CA, and Hughes Aircraft Company, Culver City, CA, for solid state amplifiers; Raytheon Corporation, Wayland, MA, for an airborne command post terminal; and Ball Brothers, Boulder, CO, for conformal aircraft antennas. Federal Contract Research Center support is provided by the Aerospace Corporation, Los Angeles, CA; the MITRE Corporation, Bedford, MA, and Lincoln Laboratory, Bedford, MA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The Lincoln Experimental Satellites 8 and 9 were successfully launched (March 1976) and evaluated. Technologies demonstrated included extremely high frequencies, advanced frequency hopping modulations, satellite-to-satellite cross links, and nuclear prime power sources. A Dual Frequency (extremely high and super high frequencies) terminal for command post aircraft was developed and testing accomplished with the Lincoln satellites. This type of terminal allows operations through the Defense Satellite Communications System at super high frequencies and through future satellite payloads for the mobile forces at extremely high frequencies. The corresponding production terminal is in use on E-4B advanced airborne command posts. Development has just been completed on a smaller and lighter version super high/extremely high frequency airborne terminal for EC-135 command post application. This terminal will weigh approximately 1,200 pounds in comparison to the existing 5,500 pound E-4B terminal. A Command Post Modem Processor development is included for control of simultaneous multiple channel communication through different satellite systems. A demonstration Space Laser Communications System was successfully completed at White Sands Missile Range for ground and airborne demonstration tests. A full one gigabit per second data rate link has been provided routinely from an EC-135 aircraft to a ground-based terminal Design and fabrication is progressing on a Laser Space Measurement Unit to fly in FY 1984 on a host satellite to support data link acquisition and propagation tests. Laboratory fabrication of extremely high frequency spacecraft technologies was accomplished. These technologies, including satellite antenna and processor components, and solid state amplifiers, will be needed in future generation military satellite communication systems for protection against electronic jamming. A detailed program plan and technology roadmap was generated in 1981 for the Advanced Space Communications program reflecting the broadened program scope directed in 1980. This program plan and technology roadmap were coordinated within the Department of Defense and represent the game plan for the expanded program.

2. FY 1982 Program: Multiple contractor efforts will be undertaken in FY 1982 to identify and define specific system approaches for satellites and payloads within the overall MILSATCOM architecture. Specific emphasis will be on future military satellite communications and data relay solutions for the strategic and tactical forces. Fabrication and testing of extremely high frequency spacecraft and airborne terminal technologies will continue. The Command Post Modem/Processor and the small super high frequency/extremely high frequency airborne terminal will be tested on an C-135 aircraft at Wright-Patterson AFB OH. During FY 1982 the LASERCOM Program will initiate development of LASERCOM TEST terminal in response to 1981 congressional direction. Development of the LASERCOM Space Measurement Unit will continue for launch in FY 1984. Antenna, transmitter, and processor technology representing significant risk to the MILSTAR schedule and cost will be initiated.

Program Element: #63431F   Title: Advanced Space Communications
DoD Mission Area: Common User Communicatins #363   Budget Activity: Intelligence and Communications #5

3. FY 1983 Planning Program: An expanded program to define space communications systems and develop technology will be implemented based on the coordinated program plan and technology roadmap updated during FY 1982. Specific emphasis will continue on future military satellite communications solutions for the strategic and tactical forces. The scope of the effort will, however, encompass the total space communications and data relay requirements of the Department of Defense, including near term strategies for transitioning selected combat forces' communications to the future extremely high and optical frequencies. Expanded development of extremely high frequency subsystems (i.e., processors, power amplifiers) for the satellite segment will take place following the constrained pace during prior fiscal years. Airborne testing will continue on the Command Post Modem/Processor and the small super high frequency/extremely high frequency terminal. Development will commence on satellite terminal technologies for aircraft application/installations. The LASERCOM Space Measurement Unit will be integrated onto its host spacecraft. Detailed design will be accomplished for a terminal for [ ]aircraft. The decrease from 63,400 to 53,300 from last year's descriptive summary was due to program readjustments.

4. FY 1984 Planned Program: Based on the space communications and data relay architectural and systems definition efforts of FY 1982, specific implementation objectives will be pursued to a next level of detailed design. Where possible, these detailed design efforts will be transitioned to acquisition program elements or new program elements initiated. Development and demonstration of key Extremely High Frequency technologies will continue. The tactical aircraft terminal technology developments will accelerate. Airborne testing of the Command Post Modem Processor and small Super High Frequency/Extremely High Frequency terminal will be completed. The Laser Space Measurement Unit payload will be tested with the host spacecraft. The LASERCOM terminal for the [ ] test will be completed and tested. Design for the operational retrofit of that terminal will begin.

5. (U) Program to Completion: This is a continuing technology development program. Component and communication subsystem development will continue to provide the requisite techniques, technologies, and concepts for future military satellite communications systems capable of surviving in the face of sophisticated electronic jamming environments.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

Project: #1227 | Title: Terminal Segment Technology
Program Element: #63431F | Title: Advanced Space Communications
DoD Mission Area: Common User Communications #363 | Budget Activity: Intelligence and Communications #5

(U) DETAILED BACKGROUND AND DESCRIPTION: The military services, the Commanders-in-Chief of the Unified and Specified Commands, and the National Command Authorities require airborne command post and bomber terminals that permit operation through designated satellite systems for command and control of United States force elements. Emphasis is placed upon increased survivability, performance and reliability for Single Integrated Operations Plan execution and management, crisis management and contingency operations. This project evaluates space communications system airborne terminal requirements (Army has the ground terminal development responsibilities for the services) and develops concepts to meet these needs; evaluates the technology available to implement the concept and determines what additional technology development is required; conducts simulation and concept evaluation efforts; and assists operational systems in planning for evolutionary improvements in capability. These efforts support development of an integrated set of satellite communications capabilities for all defense requirements and insures that the technology development required to reduce risk is available prior to full scale development decisions.

(U) RELATED ACTIVITIES: This project supports the planning activity for evaluation of space communications systems, including the Air Force Satellite Communications System PE 33601F; the Defense Satellite Communications System, PE 33110F; and MILSTAR PE 33603F satellite communications systems. The technology and systems planning are coordinated with Army and Navy terminal development efforts, in conjunction with the Defense Communications Agency/Military Satellite Communications System Office, which is responsible for overall architecture of satellite communications systems. Direct coordination with the systems program offices is used to insure responsive planning and to avoid overlap.

(U) WORK PERFORMED BY: This project is the responsibility of Air Force Systems Command, Rome Air Development Center, Griffiss AFB NY with support from Electronic Systems Division, Hanscom AFB, MA, and Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH. Facilities supporting this project include the Communications Simulation and Evaluation Laboratory (CSEL) at Air Force Wright Aeronautical Laboratories, and flight vehicle test beds from Aeronautical Systems Division at Wright-Patterson AFB, OH. This project has approximately 20 contracts active or planned. Major contractors include: Raytheon Corporation, Wayland, MA, for command post terminals; Linkabit Corporation, La Jolla, CA, for terminal modulator/demodulator and; Ball Brothers, Boulder, CO. for conformal antennas. Federal Contract Research Support is provided by the MITRE Corporation, Bedford, MA.

Project: #1227 Title: Terminal Segment Technology
Program Element: #63431F Title: Advanced Space Communications
DoD Mission Area: Common User Communications #363 Budget Activity: Intelligence and Communications #5

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The Lincoln Experimental Satellites 8 and 9 ultra high frequency and extremely high frequency airborne terminals have been successfully demonstrated from an airborne platform. A Dual Frequency Terminal (extremely high and super high frequencies) for command post aircraft was developed and testing completed. Development was completed on a small super high frequency/extremely high frequency airborne terminal weighing approximately 1,200 pounds in comparison with an existing 5,500 pound terminal with similar performance. A Command Post Modem Processor development was included in the small terminal for eventual control of multichannel command post satellite communications. Development has been initiated on a super high frequency Conformal Aircraft Antenna to provide a low drag installation for potential replacement of parabolic dishes with protruding radomes.

2. (U) FY 1982 Program: The Command Post Modem Processor and the small super high frequency/extremely high frequency airborne terminal development will be tested on a C-135 aircraft at Wright-Patterson AFB, OH. The super high frequency Conformal Airborne Antenna development will continue. Extremely high frequency terminal subsystems applicable to MILSTAR will be initiated. These include both dish and low profile antennas and multiple traveling wave tube and solid state transmitters.

3. (U) FY 1983 Planned Program: Airborne testing will continue on the Command Post Modem Processor and the small super high frequency/extremely high frequency terminal. The super high frequency Conformal Airborne Antenna will be integrated on the Wright-Patterson AFB C-135 test aircraft for tests. Extremely high frequency terminal subsystems for MILSTAR will be continued. Full scale development for the EHF terminal will then commence in PE 33601F, Air Force Satellite Communications System, leading to an operational capability in the Air Force's command post aircraft.

4. (U) FY 1984 Planned Program: The expanded technology development program for strategic and tactical aircraft will continue. Flight testing of the Command Post Modem Processor, small super high frequency/extremely high frequency terminal, and super high frequency Conformal Antenna will be completed. Development of an extremely high frequency low profile bomber terminal antenna will be initiated.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

Project: #1227
Program Element: #63431F
DoD Mission Area: Common User Communications #363

Title: Terminal Segment Technology
Title: Advanced Space Communications
Budget Activity: Intelligence and Communications #5

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	8,000	12,500	8,000	11,000	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	7,300	9,000	7,300	--	Continuing	Not Applicable

The increase from 7,300 in last year's summary to 8,000 is due to realigning some efforts within Project 1227.

Project: #2028
Program Element: #63431F
DoD Mission Area: Common User Communications #363

Title: Space Segment Technology
Title: Advanced Space Communications
Budget Activity: Intelligence and Communications #5

(U) DETAILED BACKGROUND AND DESCRIPTION: The military services, the Commanders-in-Chief of the Unified and Specified Commands, and the National Command Authorities require global, secure, jam-resistant and survivable satellite communication throughout the spectrum of war, including Single Integrated Operations Plan execution and management, theater conflict management, crisis management, and contingency operations. Satellites provide significant advantages in terms of survivability and global coverage without dependence upon foreign based assets. This project develops configurations, subsystems, and components for spacecraft to meet identified technology requirements of new or improved space communication systems. Development is initiated when a detailed system concept is prepared or when a new requirement is identified which exceeds the capabilities of available technologies. Configuration development includes design of the space segment to provide increased survivability, connectivity, reliability and capacity. Space technology to support interference and jamming protection is addressed. Subsystem development includes highly advanced communications capabilities involving extremely high frequency and optical (Laser) technologies. Component development includes spacecraft communications amplifiers at the extremely high frequencies with increased power, spacecraft antennas, communication processors, and other component technology to improve reliability, capacity, flexibility, and jam resistance.

(U) RELATED ACTIVITIES: The technology developed in this project is transitioned to operational space communications programs for implementation. The Air Force Satellite Communications Program, PE 33601F, will use the technology and concept developments from this project to implement increased survivability, reliability and capability to satisfy the communications requirements of the Department of Defense's strategic force elements. Future upgrades to the Defense Satellite Communications System will be based on technologies developed in this program element. The basic technologies for improved support of tactical forces will be developed within this project.

(U) WORK PERFORMED BY: This project is the responsibility of Air Force Systems Command, Space Division, Los Angeles, CA. Supporting organizations include: Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; Rome Air Development Center, Rome NY; and Air Force Weapons Laboratory, Albuquerque, NM. This project has over 50 active or planned contracts. The major contractors are: McDonnell Douglas Aircraft Corporation, St. Louis, MO, for the Space Laser Communications experiment; Raytheon Corporation, Wayland, MA, for space qualified communications processor; LNR Communications, Hauppauge, NY and Hughes Aircraft, Torrance, CA, for extremely high frequency (EHF) power amplifiers and Sylvania, Mountain View, CA, for a lamp pumped laser. Federal Contract Research Center support is provided by the Aerospace Corporation, Los Angeles, CA.

Project: #2028 Title: Space Segment Technology

Program Element: #63431F Title: Advanced Space Communications

DoD Mission Area: Common User Communications #363 Budget Activity: Intelligence and Communications #5

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. FY 1981 and Prior Accomplishments: The Lincoln Experimental Satellites 8 and 9 were successfully launched (March 1976) and evaluated. Multi-year developments of extremely high frequency solid state satellite power amplifiers at 40 and 60 gigahertz were completed. Twenty gigahertz solid state amplifier development work has been started. A 20 gigahertz traveling-wave-tube amplifier development is continuing under a joint program with the National Aeronautics and Space Administration. Laboratory fabrication of other extremely high frequency technologies was accomplished. These technologies include special anti-jam and directional antennas, on-board processors, and other devices. The 60 gigahertz development has potential application for satellite-to-satellite crosslinks. The Space Laser Communications System successfully completed laboratory testing and was moved to the White Sands Missile Range for field testing. Flight and Ground tests at White Sands were all successfully completed. The success of this Laser Communications Flight Test program to date has increased Air Force's assessment of the laser technology's readiness [ ] The aircraft routinely operated with a one gigabit data link to a ground based terminal. Design and fabrication was initiated on a Laser Space Measurement Unit to fly in FY 1984 on a host satellite to support acquisiton and propagation tests.

2. FY 1982 Program: Particular emphasis will be on the extremely high frequency and optical frequencies. Close coordination will be maintained with the Defense Communications Agency/Military Satellite Communications System Office and companion terminal technology efforts of the Army and Navy. Laboratory fabrication of extremely high frequency technologies for satellite applications will continue. Development of a LASERCOM terminal for the [ ] aircraft will begin pursuant to 1981 congressional direction. Development of the LASERCOM Space Measurement Unit will continue for launch in FY 1984.

3. FY 1983 Planned Program: An expanded technology development effort will be initiated based on the program plan and technology roadmap developed in FY 1981. The development effort will concentrate on extremely high frequency technologies for satellite application such as null steering and time hopped narrow beam antennas, on-board processors, advanced modulations, and solid-state power amplifiers. Technology performance demonstrated as a result of this year's efforts has to be sufficient to support potential acquisition decisions for future satellite systems and payloads beginning in FY 1983 (see Project 2029). The Laser Comm Space Measurement Unit will be integrated onto the host spacecraft. The LASERCOM [ ] terminal development will continue.

4. FY 1984 Planned Program: Extremely high frequency satellite technology development will continue. The Laser Comm Space Measurement Unit payload will be tested. The [ ] LASERCOM terminal will be tested and design begun to retrofit the test terminal. [ ]

5. (U) Program to Completion: This is a continuing program. Development efforts are focused upon increased communications capacity and survivability in the space environment.

Project: #2028 Title: Space Segment Technology
Program Element: #63431F Title: Advanced Space Communications
DoD Mission Area: Common User Communications #363 Budget Activity: Intelligence and Communications #5

6. (U) Milestones: Not Applicable

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	13,700	37,200	32,400	30,200	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary:

RDT&E	12,000	14,200	14,400	-	Continuing	Not Applicable

The 18,000 increase from last year's summary is due to realignment of the effort in Project 2028. Specifically, all of the LASERCOM work is in Project 2028 instead of divided between Project 2028 and Project 2029.

Project: #2029 Title: Systems Analyses/Demonstration
Program Element: #63431F Title: Advanced Space Communications
DoD Mission Area: Common User Communications #363 Budget Activity: Intelligence and Communications #5

(U) DETAILED BACKGROUND AND DESCRIPTION: This project addresses the systems aspect of future Military Satellite Communications System solutions (new systems and upgrades to existing systems). Space segment and terminal segment requirements identified by this project are pursued in Project 1227 (Terminal Segment Technology) and Project 2028 (Space Segment Technology). The basis of the system analyses performed in this project is the architectural requirements identified by the services working with the Defense Communications Agency/Military Satellite Communications System Office. A primary concentration at this point in time is future military satellite communications system solutions for the Department of Defense's strategic and tactical combat forces. This project includes the integration of multiple technologies for ground based and orbital testing and evaluation.

(U) RELATED ACTIVITIES: The successful accomplishment of this project calls for a close working relationship with the Defense Communications Agency/Military Satellite Communications System Office to insure the development efforts within Advanced Space Communications are consistent with the evolving MILSATCOM architectural framework. Close coordination is also required with the Army for ground terminal developments and with the Navy for shipboard terminal developments to insure compatible future system solutions. The Defense Communications Agency/Military Satellite Communications System Office provides the necessary leadership and a forum for the coordination of service technology programs.

WORK PERFORMED BY: Air Force Systems Command Space Division, Los Angeles, CA, is responsible for this project. Supporting organizations include Electronic Systems Division, Hanscom AFB, MA; and Lincoln Laboratory, Bedford, MA. Supporting commands include Air Force Communications Command, Scott AFB, IL, for operational planning, the Air Force Geophysics Laboratory, and Electronic Security Command, Kelly AFB, TX, [

] Federal Contract Research Center support is provided by the Aerospace Corporation Los Angeles, CA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Air Force Systems Command personnel participated in tri-service working groups chaired by the Defense Communications Agency/Military Satellite Communications Systems Office to refine the details of the military satellite communications architecture (published as the "Framework for MILSATCOM development" in Nov 1978) and to define tri-service compatible technology development goals to support the future military satellite communications architecture (published as the "Technology Development Program Plan in Nov 1979). System approaches were investigated for providing a future military satellite communications capability for the Department of Defense's mobile/tactical forces. Driving considerations for this future capability are: (1) highly jam resistant communications in combat environments in the face of a technically advanced, experienced, and dedicated adversary, (2) operation through a nuclear disturbed atmosphere, and (3) low probability of intercept communications to minimize the probability of location and destruction. Lincoln Laboratory participated in these analyses and structured a development program to address key system technologies. Space Division accomplished a first issue of a "Technology Roadmap" and "Implementation Master Plan" to guide the Advanced Space Communications development programs. Electronic Security Command initiated a program [

]

Project: #2029 Title: Systems Analyses/Demonstration
Program Element: #63431F Title: Advanced Space Communications
DoD Mission Area: Common User Communications #363 Budget Activity: Intelligence and Communications #5

2. FY 1982 Program: The "Technology Roadmap" and "Implementation Master Plan" will be updated for the Advanced Space Communications program reflecting the broadened scope initiated in FY 1980. Advanced concepts for future military satellite communications and data relay solutions will be explored for the strategic and tactical forces. Key technologies are being integrated both in breadboard and through simulation, to verify integrated performance characteristics of extremely high frequency MILSATCOM systems. Activities in this area are coordinated with the Army and Navy; advanced terminal development programs through tri-Service forums chaired by the Military Satellite Communications System Office.

3. FY 1983 Planned Program: An expanded program of space communications system definitions and technology development will be implemented based on the coordinated program plan and technology roadmap updated during FY 1982. Specific emphasis will be on future military satellite communications solutions for the strategic and tactical forces. The scope of the effort will, however, encompass the total space communications and data relay requirements of the Department of Defense. Performance measurements and assessment of integrated extremely high frequency technologies will continue, as will the

4. FY 1984 Planned Program: Based on the space communications and data relay architectural and systems definition efforts of FY 1983, specific implementation objectives will be pursued to a next level of detailed design. These detailed design efforts will be transitioned to acquisition program elements or new program elements initiated. Performance measurements and assessments of integrated extremely high frequency technologies will continue.

5. (U) Program to Completion: This is a continuing systems analyses/demonstration project.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	9,321	16,451	11,949	12,734	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary

RDT&E	7,700	28,300	41,700	-	Continuing	Not Applicable

The reduction from 41,700 to 11,949 is due to realignment of some activities in Project 2029. Specifically, all of the LASERCOM work is in Project 2028 instead of divided between Project 2028 and 2025. Program reductions are also reflected here.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64778F Title: Navstar Global Positioning System
DOD Mission Area: Navigation and Position Fixing, #361 Budget Activity: Intelligence and Communications, #5

RESOURCES (PROJECT LISTING): ($ in thousands)

PROJECT NUMBER	TITLE	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	126,214	165,377	122,837	98,927	114,923	1,089,578

(U) BRIEF DESCRIPTION OF PROGRAM ELEMENT AND MISSION NEED: This program element funds Air Force participation in the joint program for Phase II, full-scale development, of the Navstar Global Positioning System. Program Element 64778F Navstar Global Positioning System reflects those funds previously reported (FY 1979 and prior) in Program Element 63421F Navstar Global Positioning System, Program Element 64478F Navstar Global Positioning System Space / Control Segments and Program Element 64778F Navstar Global Positioning System User Equipment.

(U) Military forces need to know precise location (1) to enhance command and control and to coordinate battle tactics and support; (2) to engage in strategic and tactical warfare; (3) to maneuver efficiently in the battle area; (4) to provide accurate and timely fire support; and (5) to facilitate combat support. A global, common grid positioning and navigation system is required to increase both the accuracy and the availability of current weapon systems, especially at night and in adverse weather, thus increasing their effectiveness. The Mission Element Need Statement was revalidated by the Secretary of Defense at Milestone II. The GPS satellites will also carry as a secondary payload the Integrated Operational NUDET Detection System (IONDS) to detect and locate nuclear detonations.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Continues full scale development of all three system segments (space, control and user equipment). Completes the buy of three additional first generation satellites to replenish the five-satellite developmental constellation. Operates the constellation to support both developmental testing of user equipment and the Navy's Fleet Ballistic Missile Improved Accuracy Program. The second and third replenishment satellites will be delivered in FY 1983 and will be available to maintain the 5-satellite constellation to support testing and special limited operations. Fabrication of the operational satellite qualification test vehicle will continue.

(U) The initial control segment will continue to support the developmental satellite constellation until the operational control segment is available. Software development for the operational control center will continue. Hardware deliveries for the operational control segment will begin. The dual-contractor competitive user equipment development will continue with equipment being delivered for testing. Cost estimates are based on fixed price contracts covering full scale development of all three system segments.

Program Element: #64778F   Title: Navstar Global Positioning System (GPS)
DOD Mission Area: Navigation and Position Fixing, #361   Budget Activity: Intelligence and Communications, #5

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	126,600	170,100	126,000		195,300	1,082,000
PROCUREMENT (MISSILE)		78,600	108,400		To Be Determined	
MILITARY CONSTRUCTION					14,700	14,700

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement						
Program Element 35165F						
Missiles (Operational Satellites)		0*	102,000	149,300	To Be Determined	
(Quantity)		28	0	0		
Program Element 35164F						
Aircraft (User Sets)					To Be Determined	
(Quantity)						
Other (Manpack User Sets)					To Be Determined	
(Quantity)						
Military Construction						
Program Element 35165F				13,523		13,523

* The satellites for the initial 18-satellite constellation will be bought under a termination liability funded block buy starting in FY 82 with funds appropriated in Program Element 3135?F, Integrated Operational Nuclear Detonation Detection System.

(U) DETAILED BACKGROUND AND DESCRIPTION: Fundamental to the successful accomplishment of military functions is the ability to precisely position friendly forces relative to each other and with respect to enemy forces. Over the years, the Services have developed numerous positioning and navigation aids to satisfy specific requirements and to increase the effectiveness of weapon systems. Technologies available at the time these systems were developed tended to limit the design and application of these "pos/nav" aids to specific purposes with only a minimum of integration possible. Further improvement in the military utility of these systems has been constrained by accuracy limits, extent of geographic coverage, dependence on foreign basing rights and other reasons.

(U) Through extensive studies, analyses and tests, the Services confirmed that a single, highly precise, satellite based positioning system could best satisfy the broad spectrum of the Department of Defense requirements documented in the Joint Chiefs of Staff Master Navigation Plan. Thus, in December, 1973, the need for the system was affirmed through the Defense Systems Acquisition Review Council Milestone I Review. Subsequently, the Defense Navigation Satellite System,

Program Element: #64778F Title: Navstar Global Positioning System (GPS)
DOD Mission Area: Navigation and Position Fixing, #361 Budget Activity: Intelligence and Communications, #5

later named the Navstar Global Positioning System, entered the concept validation phase (Phase I). The purpose of this phase was two-fold: (1) to validate that the technology was sufficiently mature to reasonably develop a system which could provide the required capability and (2) to demonstrate the military utility of this system.

(U) A four satellite constellation was established in 1978. Advanced development user sets were built and used in eleven different host vehicles in over 700 separate tests to satisfy Phase I objectives. A thorough system cost estimate was prepared to identify the total acquisition and 15-year operational costs. Force effectiveness studies were performed by all Services for a number of missions. All the Services indicated positive benefits through extensive military use of the system. The only technical question remaining at the end of Phase I was the expected lifetime of the satellite-borne atomic frequency standards. A thorough development program was then initiated to improve the atomic standard lifetime. Therefore, no major technical or operational issues caused undue concern at the Milestone II Review in June, 1979.

(U) Concern about system acquisition cost was the only qualifying comment in the Secretary of Defense's approval to proceed into Phase II full scale development on August 24, 1979.

(U) This concern over cost was subsequently manifested in a substantial reduction in approved program funding in the FY 1981 President's Budget relative to the funding required to implement the program as directed in August, 1979. On May 28, 1980, the Secretary of Defense approved a restructured program which matched the funding available. The major impacts of the restructured program were to delay deployment of an 18-satellite constellation and to build to a constellation of 18 satellites instead of 24. However, the restructured program did provide a system which could readily accommodate future expansion to a 24-satellite constellation.

(U) In addition, the restructured program deferred incorporation of some capabilities until after deployment of the 18-satellite constellation. These deferred capabilities will not seriously impact the initial use of GPS but would adversely impact certain missions (operations in dense foliage, certain jamming scenarios and several naval missions) in the long term if totally omitted. As a result, the first generation satellite developed during Phase I is being minimally modified to increase the resistance of the satellite to nuclear effects, to add the capability to deny precision signals to adversaries and to launch the satellite from the Space Shuttle.

(U) The interim control segment to operate the system during Phase II consists of a control center at Vandenberg AFB, CA, four dispersed monitor stations and the Satellite Control Facility. This interim control center was upgraded in FY 1982 to provide satellite control during launches of production spacecraft until the Operational Control Segment, including the Navstar Control Center, is fully deployed and operational. Development of the Operational Control Segment is proceeding toward establishment of a prime facility with greater reliability than the interim control center and some increased automation to reduce the manpower/skill levels required. Construction of the Navstar Control Center facility will begin in FY 1984. Development of the user equipment was not changed by the restructuring.

Program Element: #64778F Title: Navstar Global Positioning System (GPS)
DOD Mission Area: Navigation and Position Fixing, #361 Budget Activity: Intelligence and Communications, #5

(U) The program will provide an unlimited number of users with a combination of accuracy, jamming resistance, survivability, coverage and force interoperability (through the common grid) far exceeding that of any other navigation system. Suitably equipped United States/allied military users will be able to determine three-dimensional position (latitude/longitude/altitude) to an accuracy of 16 meters or better spherical error probable (50 percentile) and 40 meters or better on a 95 percentile basis.

(U) RELATED ACTIVITIES: The joint program manager coordinates the supporting activities of the Army, Navy, Marine Corps, Defense Mapping Agency, Department of Transportation and North Atlantic Treaty Organization through his deputies in the Joint Program Office. The use of the Global Positioning System for providing guidance corrections for tactical missiles is being separately explored under Program Element 63601F, Conventional Weapons Technology. Investigation of advanced anti-jaming technology is being conducted under Program Element 63203F, Advanced Avionics for Aircraft. Program Element 64778F also supports the Navy's Fleet Ballistic Missile Improved Accuracy Program (Program Element 11221N Fleet Ballistic Missile Systems).

(U) The North Atlantic Treaty Organization Global Positioning System Project, a cooperative venture between the United States and nine other nations, provides information to these nations to assist in making decisions about adopting the system for military forces.

(U) Full scale development of user equipment is funded by all services under Program Element 64778A/N/F Navstar Global Positioning System for the Army, Navy, and Air Force, respectively. Acquisition is reflected in Program Element 35164A/N/F, all titled Navstar Global Positioning System User Equipment, and Program Element 35165F Navstar Global Positioning System Space & Control Segments.

(U) An Integrated Operational Nuclear Detonation Detection System payload will be flown with the refurbished qualification vehicle (Navstar 8) of the first generation satellites, on all three replenishment satellites (Navstars 9-11) and on all operational satellites. Program Element 31357F, Integrated Operational Nuclear Detonation Detection System, funds these payloads. A more powerful second stage launch capability is being acquired to provide the additional throwweight capability required by the addition of the nuclear detonation detection payload. Expendable launch services (Atlas E/F) are funded under Program Element 35119F, Space Boosters. Space Shuttle launches are funded under Program Element 35171F. Space Launch Support.

(U) WORK PERFORMED BY: The Joint Program Office is located at the Air Force Systems Command's Space Division, El Segundo, CA. The satellite contractor is Rockwell International/Space Operations and Satellite Systems Division, Seal Beach, CA; International Telephone and Telegraph, Nutley, NJ, is the subcontractor for the navigation subsystem. Aerospace Corp., El Segundo, CA, provides technical and engineering support. User equipment development is being performed competitively by Magnavox Advanced Products Div., Torrance, CA, and Rockwell International/Collins Government Avionics Div., Cedar Rapids, IA; Intermetrics, Cambridge, MA, is the independent user equipment software verification/validation contractor. Operational Control Segment development/deployment is being done by International Business Machines/Federal Systems

Program Element: #64778F Title: Navstar Global Positioning System (GPS)
DOD Mission Area: Navigation and Position Fixing, #361 Budget Activity: Intelligence and Communications, #5

Div., Gaithersburg, MD; Logicon, Long Beach, CA, is the independent software verification/validation contractor.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1981 and Prior Accomplishments: User equipment has been tested on the C-141, UH-1H, F-4J and P-3 aircraft, wheeled and tracked vehicles, ships and manpacks. Actual testing has verified the positioning accuracy predicted for the 18-satellite system. Demonstrations of the effects of improved positioning accuracy on bomb delivery have yielded significant results. Inert 500-pound bombs (MK-32) dropped from Navy F-4J aircraft have impacted the target area with a several fold improvement in accuracy over current methods. Both straight-and-level and toss delivery modes have been used. Improved weapon delivery accuracy with different crews and aircraft in over 500 separate bomb deliveries has verified that the Global Positioning System itself is the prime source of improvement.

(U) Other demonstrations of the military value of precise positioning have included passive rendezvous similar to aerial refueling, simulated precision helicopter rescues, aircraft reconnaissance of a preselected ground point, simulated combined aircraft/ship antisubmarine operations and reduced visibility ship departures from harbor. Sets have been used in Service and Joint exercises (RIMPAC 80 and SOLID SHIELD 81) with outstanding results.

(U) North Atlantic Treaty Organization Project activities have included two successful flights of an aircraft set over the North Pole in a United Kingdom aircraft. The Project is developing standards for the development/production of user equipment to further rationalization, standardization and interoperability objectives.

2. (U) FY 1982 Program: The constellation will be maintained to support the Navy's Improved Accuracy Program and continued Global Positioning System user equipment testing. The launch of Navstar 7 on 18 December 1981 was not successful due to Atlas booster failure. This satellite was launched to replace Navstar 1 which has experienced malfunctions in its atomic frequency standards. These problems were analyzed and corrected in Navstar 3 and subsequent satellites. Orbital operations with the modified atomic frequency standards has been excellent since Navstar 3 was launched in October 1978.

(U) Fabrication of the three replenishment satellites (Navstars 9-11) will continue with Navstar 9 being delivered. The design of Block II satellite modifications to incorporate operational requirements and provide for shuttle launch will be completed. Fabrication of the Block II qualification test vehicle will begin. The development and integration of mission control functions for the control segment will continue with the software critical design review. User equipment development will continue with both contractors finishing critical design reviews of the user sets and their interfaces with the test platforms.

(U) The FY 1982 Navstar GPS President's Budget request for satellite procurement was not approved by Congress. The satellites for the initial 18-satellite constellation will be bought under a termination liability funded block buy starting in FY 1982 using available funds appropriated in Program Element 31357F, Integrated Operational Nuclear Detonation Detection System.

Program Element: #64778F | Title: Navstar Global Positioning System (GPS)
DOD Mission Area: Navigation and Position Fixing, #361 | Budget Activity: Intelligence and Communications, #5

3. (U) FY 1983 Planned Program: Replenishment satellites, Navstars 10 and 11, will be tested and delivered ready for launch. Fabrication of the qualification test vehicle will be completed and testing will begin. Control segment development will continue with start of checkout of the master control station software. User equipment development will continue with integration of preproduction user equipment into Phase II host vehicles and start of development and initial operational test and evaluation. The minor changes in FY 1982 and FY 1983 RDT&E funding between this year's and last year's descriptive summaries were caused by a change in inflation escalation indices. A delay in user equipment delivery caused the FY 1983 - FY 1984 test program to be extended about eight months, thus raising test and total program costs.

4. (U) FY 1984 Planned Program: User equipment initial operational test and evaluation will be completed. Based upon a favorable Defense Systems Acquisition Review Council Milestone III, user equipment production will be authorized. Master control station software checkout will be completed. Qualification testing of the operational satellite will be completed before the first Shuttle launch.

5. (U) Program to Completion: The Vandenberg Air Force Base interim control center will support the first operational satellite launch with the shuttle in early FY 1986. Operational control segment development will culminate with combined development test and evaluation/initial operational test and evaluation beginning in CY 1985. The segment will become operational in CY 1987. Integration engineering for all remaining Air Force aircraft (other than the F-16 and B-52 which are the initial test vehicles) will be accomplished.

6. (U) Milestones

	Previous Date*	Current Date
a. Defense Systems Acquisition Review Council Milestone II		Jun 1979
b. Begin Initial Operational Test and Evaluation	1Q CY 1983	3Q CY 1983
c. Defense Systems Acquisition Review Council Milestone III	3Q CY 1983	2Q CY 1984
d. First Shuttle Launch	1Q CY 1985	4Q CY 1985
e. Worldwide Three-dimensional Operational Capability (18 satellites)	4Q CY 1987	3Q CY 1988

* Dates presented in FY 1982 Descriptive Summary are shown if changed in FY 1983 Descriptive Summary.

(U) Explanation of Milestone Changes: The operational test and evaluation and Milestone III schedule changes resulted from user equipment delivery delays caused by the inability of the two contractors to meet the original contractual schedule. The technical problems encountered, principally custom large scale integrated circuit design and fabrication, have now been overcome.

Program Element: #64778F
DOD Mission Area: Navigation and Position Fixing, #361

Title: Navstar Positioning System (GPS)
Budget Activity: Intelligence and Communications, #5

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Budget Data:

Total

FY 1981 change reflects actual obligations.

Budget Activity: Intelligence and Communications, #5
Program Element: #64778F, Navstar Global Positioning System (GPS)

Test and Evaluation Data

1. Development Test and Evaluation (DT&E): This Program Element covers the development of the Navstar Global Positioning System (GPS). Phase I testing has validated the system concept, identified preferred design parameters and demonstrated military utility. In the space segment, six of the eight satellites procured from Rockwell Space Division for the Validation Phase (Phase I) have been launched. Five of these six are supporting user equipment testing. Because all of the clocks on Navstar 2 have failed, it is only being used for on orbit subsystem testing to provide design verification data. One of the two remaining Phase I satellites will be launched in December 1981 to better support testing for the Navy's Fleet Ballistic Missile Improved Accuracy Program. User equipment testing with GPS providing 3-dimensional position and velocity data (four satellite coverage) began in January 1979. Testing with all platforms (C-141, P-3B, F-4J, UH-1H and Army truck) prior to the Defense System Acquisition Review Council Milestone II in June 1979 demonstrated navigation and positioning accuracies within ten meters 50% of the time. A GPS Phase I receiver has been integrated with an inertial measurement unit on a F-4J aircraft. With this system using only toss bombing techniques, 16 bombs were "dropped" on 3-6 Aug 1981. Bomb impacts were within [redacted] of the aim point 50% of the time. In addition, successful terrain following tests were flown this summer with a UH-1H helicopter equipped with a GPS receiver. The GPS equipped helicopter flew thru 3-dimensional stored way points (latitude, longitude, altitude). These way points were computed by adding a preselected clearance to points from a terrain contour map. User equipment testing and demonstrations with Phase I sets have also been done under a ten nation North Atlantic Treaty Organization Memorandum of Understanding as well as the program DT&E. A "low cost" set has twice (Sep 1980 and Sep 1981) navigated successfully over the North Pole in a United Kingdom aircraft. A GPS set is also scheduled to be tested on a French maritime patrol aircraft in the fall of 1981. DT&E of the space and ground control segments will be limited to refining further the effects of seasonal variations on satellite ephemeris predictions and determining the long term reliability of the space segment.

2. (U) Operational Test and Evaluation (OT&E): During the GPS Validation Phase (Phase I) completed in May 1979, tests were conducted by the Space Division (SD) to demonstrate some of the system's military applications, such as coordinate bombing, passive rendevous, special anti-jam performance, approach to landing, Army land operations, and coordinated sea operations. Four satellies were used in the final Phase I testing stages. Testing was conducted at Yuma Proving Ground, AZ, and San Clemente Island Test Area, CA. The Air Force Test and Evaluation Center (AFTEC) monitored selected portions of the Phase I user equipment testing and provided an independent assessment for use in the Milestone II program review. No operational deficiencies were noted by AFTEC that would preclude transitioning to the full-scale engineering development (FSED) phase. Phase I contractors were Magnavox, Texas Instruments, Rockwell International Cedar Rapids Division, Rockwell International Satellite Systems Division, and General Dynamics Electronics Division.

(U) In the Full-Scale Engineering Development (FSED) Phase (Phase II) of the program, Air Force Test and Evaluation Center (AFTEC) will be the executive test agency for all Global Positioning System (GPS) operational test and evaluation (OT&E). Multi-service OT&E will be conducted on user equipment and the control segment, while the space segment testing will be primarily an Air Force effort.

(U) The user equipment OT&E is scheduled from mid-April 1983 through early July 1984. The Army, Navy, Marine Corps, and North Atlantic Treaty Organization (NATO) will participate in the operational testing of the user equipment in a broad range of military applications. User equipment testing will include several months of combined developmental and operational test and evaluation (DT&E/OT&E) followed by a period of dedicated OT&E for each vehicle prior to the Defense Systems Acquisition Review Council (DSARC) Milestone III review. This testing is intended to provide the independent OT&E input for a user equipment production decision. Primary test vehicles will be: B-52, F-16, P-3C, and A-6 aircraft, Aircraft Carrier, Attack Submarine, Army Tank, UH-60 Helicopter, and a manpack. Operator and maintenance personnel will be drawn from operational units. Primary test locations will be Yuma Proving Ground AZ, Nellis AFB NV, Eglin AFB FL, Ft Carson CO, and the San Clemente Island Test Area CA. Phase II user equipment contractors are Magnavox and Rockwell International Cedar Rapids Division.

(U) Control segment OT&E will begin in April 1985 and extend to approximately January 1987. A period of combined DT&E/OT&E followed by a dedicated 90-day OT&E is planned. Qualified satellite command and control operators and maintainers from the Strategic Air Command (SAC), the control segment operating command, will perform the 90-day IOT&E. Sole control segment contractor is International Business Machine.

(U) Space segment testing consists of an operational assessment using DT&E generated data. The report, based on the current limited constellation of four development satellites with functioning atomic time standards, will support a status review scheduled for February 1982. Specific areas to be addressed in space segment OT&E include survivability, operability, selective availability, and the effects of satellite outages on system accuracies. Sole space segment contractor is Rockwell International.

(U) Overall NAVSTAR GPS OT&E objectives are to:

a. (U) Evaluate GPS performance in a spectrum of missions in representative vehicles for Army, Navy, Air Force, Marine Corps application. These include air, land, and water navigation, ordnance delivery, rendevous, and landing approaches in both passive and hostile environments.

b. (U) Evaluate GPS performance when operated and maintained by Air Force, Army, Navy, and Marine Corps operational and maintenance personnel.

c. (U) Identify and track deficiencies and improvements.

3. (U) System Characteristics:

Characteristic	Objective	Demonstrated
Three-Dimensional Position Accuracy	16 meters (50% of the time)	11.1 meters (Note 1)
Three-Dimensional Velocity Accuracy	0.1 meters/second	0.12 meters/second
Time Transfer	10×10^{-9} second	25×10^{-9} second (Note 2)
Active Satellites on Orbit	18	5
Satellite Coverage	24 hours/day world-wide	4 hours/day over test area
Clock Stability	2×10^{-13}	2×10^{-13}
Satellite Mean Mission Duration	5 years	3 years (not valid for projections) (Note 3)

NOTES:

1. (U) Accuracy is within 11.1 meters 50% of the time and 22 meters 90% of the time with test constellation spacing the same as a 24-satellite constellation. The 16 meter objective (18 satellites) corresponds to 10 meters (24 satellites).
2. (U) The standard deviation of the synchronization error is 25 nanoseconds.
3. (U) Phase I spacecraft have a design mean mission duration of 4.6 years. The spacecraft in orbit are supporting testing in spite of several clock failures. Fixes implemented on Navstars 3-6 and installed on the two remaining Phase I spacecraft are expected to permit achieving the 4.6 year mean mission duration.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #31324F
DOD Mission Area: General Defense Intelligence Programs, #312

Title: FOREST GREEN
Budget Activity: Intelligence and Communications, #5

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	28,494	21,200	31,802	41,627	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The principle objective of the RDT&E program is to improve the [redacted] to meet specific requirements. The RDT&E effort is directed at the development of new scientific sensors, collection devices and analytical techniques to satisfy specific [redacted]

BASIS FOR FY 1983 RDT&E REQUEST: This program will support continuing development efforts to improve and modernize the collection, analytical, and evaluation systems [redacted] and to reduce operating costs while improving performance.

Program Element: #31324F
DoD Mission Area: General Defense Intelligence Programs, #312

Title: Forest Green
Budget Activity: Intelligence and Communications, #5

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY

FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimate Costs
15,575	20,334	29,168		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimate Costs
Procurement						
Missile *	1,401	2,070	4,988	1,381	Continuing	Not Applicable
Other **	2,912	10,266	11,290	6,406	Continuing	Not Applicable
Operation & Maintenance***	9,347	7,300	10,344	12,432	Continuing	Not Applicable

* Missile Procurement is for procurement and integration

** Other procurement includes peripherals/software for the headquarters

*** O&M funds include follow-on support for the interim technique, operational test and evaluation of newly developed systems and equipment, and station operations.

Program Element: #31324F

DOD Mission Area: General Defense Intelligence Program, #312

Title: FOREST GREEN

Budget Activity: Intelligence and Communications, #5

DETAILED BACKGROUND AND DESCRIPTION: This is a continuing program to improve the

Program Element: #31324F
DoD Mission Area: General Defense Intelligence Program, #312

Title: Forest Green
Budget Activity: Intelligence and Communications, #5

RELATED ACTIVITIES:

WORK PERFORMED BY:

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments:

Program Element: #31324F
DOD Mission Area: General Defense Intelligence Programs, #312

Title: FOREST GREEN
Budget Activity: Intelligence and

Program Element: #31324F
DOD Mission Area: General Defense Intelligence Programs, #312

Title: FOREST GREEN
Budget Activity: Intelligence and Communications, #5

Program Element: #31324F

DOD Mission Area: General Defense Intelligence Programs, #312

Title: FOREST GREEN

Budget Activity: Intelligence and Communications, #5

2. FY 1982 Planned Program:

Program Element: #31324F
DOD Mission Area: General Defense Intelligence, #312

Title: FOREST GREEN
Budget Activity: Intelligence and Communications, #5

3. FY 1983 Planned Program: Major efforts initiated in prior years will be continued.

4. FY 1984 Planned Program: Efforts initiated in FY 1982 and 1983 will continue.

Program Element: #31324F

DOD Mission Area: General Defense Intelligence Programs, #312

Title: FOREST GREEN

Budget Activity: Intelligence and Communications, #5

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) Milestones: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #31357F/12433F

Title: Integrated Operational NUDETS Detection System (IONDS)

DoD Mission Area: General Defense Intelligence Programs, #312; Strategic Surveillance and Warning, #332

Budget Activity: Intelligence and Communications, #5; Strategic Programs, #3

(U)RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT						
31357F		0	4,500	1,996	1,099	Continuing	Not Applicable
12433F		4,000	6,974	19,885	9,470	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Development of an Integrated Operational Nuclear Detonation Detection System (IONDS) is being pursued in this element. The IONDS is being developed to provide a capability to detect, locate and report in near real time tactical nuclear detonations on a global basis. IONDS will provide data to satisfy [ ] The program plan calls for sensors on [ ] and NAVSTAR Global Positioning System (GPS) satellites and ground readout and display equipment for several users: the National Command Authorities, commanders of theaters and unified/specified commands, Air Force Technical Applications Center, and others as may be designated. [ ] support are the primary wartime benefits of data derived from the IONDS sensor network.

BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 program will support integration of IONDS sensors on NAVSTAR Global Positioning System (GPS) satellites and continues development of a prototype user terminal, a satellite-to-satellite data crosslink, and an [ ] sensor. The data crosslink will assure transmission of IONDS data in near real time on a global basis and the sensor will improve IONDS location accuracy to provide a [ ] strike/damage assessment capability.

(U)COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

		FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
31357F	RDT&E	11,953	4,500	2,047			
	Msl Proc		16,435	22,526			
12433F	RDT&E	4,000	7,000	2,900			
	Other Proc			11,300			

(U)OTHER APPROPRIATION FUNDS:

Missile Procurement (PE 31357F)	16,435	22,455	20,638	Continuing	Not Applicable
Other Procurement (PE 12433F)			21,253	Continuing	Not Applicable

Program Element: #31357F/12433F

Title: Integrated Operational NUDETS Detection System (IONDS)

DoD Mission Area: General Defense Intelligence Programs, #312 Strategic Surveillance and Warning, #332

Budget Activity: Intelligence and Communications, #5 Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The U.S. nuclear detonations (NUDETS) reporting system is comprised of sensors and reporting elements which were developed primarily for technical intelligence reporting. The effectiveness of these systems in reporting NUDET events during limited or general war will degrade rapidly during the opening phases of an attack. The objective of this program is to remove deficiencies resulting from Soviet technological advances and limitations inherent in current U.S. surveillance systems. A study was performed in FY 1975 by Air Force Systems Command, with Strategic Air Command, Aerospace Defense Command, and Air Force Technical Applications Center (AFTAC) participation, to evaluate current systems and determine sensor capabilities required to provide the National Command Authorities (NCA) information on which to base the selection of appropriate trans attack responses and to support effective strategic force management during all phases of a nuclear conflict. The study concluded that a highly survivable nuclear detonation system is required to enhance the ability of the NCA and theater commanders to assess the nature of attacks on the Continental United States and on our overseas forces. A space based nuclear detonation detection and diagnostic system exists today. This system consists of radiation detection sensors on satellites, bhangmeters on other program satellites, and ground elements of the and the Satellite Control Facility. Bhangmeters will be deployed on satellites as replacement satellites are required. Of the current systems, the provides NUDET detection and location data to the NCA, designated Commanders-in-Chief, and other users. Current space assets will be combined with additional resources, where practical, to partially satisfy NCA and theater NUDET surveillance requirements, while continuing to provide limited data for The IONDS system, as planned, will consist of improved sensors on and sensors on Global Positioning System (GPS) satellites with ground/airborne readout and processing equipment for the system users. In FY 1976 a contracted effort, by Ford Aerospace and Electronics Co., evaluated parametrically how best to accomplish the IONDS requirements and then produced a system design definition. Concurrently, a contract with Rockwell International defined the GPS interface modification requirements to support IONDS. Rockwell International completed the contract to identify specific interface and subsystem designs for IONDS and performed testing to validate that there would be no mission impact on GPS satellites incorporating IONDS subsystems.

RELATED ACTIVITIES: Development of the IONDS was previously pursued under Program Element (P.E.) 12433F in FY 1978 and P.E. 63435F in FY 1979 and FY 1980. NUDET sensors are currently deployed on and improved sensors will be deployed on those satellites as IONDS becomes operational. As an interim step in achieving the IONDS full operational capability, sensors were deployed on satellites of the starting with the satellite launch in IONDS sensors are planned for deployment on GPS (P.E. 64778F) as early as the launch of the refurbished Qualification Test Vehicle in FY 1982. Development and production of the NUDET sensors for IONDS/GPS is being funded by the Department of Energy, with support from

Program Element: #31357F/12433F

DoD Mission Area: General Defense Intelligence Programs, #312
Strategic Surveillance and Warning, #332

Title: Integrated Operational NUDETS Detection System (IONDS)
Budget Activity: Intelligence and Communications, #5
Strategic Programs, #3

(U) WORK PERFORMED BY: Development and procurement is accomplished by Hq Space Division, Los Angeles, Ca with the assistance of the Air Force Technical Applications Center, Patrick AFB, Fl. Rockwell International, Downey, Ca completed preliminary Global Positioning System/IONDS interface studies during FY 1976 and is currently under contract to integrate IONDS sensors on GPS satellites. Ford Aerospace and Electronics Co., Palo Alto, Ca performed System Definition Studies in FY 1976 and is continuing to provide systems engineering support. Sandia Corporation, Albuquerque, NM will develop and produce the nuclear detonations sensors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In response to an evolving requirement for an increased NUDET detection capability, an IONDS/NAVSTAR GPS study was performed by the NAVSTAR GPS payload contractor under Project 2124 of P.E. 63424F in FY 1975. This study concluded that a relatively simple sensor package could be accommodated within the weight, power, and physical constraints of the predicted GPS Phase II satellites. In FY 1976 Ford Aerospace and Electronics Co. conducted a contracted study to parametrically explore feasible alternatives to performing the IONDS task. This study also sized the system and produced a preliminary design definition. Also in FY 1976, Rockwell International conducted a study to further define the IONDS/GPS interface requirements. A study was also performed to define performance and costs for a change to the GPS launch vehicle if one is required because of increased weight from the incorporation of secondary payloads on the GPS Phase II satellites. Contract work with Rockwell continued in FY 1977 to modify the GPS Development Test Vehicle to include the IONDS payloads and perform integrated functional and electromagnetic compatibility tests at the spacecraft level. This effort was time phased to be completed prior to the generation of the GPS Request for Proposal for the FY 1979 buy of satellites. Integrated functional and thermal vacuum tests using qualification model sensors have been performed. During FY 1978 a single channel IONDS receiving terminal was delivered by Ford Aerospace and specifications for the prototype operational receiving terminal (8 channel/8 satellite) were developed. During FY 1979 a positive decision was made relative to the incorporation of an IONDS flight payload on the GPS Qualification Test Vehicle (QTV) satellite. With that decision, integration of the IONDS payload onto the QTV was initiated and tests performed. Long lead items were procured for inclusion of IONDS on GPS satellites to be purchased in FY 1979.

During FY 1979, qualification testing of the IONDS payload on the GPS QTV was completed. Based upon these and prior test results, the decision to deploy IONDS on the full GPS constellation was made at the GPS Defense Systems Acquisition Review Council II in June 1979. The IONDS program was transferred to the General Defense Intelligence Program early in FY 1980 with the new program element 31357F. This transfer was recommended by OMB, supported by Air Force Intelligence, and agreed to by the Secretary of Defense in December 1979. The Director of Central Intelligence identified funding to support integration of the IONDS sensors on the GPS satellites. Design changes for the incorporation of IONDS on the GPS Phase II satellites were developed and modifications were made on unlaunched

Program Element: #31357F/12433F

DoD Mission Area: General Defense Intelligence Programs, #312
Strategic Surveillance and Warning, #332

Title: Integrated Operational NUDETS Detection System (IONDS)

Budget Activity: Intelligence and Communications, #5
Strategic Programs, #3

satellites, as required. Program element 12433F was reactivated to support development of the data cross-link subsystem, the EMP sensor, and development of the receiving terminal. The terminal will be designed to be compatible with the E-4B and EC-135 airborne command posts and ground based command centers.

2. (U)FY 1982 Planned Program: A competitive selection of a contractor for development of the IONDS operational ground/airborne receiving terminal will be made and a contract awarded the winner in FY 1982. Preparations will continue for launch of IONDS sensors on GPS Phase II satellites, beginning late in the fiscal year. Development of the data cross-link will be completed during this year.

3. FY 1983 Planned Program: User terminal development will continue as will launch of an IONDS sensor to complete launch of the Phase II block of satellites. Procurement and integration of cross-link units will be incorporated with the IONDS sensor units on each satellite. FY 1983 funding increase over last year supports further development of a satellite-to-satellite data crosslink, an sensor for strike/damage assessment, and engineering design of user terminal interfaces with EC-135 and E-4B command post aircraft.

4. (U)FY 1984 Planned Program: Testing of the IONDS prototype terminal on an EC-135 will be completed. Procurement of operational user terminals will continue, with delivery for aircraft integration planned for FY 1985. Integration of IONDS sensors onto NAVSTAR GPS operational satellites will continue.

5. (U)Program to Completion: This is a continuing program. Design and development activities are keyed to the GPS schedule. The Initial Operational Capability (IOC) will be achieved when 12 IONDS configured GPS satellites are on orbit.

6. (U)Milestones: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33110F Title: Defense Satellite Communications System
DOD Mission Area: Common User Communications, #323 Budget Activity: Intelligence and Communications, #5

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	35,093	40,149	53,126	25,815	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Defense Satellite Communications System has been developed to provide super high frequency satellite communications for secure voice and high data rate transmissions. It satisfies the unique and vital national security communications requirements of worldwide military command and control, crisis management, and relay of intelligence and early warning data, treaty monitoring and surveillance information, and diplomatic traffic. Specifically, the Defense Satellite Communications System supports the National Command Authorities, the Worldwide Military Command and Control System, the Defense Communications System, the Diplomatic Telecommunications Service, the White House Communications Agency and mobile forces of all Services.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds to continue Defense Satellite Communications System III full scale development, first time integration associated with expendable launch vehicles and the Space Shuttle and storage of DSCS spacecraft. An improvement program designed to enhance high level traveling wave tube amplifier reliability and efficiency will start. Other satellite improvements that have the potential of significantly enhancing performance will be investigated. Cost estimates are based on contractor proposals and other inputs, and program office estimating relationships.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	33,094	40,300	32,100		Continuing	Not Applicable
Procurement (missile)	80,489	129,954	211,646		Continuing	Not Applicable
(other)	6,278	2,220	2,872		Continuing	Not Applicable

Program Element: #33110F Title: Defense Satellite Communications System
DOD Mission Area: Common User Communications, #323 Budget Activity: Intelligence and Communications, #5

(U) OTHER APPROPRIATION FUNDS:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
Procurement (missile) (Quantity)	80,500 (1)	129,614 (2)	192,900 (2)	89,900 (0)	Continuing (7)	Not Applicable (12)
Procurement (other)	6,278	2,205	2,649	3,058	Continuing	Not Applicable
Military Construction	4,820	4,260	6,750	1,319	Continuing	Not Applicable
Operation and Maintenance	6,81[illegible]	12,5[illegible]2	13,884	13,795	Continuing	Not Applicable
[illegible]itary Personnel	4,275	4,802	6,877	[illegible],619	Continuing	Not Applicable

(U) DETAILED BACKGROUND AND DESCRIPTION: The need for an operational Super High Frequency satellite communications system to provide secure, wideband connectivity evolved as an outcome of satellite communications experiments conducted in the early-1960s when the initial Defense Communications Satellite Program or Defense Satellite Communications System Phase 1 was approved. The Defense Satellite Communications System Phase I, originally intended as a research and development demonstration, provided limited operational point-to-point service between 1967 and 1973, confirming the utility of satellite communications. However, several Phase I performance limitations, including channel capacity and orbital position drift (due to the sub-synchronous orbit), led to approval of Defense Satellite Communications System Phase II in 1969. Defense Satellite Communications System II satellites were developed to establish an operational Super High Frequency communications system to support military satellite communications requirements into the early 1980s. The authorized space segment consists of four operational and two in-orbit spare satellites in geosynchronous orbits. Based on validated user requirements, and the growing electronic countermeasures threat, the Defense Satellite Communications System Phase III satellite concept was approved in 1974. Defense Satellite Communications System III will replenish DSCS II satellites and provide a two fold increase in capacity; unique spot, area, and earth coverage; and the capability to reallocate power and bandwidth to satisfy dynamic user connectivity requirements in an electronic jamming and/or nuclear environment.

Major commitments have been made in the Defense Satellite Communications System terminal segment. The Navy is acquiring Super High Frequency ship terminals and the Air Force has installed a terminal on the Advanced Airborne Command Post. In addition, about four hundred transportable terminals for the Ground Mobile Forces will be employed to establish high capacity links within and between units of the Army, Air Force and Marine Corps.

Program Element: #33110F   Title: Defense Satellite Communications System
DOD Mission Area: Common User Communications, #323   Budget Activity: Intelligence and Communications, #5

(U) RELATED ACTIVITIES: The Defense Communications Agency is responsible for overall Defense Satellite Communications System program management, system engineering, and satellite operational direction. The military departments are responsible for individual elements of the system. The Army budgets, develops, and procures ground terminals under Program Element 33142A, Defense Satellite Communications System. The Navy performs these functions for shipborne terminals under Program Element 33109N, Satellite Communications System. In addition to its responsibility for the space segment, the Air Force develops and integrates airborne terminals under Program Element 64723F and Program Element 11312F, Advanced Airborne Command Post, and provides launch services for the Titan III launch vehicle under Program Element 35119F, Space Boosters. The Inertial Upper Stage, to be used for launch with the Titan III(34)D and Space Shuttle, is being developed by the Air Force under Program Element 63411F. Inertial Upper Stage procurement, Inertial Upper Stage recurring integration, and Space Shuttle launch support will be furnished under Program Element 35171F, Space Launch Support. Development of an Air Force Satellite Communications System Single Channel Transponder for incorporation on the Defense Satellite Communications System III is funded under Program Element 33601F. The Advance Space Communications Program, Program Element 63431F, evaluates, develops, and demonstrates evolutionary communication satellite technologies for future Defense communications satellite programs.

(U) WORK PERFORMED BY: The Air Force Space Division, Los Angeles, CA, is responsible for the space segment of the Defense Satellite Communications System. TRW, Redondo Beach, CA, is the prime contractor for the design, fabrication, test and integration of Defense Satellite Communications System Phase II satellites. The Martin-Marietta Corporation, Denver, CO, is the prime contractor for the Titan III launch vehicle. General Electric Company, Valley Forge, PA, is the full scale engineering development and production contractor for the DSCS III spacecraft. Boeing Aerospace Division, Seattle, WA, is developing the Inertial Upper Stage. The Aerospace Corporation, El Segundo, CA, provides general systems engineering/technical direction to the Air Force Space Division System Program Office.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: To demonstrate the feasibility of a military satellite communications system, twenty-six Initial Defense Communications Satellite Program satellites were placed in near synchronous orbit during 1966-1968 and provided limited operational point-to-point service into 1973. The follow-on Defense Satellite Communications System II program, which was started in 1969, now provides an operational Super High Frequency military satellite communications system. Since 1971, a total of fourteen Defense Satellite Communications System II satellites have been launched with four failing to achieve orbit due to booster malfunctions. With the launch of a Defense Satellite Communications System II satellite pair in November 1979, the Defense Satellite Communications System Program achieved the authorized six satellite orbital configuration for the first time. In December 1974, the Defense Systems Acquisition Review Council approved the preliminary design/definition phase for Defense Satellite Communications System III, and two contractors were selected to deliver competitive designs. Following a favorable Defense Systems Acquisition Review Council recommendation, the Deputy Secretary of Defense approved initiation of full scale development of Defense Satellite

Program Element: #33110F | Title: Defense Satellite Communications System
DOD Mission Area: Common User Communications, #323 | Budget Activity: Intelligence and Communications, #5

Communications System III in January 1977. In February 1977, the General Electric Company was selected to complete satellite design and support the launch of two Demonstration Flight Satellites In addition, two Satellite Configuration Control Element engineering development models and an Air Force Satellite Communications System Single Channel Transponder are being developed. In early FY 1980, the Defense Satellite Communications System III full scale development program experienced non-technical developmental problems which prevented the planned launch of the first Demonstration Flight Satellite by June 1980. Based on these problems, the program was rephased to start production in FY 1982.

In an attempt to partially mitigate a potential gap in on-orbit service and assure continuity of coverage, the refurbishment of the Defense Satellite Communications System III qualification satellite was started in FY 1980 with the procurement of advance buy. The first developmental model DSCS III was delivered. The second development model is in system level qualification testing. In December 1981, the Deputy Secretary of Defense approved the acquisition of two DSCS III spacecraft in FY82 and planning to acquire two DSCS III spacecraft in FY83.

2. (U) FY 1982 Planned Program: Integration and testing of the second full scale development model satellite will be completed. The contract will be awarded for initial production of two DSCS III satellites. Planning will continue for future production. The first DSCS III will be stored pending a planned launch in Sept 1982 with a DSCS II. Additional funds will be requested to store the first DSCS III satellite. Launch of this spacecraft was postponed from June 1981 to Sept 1982 to conserve the existing inventory of expendable launch vehicles. Refurbishment of the DSCS III qualification satellite will be initiated. Selective performance improvements including shuttle compatibility modifications are planned. A developmental improvement program designed to enhance high level traveling wave tube amplifier efficiency and reliability will be initiated. The production satellite design baseline will be updated to ensure compatibility with revised Shuttle interface and environmental requirements.

3. (U) FY 1983 Planned Program: The major Defense Satellite Communications System III full scale development will be completed with the second demonstration flight satellite available for launch paired with the last Defense Satellite Communications System II satellite. The refurbishment of the qualification satellite will continue toward an expected launch availability in mid-1984. Funding estimates changed due to additional first time integration costs, satellite storage and reactivation costs and acquiring two DSCS satellites vice three.

4. (U) FY 1984 Planned Program: Launch of the refurbished qualification satellite, continuation of DSCS Phase III production and award of an advanced buy contract for the FY85 production program are planned. Shuttle integration tasks for DSCS III will continue.

5. (U) Program to Completion: Production of the Defense Satellite Communications System Phase III satellites will continue. Additional production satellites will be acquired in FY 1985 and FY 1986 with advance buy for four satellites procured in FY 1984. The first two production satellites should be available for a Shuttle launch in mid-1985,

with Shuttle first time integration completed by FY 1985. The Air Force, in conjunction with the Defense Communications Agency/Military Satellite Communications System Office will investigate system improvements.

6. (U) Milestones:

Defense Satellite Communications System II		DATE
Initial Contract Award (F1 - F6)		Mar 1969
Initial Satellite Launch (F1 - F2)		Nov 1971
Award contract for replenishment satellites (F7 - F12)		Oct 1974
Award contract for additional satellites (F13 - F16)		Jul 1976
Last Launch (F13 - F14)		Nov 1979
Remaining launches - F15 and F16		Paired with first two DSCS III satellites

Defense Satellite Communications System III		DATE
Defense Systems Acquisition Review Council - (approval for preliminary design)		Dec 1974
Award Phase I (Preliminary Design) Contracts		Dec 1975
Preliminary Design Review		Oct 1976
Defense Systems Acquisition Review Council II - (Full Scale Development Decision)		Dec 1976
Award Phase 2 (Engineering Development) Contract		Feb 1977
Launch First Demonstration Flight Satellite	*(Jun 1981)	Sep 1982 1/
Defense Systems Acquisition Review Council III Production Decision	*(Jul 1981)	Dec 1981 2/
Refurbished qualification satellite launch availablity	*(Sep 1983)	Jul 1984 3/
First production satellite launch availability	(Dec 1984)	Jun 1985 4/

*Date presented in FY 1982 Descriptive Summary

1/ Launch delayed based on Air Force, JCS and Deputy Secretary of Defense decisions to conserve remaining expendable launch vehicles.

2/ Production decision date changed based on decision to delay first DSCS III launch and additional time required to evaluate production readiness.

3/ Launch date changed based on a re-estimation of refurbishment.

4/ Launch date changed based on projected contract award and time to deliver first two production spacecraft.

Budget Activity: Intelligence and Communications, #5

Program Element: #33110F, Defense Satellite Communications System

Test and Evaluation Data

1. (U) Development Test and Evaluation: Development Test and Evaluation for the Defense Satellite Communications System II Space Segment is complete. For the Defense Satellite Communications System III, development test and evaluation was separated into two distinct phases. During Phase One, which extended from Defense Systems Acquisition Review Council I in December 1974 to Defense Systems Acquisition Review Council II in December 1976, development tests were conducted to demonstrate that technical risks had been minimized and that the satellite was "buildable". During Phase Two, which extended from Defense Systems Acquisition Review Council II through June 1981, the design was translated into a developmental satellite with performance verified through a series of component, subsystem, and system level qualification tests.

(U) In December 1975, two contractors were selected to accomplish the Defense Satellite Communications System III preliminary design and test their satellite design concepts. These tests identified critical design areas, including component environments, and were used to verify the adequacy of the design approach over a range of operating conditions. The objective of Phase One was to identify design problems early so that corrective action could be taken, and to provide a high level of confidence in the ability of the hardware to satisfy requirements. Those tests demonstrated the adaptability of already-proven concepts and technique.. The development test program proceeded from parts, materials, and processes to breadboard/brassboard tests on circuits and subassemblies. Also, selective testing of engineering critical items in each proposed subsystem was performed and included, among others, the Multiple Beam Antenna, the Beam Forming Network, Traveling Wave Tube Amplifiers, Super High Frequency transponders, Attitude Control System electronics, earth sensors, and the solar array deployment mechanism. Results of the Phase One test program were included in the respective contractors' preliminary design review. Performance and electrical characteristics of piece parts such as diodes, transistors, integrated circuits, hybrids, crystals, variable resistors and capacitors, were evaluated under thermal cycling, shock, accelerated life, mechanical environments, and for survivability. Selected components and subsystems were also evaluated. Multiple Beam Antenna components were tested functionally and evaluated after vibration, thermal cycling, and during thermal vacuum tests. The Multiple Beam Antenna engineering model performance was also evaluated to include critical array component stability during thermal cycling. Component survivability testing was conducted to determine the ability of components to perform in a nuclear environment. The results of these piece part tests allowed the selection of adequately hardened piece parts, utilization of most effective circuit designs, and optimized shielding to prevent function upset/outage, circuit burnout, or piece part degradation which would negate mission capability.

Budget Activity: Intelligence and Communications, #5

Program Element: #33110F, Defense Satellite Communications System

(U) At the completion of the preliminary design effort, General Electric Company, Space Division, was selected to proceed with full scale development and Phase Two testing. This selection followed the Defense Systems Acquisition Review Council II in December 1976 and Deputy Secretary of Defense approval in January 1977 The objective of Phase Two Development Test and Evaluation is to verify the design and attain the highest confidence in Defense Satellite Communications System III Demonstration Flight Satellite performance. Phase Two testing is divided into three parts: in-plant, launch base, and on-orbit. The in-plant test program which will provide the performance baseline for production, consists of a combination of: developmental testing using thermal, structural, and development models; piece part, component and subsystem qualification testing; and extensive, systematic system level qualification model satellite tests to confirm total design integrity in a realistic, simulated orbital environment. Acceptance testing of the Defense Satellite Communications System III Demonstration Flight Satellite has verified manufacturability and performance against the design baseline. This testing was planned to be incremental and establish performance confidence as satellite integration proceeded. During launch base testing, each Demonstration Flight Satellite will be tested to verify its launch readiness. After launch, on-orbit testing will consist of three distinct sequential elements to determine if launch caused damage: (1) immediate post-injection evaluation of the performance of satellite support subsystems conducted by the Air Force Space Division via the Air Force Satellite Control Facility; (2) verification of communications subsystem and Super High Frequency tracking, telemetry, and command performance via the Camp Parks, CA radiometric test terminal; and (3) evaluation of interoperability with varied Defense Satellite Communications System and non-Defense Satellite Communications System earth terminals and compatibility with the Satellite Configuration Control Element. The third test element will be managed by the Defense Communications Agency Defense Satellite Communications System Program Manager.

(U) System level qualification satellite testing started in June 1980 and continued through May 1981. The Qualification Test Satellite was subjected to electromagnetic compatibility tests, acoustic, pyro shock, thermal balance, and thermal vacuum environmental tests. The qualification satellite completed system level integration, radio frequency compatibility electrical system baseline tests and thermal vacuum tests. The results of completed tests indicate that demonstrated performance meets specification requirements. The overall test objectives required to qualify the design are:

(1) Verification that the satellite and its associated subsystems meet design performance characteristics.

(2) Verification of the design performance and compatibility of all subsystems for normal and backup modes of operation which are representative of mission usage.

Budget Activity: Intelligence and Communications, #5

Program Element: #33110F, Defense Satellite Communications System

(3) Demonstration of the design compatibility of the satellite with all electrical and mechanical support equipment in support of spacecraft level integration and test at the factory and launch base.

(4) Demonstration of the operability and functional performance of normally operating satellite subsystems and components during environmental conditions more severe than may be encountered in the launch, transfer orbit, and synchronous orbit phases of the mission.

(5) Verification that the satellite and associated subsystems survive exposure to the overstressed environment conditions and meet the design performance characteristics.

(6) Verification that the satellite and associated subsystem operational performance are not detrimentally affected and survive the spacecraft charging, electromagnetic pulse, and system generated electromagnetic pulse.

(7) Verification of the final thermal analytical modeling of the satellite.

(8) Demonstration of the design compatibility between the satellite and software systems.

(9) Development of the procedures and demonstration of the adequacy of these procedures for the handling, transportation, assembly, integration, and testing of the flight satellites.

(U) All subsystems for the first Defense Satellite Communications System III Demonstration Flight Satellite completed acceptance tests and were integrated in the satellite. System level acceptance testing started in July 1980 and continued through March 1981. This satellite (and the second Demonstration Flight Satellite) were subjected to a similar sequential series of tests as the qualification satellite. The first Demonstration Flight Satellite completed system level integration, radio frequency compatibility, electrical system baseline tests, acoustic and thermal vacuum tests. The results of completed tests indicate demonstrated performance meets specification requirements. All components passed, all subsystems passed, no major waivers were required, no major design problems were uncovered. The first demonstration

Budget Activity: Intelligence and Communications. #5

Program Element: #33110F, Defense Satellite Communications System (DSCS)

flight spacecraft passed acceptance tests in June 1981 and currently is in storage. Assembly and test of the second flight demonstration satellite is in progress and on schedule. On completion of acceptance tests, the second Demonstration Flight Satellite will be paired with Defense Satellite Communications System II spacecraft F16 for launch not earlier than September 1982. Launch of the first DSCS III spacecraft has been delayed due to a decision to assign the launch vehicle to another space program. Initial Operational Test and Evaluation (IOT&E) will begin 60 days after launch of the first satellite.

2. Operational Test and Evaluation:

(U) The Defense Communications Agency manages the overall Defense Satellite Communications System (DSCS) program, which includes the space and terminal segments. The operational test and evaluation (OT&E) program is a tri-service effort with the Air Force Systems Command Space Division (AFSC/SD) (formerly Space and Missile Systems Organization (SAMSO)) responsible for the acquisition, deployment, testing, and operational support of the space segment. The US Army is the executive agent for all ground terminal procurement, installation and testing. The Army's Operational Test and Evaluation Agency (USAOTEA) is the responsible independent test agency for OT&E.

(U) The AN/FSC-78 (heavy terminal) completed a 113-day OT&E in late 1976. The OT&E was conducted by the US Army Communications-Electronic Engineering Installation Agency with Air Force Communications Command and Navy participation. The test item was a production terminal installed at Sunnyvale Air Force Station (AFS), CA. The terminal was operated and maintained by personnel assigned to Detachment 3, 1901 Communications Squadron, the operational unit at Sunnyvale AFS. The testing evaluated the operational technical performance, station and satellite interface, training, safety, human factors, logistics support, and reliability/availability/maintainability. There were no major deficiencies. The AN/FSC-78 terminal has been operational throughout the world since the OT&E.

(U) The AN/GSC-39 medium terminal basically will use the AN/FSC-78 electronics, but will have a smaller antenna. The AN/TSC-86 is a small, transportable terminal. The Army will conduct (with Air Force and Navy participation) OT&E on these terminals in a manner similar to the AN/FSC-78 OT&E. The AN/GSC-39 was tested in mid 1981; the AN/TSC-86 in late 1981.

Budget Activity: Intelligence and Communications, #5

Program Element: #33110F, Defense Satellite Communications System

(U) Operational Characteristics	Objective	Current Estimate	Demonstrated
1. Quantities (per satellite)			
a. 40 Watt TWTAs A/ (Channels 1 and 2)	2	2	2
b. 10 Watt TWTAs (Channels 3 thru 6)	4	4	4
c. SHF Command Links	2	2	2
d. Protected Beacons	2	2	2
2. Satellite Reliability B/	0.7	0.7	0.75*
3. Launch Vehicle (types) C/	Titan IIIC Titan 34D/IUS STS/IUS	Titan IIIC Titan 34D/IUS STS/IUS	-
4. Weight (lbs) D/	1650	1876	1876

A/ TWTA - Traveling Wave Tube Amplifier
B/ Probability of survival at 7 years
C/ IUS - Inertial Upper Stage: STS - Space Transportation System (Space Shuttle)
D/ On-orbit satellite weight less expendables (dry weight)

* Based on analysis of demonstrated piece part reliabilities.

Budget Activity: Intelligence and Communications, #3

Program Element: #33110F, Defense Satellite Communications System (DSCS)

(U) DSCS III consists of the space segment and its Satellite Configuration Control Element (SCCE). For the space segment, AFSC/SD is responsible for the overall test and evaluation. The USAOTEA will conduct, with tri-service participation (Air Force Test and Evaluation Center will manage the Air Force participation), a combined developmental and operational test and evaluation in order to reduce test duplication. The Initial Operational Test and Evaluation (IOT&E) will begin 60 days after launch of the DSCS III demonstration flight satellite (currently anticipated to be not earlier than September 1982) and will last for up to 6 months. The objectives will be to independently evaluate DSCS III performance and operational effectiveness, to assess the anti-jam capabilities of the satellite and the Satellite Configuration Control Element and the interface of these new items with current operational DSCS terminals, and to evaluate the SCCE logistics supportability, reliability, availability and maintainability. The first SCCE will be installed at Sunnyvale Air Force Station, CA, and will be operated by personnel from Detachment 3, 1901 Communications Squadron. The SCCE will be contractor (General Electric) maintained and supported during IOT&E.

3. System Characteristics:

Technical Characteristics	Objective	Current Estimate	D/ Demonstrated
Frequency (Gigahertz)	7.25-8.4	7.25-8.4	7.25-8.4
Bandwidth (Megahertz per channel)	50-85	50-85	50-85
Effective Isotropic Radiated Power (decibels)			
a. Channels 1 & 2 (EC/Spot/AC(Dish)) A/	29/40/44	29/40/44	29/40/44
b. Channel 3 (EC/EC/Spot)	25/23/34	25/24/34	25/25/34
c. Channel 4 (EC/EC/Spot/AC(Dish))	24/23/34/37.5	25/24/35/39	25/24/35/38
d. Channels 5 & 6 (EC)	25	25	25
e. Beacons (EC)	12	12	12
Signal Gain to System Noise Temperature Ratio E/			
a. Earth Coverage Horn	-15	-13	-13
b. Earth Coverage MBA B/	-16	-15	-15
c. Spot MBA	-1	-0.5	-0.5
Nulling (decibels below EC reference) Receive MBA C/			

A/ EC - Earth Coverage; Spot - 1.0° minimum diameter; AC - Area Coverage; Dish - 3.5° beam diameter switchable on orbit to desired channel.

B/ MBA - Multiple Beam Antenna.

C/ Based on a single null anywhere in the satellite field of view created within a MBA earth coverage pattern.

D/ Demonstrated performance based on the results of system level qualification satellite testing.

E/ Decibels per Degree Kelvin.

Budget Activity: Intelligence and Communications, #5

Program Element: #33110F, Defense Satellite Communications System

3. System Characteristics:

a. Satellite:

	OBJECTIVE/ DEMONSTRATED	OBJECTIVE	OBJECTIVE/ DEMONSTRATED
Physical Characteristics	DSCS II (1-12)	DSCS IIA (13-16)	DSCS III
Size	9' Dia x 13'	9' Dia x 13'	9' x 6 1/2 x 6 1/2'
Weight (Dry)	1200 pounds	1240 pounds	1860 pounds
Stabilization	Spin 60 rpm	Spin 60 rpm	3 axis (inertial)
Mean Mission Duration	38 months	38 months	76 months
Design Life	60 months	60 months	120 months
Performance Data			
Frequency	7-8 GHz	7-8 GHz	7-8 GHz
Transponders	2-20 watt	2-40 watt	4-10 watt & 2-40 watt
EIRP (dBw), DSCS II 1/			
Earth Coverage (EC)	28	31	N/A
Narrow Coverage (NC) Both	40	40	"
Area Coverage (AC) Powered	28.5	33	"
Narrow Coverage Only (No AC)	43	46	"
Area Coverage Only (No NC)	31.5	34.5	N/A
EIRP (dBw), DSCS III 2/			
Channel 1&2 - EC (MBA) or NC (Spot) or AC (Dish)	N/A	N/A	29 or 40 or 44
Channel 3 - EC (Horn) or EC (MBA) or NC (Spot)	"	"	25 or 25 or 34
Channel 4 - EC (Horn) or EC (MBA) or NC (Spot) or AC (Dish)	"	"	25 or 24 or 35 or 38
Channel 5&6 - EC (Horn)	"	"	25
Beacons (EC)	"	"	12

1/ Consisting of two Earth Coverage (EC) Horns (1 receive and 1 transmit) and 2 parabolic dish antennas (one Narrow Coverage (2°) beam and one Area Coverage (6°) beam).

2/ Consisting of four Earth Coverage Horns (2 receive and 2 transmit), one 61 element receive Multiple Beam Antenna (MBA), two 19 element transmit MBAs and one parabolic dish antenna (3.5° beam). The spot beam refers to the use of one beam in the MBA. Channels 1 and 2 have 40 watt TWTAs. Channels 3-6 have 10 watt TWTAs.

Budget Activity: Intelligence and Communications, #5

Program Element: #33110F, Defense Satellite Communications System

b. DSCS Terminals:

	AN/TSC-54	AN/MSC-46	AN/FSC-78	AN/TSC-86	AN/GSC-39
Antenna size (feet)	13(folding) (Air Mobile)	38	60	20	
Gain/System Noise Temperature (dB/^{o}K)			39	26	
Effective Isotropic Radiated Power (dBm)					
Reliability:					
o Mean-Time-Between-Failure (MTBF)(HRS)					
o Objective	274	375	1003	1000	1000
o Demonstrated	1404	546	3276	*	*
o Confidence level	95	95	98	*	*
o Mean-Time-to-Repair (MTTR) (HRS)					
o Objective	.37	1.67	1.0	1.0	1.0
o Demonstrated	.74	2.14	.95	*	*
o Subsystem Element Availability					
o Objective	None	None	99.98	99.9	99.9
o Operational	99.95	99.61	99.97	*	*

*Terminals in development; no operational data existent

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 33126F　　　Title: Long Haul Communications - DCS
DOD Mission Area: Common User Communications, #363　　　Budget Activity: Intelligence and Communications, #5

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	TITLE	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL PROGRAM ELEMENT	10,854	7,970	9,537[1]	10,337	Continuing	N/A
2022	Automated Digital Communications Processing	3,646	2,790	2,600	3,237	Continuing	N/A
2155	Systems Control	3,199	2,490	2,790	3,300	Continuing	N/A
2157	Transmission Improvements	3,809	2,390	2,700	3,300	Continuing	N/A
2206	Digital European Backbone	200	200	200	200	Continuing	N/A
2443	Secure Voice Improvements Program		100	216	300	Continuing	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This element is the United States Air Force portion of the Tri-Service RDT&E program for the Defense Communications System (DCS). The DCS provides the long haul, point-to-point, and switched network telecommunications needed to satisfy requirements of the National Command Authorities, the Department of Defense and certain other Government agencies. The DCS RDT&E program is structured to define system and subsystem architecture, specify design parameters, and develop telecommunications technology for DCS modernization and improvement. Work in this element provides the equipment for an orderly transition to a unified second generation DCS (1985) and determines the architecture for the third generation DCS. It includes technology development and subsystem implementation in the areas of automated digital communications processing and distribution techniques, performance assessment and networks management improvements, and transmission improvements.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds to continue development of a multi-network gateway to interconnect key data networks, to integrate control features of digital transmission upgrades into the overall DCS's system control structure, and to develop improved transmission subsystem equipment. Costing estimates were formulated by the Electronic Systems Division, Hanscom Air Force Base, MA; and the Rome Air Development Center, Rome, NY.

Note: 1. $1,031 is carried in this Program Element for the Movements Information Network (MINET), a Defense Communications Agency project, and is not amplified further in this Descriptive Summary.

Program Element: #33126F — Title: Long Haul Communications - DCS

DoD Mission Area: Common User Communications, #363 — Budget Activity: Intelligence and Communications, #5

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
RDT&E	11,313	8,200	8,900		Continuing	N/A
1144 Automated Technical Control	488	Project Cancelled				
2022 Automated Digital Communications Processing	3,801	2,812	2,983		Continuing	N/A
2155 Systems Control	3,490	2,592	2,987		Continuing	N/A
2157 Transmission Improvements	3,101	2,496	2,480		Continuing	N/A
2206 Digital European Backbone	200	200	150		150	1,628
2440 Secure Voice Improvements Program	233	100	300		Continuing	N/A
Other Procurement						
Project 1144 (ATEC)	3,692				Cancelled	
Project 2206 (DEB)	13,100	7,920	9,300			72,000
Project 2440 (SVIP)	3,005				Continuing	N/A
Military Construction						
Project 2206 (DEB)		610	2,804		2,950	8,364 Total

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
Other Procurement						
Project 2206 (DEB)	12,175	8,843	8,249	18,203	27,736	99,115
Project 2440 (SVIP)				2,030	Continuing	N/A
Project 2157 (Transmission Improvements)	7,885	5,580	1,000	7,370	Continuing	N/A
Military Construction						
Project 2206 (DEB)		630	970	2,182	0	3,782

Program Element: #33126F Title: Long Haul Communications - DCS
DoD Mission Area: Common User Communications, #363 Budget Activity: Intelligence and Communications, #5

(U) DETAILED BACKGROUND AND DESCRIPTION: Project 2022 Automated Digital Communications Processing. As the Defense Communication System (DCS) transitions to an all digital system, three units are required to provide service which meets customer needs. These units will be designed and tested under this project. First, a centralized service facility will emulate features of existing Automatic Digital Network (AUTODIN) switches. Second is a gateway element which will provide the interface between the DCS and other digital networks. The ability to connect the DCS to other digital networks will provide significant cost savings and more timely information exchange between Defense and non-Defense customers. Third is a feasibility demonstration of features such as automated distribution (electronic mail), digital facsimile, and word processing. The purpose of the latter is to assess potential cost savings and manpower reductions accruing from their use.

(U) Project 2155 System Control. The purpose of this project is to develop system control techniques, algorithms, and hardware and software specifications which provide worldwide automated traffic reroute and restoral. Basic data on traffic loading will come from DCS switches. System control equipment will improve DCS traffic management effectiveness by more than thirty percent.

(U) Project 2157 Transmission Improvements. The objective of this project is to improve transmission survivability, efficiency, capacity, and reliability of Air Force and DCS communication links by operational application of new transmission techniques such as millimeter wave and fiber optics, and by developing transmission equipment embodying new techniques and technology.

(U) Project 2206 Digital European Backbone (DEB). Under this project, a digital transmission system is being installed in four phases in Europe (Coltano, Italy to England). DEB is a follow-on to the prototype digital transmission system now in operation between Frankfurt and Vaihingen. DEB equipment replaces obsolete analog equipment, improves security, and increases capacity. It is the first major digital transmission subsystem in the DCS. The initial phase of the DEB was completed in November 1979.

(U) Project 2440 Secure Voice Improvement Program (SVIP). The SVIP was restructured in accordance with FY 1979 Congressional guidance. This project supports the Defense Communications Agency's program outlined in its Five Year Plan.

(U) RELATED ACTIVITIES: The DEB project (2206) involves tri-Service funding. It involves installation of equipment at Army, Navy, and Air Force sites. Overall program management for this project is exercised by the Defense Communication Agency (DCA) through appropriate Management Engineering Plans. The remaining four projects (2022, 2155, 2157, and 2440), are part of the coordinated DCS RDT&E program as directed by the DCA Five Year Program. Each Service programs funds to support work directed by the DCA Plan.

(U) WORK PERFORMED BY: Air Force Systems Command manages this program element through the Electronic Systems Division (ESD), Hanscom Air Force Base, MA, (Projects 2206, 2440, and the acquisition aspects of 2157) and the Rome Air Development Center, Rome, NY, (Projects 2022, 2155, and 2157). Contractors for Rome Air Development Center projects are: GTE Sylvania, Needham, MA, (Automated Communications Performance Monitoring and Assessment); Softech, Waltham, MA, (Higher

Program Element: #33126F
DoD Mission Area: Common User Communications, #363

Title: Long Haul Communications - DCS
Budget Activity: Intelligence and Communications, #5

Order Language Investigation); and Ford Aerospace and Communications Corporation, Palo Alto, CA, (Advanced Research Project Agency Network (ARPANET)/Automated Digital Network (AUTODIN) II Gateway). Contractor for ESD is Harris Corporation Melbourne, FL, (16 Kilobit Per Second Modulator/Demodulator).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments:

(U) Project 2022: The JOVIAL compiler which incorporates several communications-oriented language changes was completed. This compiler will permit evaluation of efficiency/acceptability of a higher order language for real-time communications and routing applications.

(U) Project 2155: Work was completed on the automated digital fault isolation algorithm for potential application to the Digital European Backbone (DEB) program. Work was also completed on definition of the DCS TRI-TAC interoperability requirements for system control elements.

(U) Project 2157: The 16 Kilobit Per Second Modulator/Demodulator with secure voice terminal transitioned to full scale production for the AUTOSEVOCOM and NATO applications. The development and testing of the advanced timing and synchronization experimental model was successfully completed.

(U) Project 2206: Research and Development funding for program office implementation and test support continued. Final Operational Capability of Stage I (Coltano, Italy to Vaihingen, Germany) occurred in November 1979.

2. (U) FY 1982 Program:

(U) Project 2022: Development of AUTODIN II-ARPANET gateway node will be completed and development of a Multinetwork gateway node will continue. A satellite terminal will be installed and modification of the Rome Air Development Center (RADC) Integrated Node will begin. The RADC Integrated Node will support Air Force participation in the Experimental Integrated Switched Network (EISN) which will in turn support Defense Switched Network (DSN) definition. Development of the EISN Traffic Simulator and On-Line Traffic Monitor will be completed. ADA compiler development for evaluation of the RADC Integrated Node will begin.

(U) Project 2155: Development will continue on overseas AUTOVON monitoring and control improvements. These efforts will support rapid reconfiguration under crisis conditions. Efforts that will continue are: definition of monitoring and status reporting improvement for base access areas feeding the DCS; system control interoperability work for reliable interoperation of satellite and terrestrial networks in crisis; developing techniques to detect and characterize ECM at technical control facilities; and, evaluation of commercial, off-the-shelf digital patching equipment for DCS applications. Definition of station level system control functions to form a baseline for future integrated technical control capability will begin.

Program Element: #33126F Title: Long Haul Communications - DCS
DoD Mission Area: Common User Communications, #363 Budget Activity: Intelligence and Communications, #5

(U) Project 2157: The following efforts will be completed in FY 1982: adaptive antenna retrofit for Digital Radio and Multiplex Acquisition (DRAMA) microwave radio; and DCS tropospheric scatter spread spectrum modems for anti-jam capability. Development will continue on the Digital Channel Efficiency Model (DCEM) for better channel bandwidth utilization and direct DCS-NATO transmission system interoperability at group level. The following efforts will begin: development of advanced DCS tropospheric scatter electronic counter-counter measures (ECCM) antenna processing; development of timing and synchronization advanced development model; and, DCS Vulnerability Assessment Program.

(U) Project 2206: Research and Development funding for program office implementation and test support will continue. Equipment installation at Stage II sites (central Germany, north to Schoenfeld) begins.

(U) Project 2440: Support the DCA's Secure Voice Improvement Program.

3. (U) FY 1983 Planned Program:

(U) Project 2022: RADC Integrated Node modifications will be completed. EISN experiments with Lincoln Lab, DCA and Army radios will begin. The Multinetwork Gateway effort will continue and the ADA Compiler Development will be completed.

(U) Project 2155: Development of overseas AUTOVON control improvements will continue, as will evaluation of commercial digital patching equipment. Defining station level integrated technical control functions and the study of interoperability of system control elements addressing DCS-NATO networks will be completed. The following efforts will begin: hardware/software development of base-oriented performance monitoring and reporting capability; adaptation of digital trunk decision algorithms in Digital European Backbone (DEB) system elements and monitor points; and, long range development effort to implement electronic counter measures (ECM) signal identification and characterization techniques.

(U) Project 2157: DCS Timing and Synchronization advanced development model, advanced DCS tropospheric scatter ECCM antenna processor and DCS Vulnerability Assessment Program efforts will continue. The High Frequency (HF) Survivability Program will begin, as will the L-band and S-band angle diversity feed development; development of efficient, reliable, high power amplifer for L-band tropospheric scatter applications; and, development of a DCS Integrated ECCM Microwave Radio.

(U) Project 2206: Research and Development funding for program office implementation and test support will continue. Work will continue on Stage II sites. Stage IV construction will begin. Stage III planning will continue.

(U) Project 2440: Efforts will continue in support of DCA's Secure Voice Improvement Program.

Program Element: #33126F Title: Long Haul Communications - DCS
DoD Mission Area: Common User Communications, #323 Budget Activity: Intelligence and Communications, #5

4. (U) FY 1984 Planned Program:

(U) Project 2022: The development of the Multinetwork Gateway and the initial set of EISN experiments to define the DSN will be completed. Field testing of the Multinetwork Gateway will begin. The following additional efforts will begin: DSN protocol analysis program; DSN software structure definition for data services (versus initial voice-oriented work); and, efforts to automatically analyze terminal-host protocol interoperability.

(U) Project 2155: Overseas AUTOVON improvement program will be completed. An evaluation of Digital Fault Isolation Algorithms in the DEB system in Europe will be conducted. Feasibility model development for base-oriented monitoring and reporting, ECM signal identification and characterization work, and digital patching evaluation by integrating control software to operate several equipments on a system basis will continue. Efforts will begin on developing Interoperability Control Element (ICE) to achieve interoperability of system control elements of different systems, and development of station level integrated technical control functional elements.

(U) Project 2157: Advanced DCS tropospheric scatter ECCM antenna processor and timing and synchronization advanced development model efforts will be completed. The following efforts will continue: DCS Vulnerability Assessment Program; HF Survivability Program; and L-band and S-band feed and L-band Power Amplifier development; and, DCS integrated ECCM microwave radio development.

(U) Project 2206: Research and Development funding for program office implementation and test support will continue. All of Stage II links will achieve final operation capability in FY 1984. Stage III and IV equipment installation will proceed.

(U) Project 2440: Efforts will continue in support of DCA's Secure Voice Improvement Program.

5. (U) Program to Completion: This is a continuing program responsive to the DCA's TriService program for the DCS. The implementation project, (2206 - Digital European Backbone), is scheduled for completion in FY 1987-FY 1988. Technology development projects, (2022, 2155, and 2157) are continuing projects which define system and subsystem architecture, specify design parameters, develop telecommunications technology, and provide the hardware and software required for DCS modernization and improvement.

6. (U) Milestones: N/A

7. (U) Resources: N/A

8. (U) Comparison with FY 1981 Budget Data: N/A

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33144F
DOD Mission Area: Common User Communications, #363

Title: Electromagnetic Compatibility Analysis Center (ECAC)
Budget Activity: Intelligence and Communications, #5

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	6,091	6,880	7,251	7,239	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Electromagnetic Compatibility Analysis Center (ECAC) is a Department of Defense Center operated by the Air Force. The creation of the Center stemmed from recognition that action was required to cope with the increasing number and severity of electromagnetic compatibility problems. The Center is tasked with the responsibility of developing a communications-electromagnetic systems data base and the analysis tools necessary to determine if these systems will operate in their intended electromagnetic environment. This program element provides core funding to support data base and analysis capability development as well as specific analyses tools requested in support of the Secretary of Defense and the Joint Chiefs of Staff. Analyses performed in support of Department of Defense components operational and developmental systems are performed on a user reimbursement basis.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The requirement for electromagnetic compatibility analysis is increasing because of the growing number and complexity of communications-electromagnetic systems. This program will develop and maintain improved analytical tools and data bases and make these capabilities available to all Department of Defense users. Examples of the wide variety of systems which will be supported in FY 1983 include the MX Ground Sites EMC Analysis and Compass Call Electronic Warfare (EW) platform. Joint Tactical Information Distribution System, Worldwide Airborne Command Post E-4B Aircraft and Marine Corps Foliage Penetration Battlefield Surveillance Radar system. In addition, this program will support the Secretary of Defense and Joint Chiefs of Staff in Spectrum allocation/assignment and special electromagnetic compatibility analysis projects. The estimated costs are based on past program experience, adjustments for expected cost growth and projected workload to support the above projects.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	6,000	7,000	7,500		Continuing	Not Applicable

(U) OTHER APPROPRIATIONS FUNDS:

Operation and Maintenance	3,700	4,011	4,247	4,485	Continuing	Not Applicable

Program Element: #33144F   Title: Electromagnetic Compatibility Analysis Center (ECAC)
DOD Mission Area: Common User Communications, #363   Budget Activity: Intelligence and Communications, #5

(U) DETAILED BACKGROUND AND DESCRIPTION: The Electromagnetic Compatibility Analysis Center (ECAC) is a Department of Defense (DoD) facility established to provide advice and assistance on electromagnetic compatibility (freedom from radio interference) problems to the Secretary of Defense, Joint Chiefs of Staff, the military departments and other DoD components. The Center, at Annapolis, MD, is managed by the Air Force, but is available to all DoD users. The Chairman of the Joint Chiefs of Staff and the Assistant Secretary of Defense for Communications, Command, Control and Intelligence jointly provide policy guidance, assign projects and establish project priorities. The Center consists of an Air Force Commander, Deputies for Army, Navy, Marine Corps, Air Force, and Special Projects, and an in-house technical management staff assisted by a contractor. The Center's primary function is the analysis of inter-system and system-to-environment electromagnetic compatibility. The purpose of these analyses is to determine whether Department of Defense communications-electronics systems, in use or under development, will operate in current and projected electromagnetic environments. These analyses include consideration of the impact of the expected electromagnetic environment on both civilian and military telecommunications equipment and consideration of efficient use of the available frequency spectrum to enhance spectrum management. Other analyses performed are those on frequency allocations and assignments in support of the frequency management in the military departments and the Unified and Specified commands. To perform the required analyses, the Center maintains and develops basic analysis techniques including models, prediction analysis system and special techniques. In addition to the analysis techniques, the Center maintains and develops an extensive environmental data base which contains millions of pieces of data to perform the electromagnetic compatibility analyses. The data base files include information on the location and operating characteristics of United States and foreign equipment and systems, the equipment complements of specific vehicles or platforms (ship, army, units, aircraft, etc.), the allocation and use of the frequency spectrum and all associated United States and international rules and regulations, digitized topographic data (U.S. and other nations), and future communications-electronics (C-E) equipments and systems in development or conceptual stages. The Center also provides the necessary facilities to perform its mission. This includes computer rental and operations, administrative support, purchased supplies and services, building rental, and contract functions. The Research, Development, Test and Evaluation (3600) funds primarily provide for development and maintenance of the analytical capabilities, development of additional data base requirements and government support. The Operation and Maintenance funds (3400) primarily support operational analysis projects of the military services and data base maintenance.

(U) RELATED ACTIVITIES: The Center performs electromagnetic compatibility analyses for major Department of Defense communication-electronics systems. These system analysis projects are funded by reimbursements from users. These reimbursed funds are estimated to be $22.4 million in FY 82, $25.9 million in FY 83 and $28.4 million in FY 84. In FY 1981 for example, more than 205 separate projects for the Army, Navy, Marine Corps and Air Force were supported.

In addition, approximately 50 other Department of Defense (DoD), joint agency, and other Federal agency projects will be addressed by the Electromagnetic Compatibility Analysis Center (ECAC). Examples of the systems being analyzed are: Air Force - E-3 and E-4 aircraft, Joint Tactical Information Distribution System (JTIDS), Air Force Strategic Satellite System and Global Positioning System; Army - Communications Command System, Airborne Frequency Engineering Management System, Patriot Missile System, Tactical Frequency Engineering System; Navy - EA-6B Prowler, Special Electromagnetic Interference Project, Surface Missile System (AEGIS), and PHALANX; and Marine Corps - Tactical communications electromagnetic compatibility analysis and operational support. Efforts of mutual concern to the Department of Defense and other Federal Agencies (i.e., Federal Communications Commission, Federal Aviation Administration) include projects such

Program Element: #33144F Title: Electromagnetic Compatibility Analysis Center (ECAC)
DOD Mission Area: Common User Communications, #363 Budget Activity: Intelligence and Communications, #5

as the Microwave Landing System, Air Traffic Control Frequency Assignment System, Air-Ground-Air Frequency Assignment Program, and Communications and Control Systems. The Center also exchanges data, math models, and computer programs with other agencies involved in frequency management such as the Department of Commerce, Interdepartment Radio Advisory Committee and the National Telecommunications and Information Administration (NTIA).

(U) WORK PERFORMED BY: The Electromagnetic Compatibility Analysis Center is located in Annapolis, MD. The contracting responsibility is performed by Headquarters, Air Force Systems Command through the Electronic Systems Division, Hanscom AFB, MA. The current contractor is the IIT Research Institute, Chicago, IL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) In recent years, the program element funding provided the operation, maintenance and administration, updating of data, and the continued development of electromagnetic capability analysis. Timely short term responses to operational problems from Southeast Asia, Europe, and the Continental United States were provided. Frequency assignment analyses have been continuous. Analyses of equipment, proposed or in research and development, have been documented in technical reports. Beginning in FY 1973, the Frequency Resource Record System (FRRS) provided major frequency record keeping functions for several Unified and Specified Commands. With this system, worldwide frequency utilization of the Commands is maintained at the Center to provide quick response assistance to the operational forces on frequency utilization questions. Other work included continued development, updating and maintenance of the data base and advanced mathematical modeling to simulate characteristics of new types of receivers, transmitters and circuits.

(U) During FY 1976-1981 data base maintenance and outputs continued and software updating improved efficiency. The Frequency Resource Records System (FRRS) continued operational test in support of most of the Unified and Specified Commands. Emphasis was on analyses of equipment and systems in the development phase. Mathematical models were developed for new types of modulation and new scenarios. Electromagnetic compatibility system analysis was performed and continuation of Center outputs such as data base, operational analysis support, Frequency Records Resource System (FRRS), and frequency allocation and assignment assistance was provided.

(U) Model development included improvement of the high frequency (HF) skywave and antenna models, satellite propagation, frequency division muliplex/frequency modulated models, conventional radar antenna models, system modeling and prediction analysis system models. The Center analyzed and formulated the Department of Defense (DoD) and Services positions relative to the General Worldwide Administrative Radio Conference (GWARC) which was held in Geneva during 1979. All world nations attend this conference; therefore, it was imperative for the United States to be ready to defend or negotiate its frequency spectrum needs through year 2000. The Center will again support the GWARC representatives in 1984 and is preparing for that meeting in the 1982-83 time frame. In FY 1981, the ECAC manpower to support its mission was 54 military/civil service and approximately 600 contractor personnel.

2. (U) FY 1982 Program: Research, Development, Test and Evaluation (RDT&E) funding will provide continued data base and Frequency Records Resource System development and the expansion of analytical model capabilities in many areas of electromagnetic compatibility solution. The analysis project effort will expand as demand by Defense and other government agencies for analysis services continues to increase. The majority of analysis projects, for both Defense

and non-Defense activities, are financially supported by those activities through reimbursement.

3. (U) FY 1983 Program: The FY 1983 program will be similar in content to the efforts described above. It is anticipated that as systems become more complex and the number of frequency spectrum users grows, the interference problems and requests for analysis and data will increase. The level of effort expended on work directly funded under this program will be held approximately constant while the amount of user reimbursed work is expected to grow about two percent.

4. (U) FY 1984 Planned Program: The FY 1984 plan will be similar in content to FY 1983 activities. The capability development will continue since the sophistication of electronic communications systems will increase. Because of the previous fiscal year increases in requirements and complexity, it is predicted that reimbursed programs will increase at the same rate predicted for FY 1983.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 33401F
DOD Mission Area: COMSEC, #364

Title: Communications Security (COMSEC)
Budget Activity: Intelligence and Communications, #5

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3,538	1,594	1,621	1,593	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The principal objective of this program is the improvement of communications security within the United States Air Force. It is a continuing effort divided into several task areas. The overall effort is part of national communications security program managed by the National Security Agency with participation by other services/agencies. The Air Force portion of this overall program addresses problems encountered in adapting general purpose cryptographic equipment for use in new communication systems. The efforts are primarily directed at insuring that all systems being developed by the Air Force meet current national communications security requirements. Specific emphasis is placed on correcting any known deficiencies.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This level of effort program supports all Air Force communications security Research, Development, Test, and Evaluation. Tasks under this project include support of the development of advanced narrowband digital voice techniques for communications security applications, the development of new secure communications techniques using fiber optics, and the evaluation of hazards and the means of protecting against the hazards of non-desired radiation. The project supports the Air Force Electronic Security Command in providing compromising emanations testing for all Air Force cryptographic equipment. Cost estimates are based on previous similar program experience and were made by the Air Force Systems Command on 30 October 1981.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	1,988	1,600	1,400		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: # 33401F
DOD Mission Area: COMSEC, #364

Title: Communications Security (COMSEC)
Budget Activity: Intelligence and Communications, #5

(U) DETAILED BACKGROUND AND DESCRIPTION: This program accomplishes communications security research, development, test and evaluation for improved security in United States Air Force systems. It is a continuing effort divided into security standards and assessments, communications security technology, secure voice, space and weapons security, record and data security and communications security technical support task areas. The overall effort is part of a national communications security program managed by the National Security Agency with participation of all the services and defense agencies. Such an organization fosters exchanges of communications security technology, reduces duplication and insures that national objectives are being satisfied with a high degree of commonality.

(U) RELATED ACTIVITIES: The National Security Agency is the overall manager of communications security equipment research and development under the policy guidance of the Assistant Secretary of Defense (Communications, Command, Control and Intelligence). The services perform efforts under common Program Element #33401. The Air Force Electronic Security Command performs COMSEC testing on off-the-shelf equipment selected for operational use in the USAF and also recommends the use of cryptographic equipment to operational commands.

(U) WORK PERFORMED BY: All research and development tasks under this program are managed through the Rome Air Development Center of the Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA. Contractors are: Lincoln Laboratories Bedford, MA; National Bureau of Standards, Boulder, CO; Booz-Allen, Bethesda, MD; ARCON, Wakefield, MA; DYNASTAT, Inc., Austin, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: This project has supported Air Force research and development of fiber optics communications and has demonstrated the use of fiber optics for both system control and communications security functions. The National Security Agency has tested a secure fiber optics system developed under this program. The Air Force and Navy have a joint program to provide secure telemetry for test ranges at Eglin, Edwards and Kirtland Air Force Bases and the Eastern and Western test ranges which was initiated in this program. A secure communications controller was tested at the Air Force Data Services Center and is being further developed by the National Security Agency. An automated compromising emanations analysis system to improve the manpower intensive nature of compromising emanations testing was delivered to the Air Force Communications Security Support Center.

2. (U) FY 1982 Program: Fiber optics development will continue with National Security Agency participation in the development of an intrusion resistant optical communications testbed. Work in the voice processing area will emphasize solution of problems in high noise environments. Support will continue to the Air Force Cryptologic Support Center compromising emanations testing program in the form of continued research into automated testing techniques and compromising emanations problems. A digital voice interoperability program is being pursued to resolve interoperability problems between secure voice systems projected for use throughout the Air Force, the Department of Defense and allied nations. Prototype development of the Ground Radio Interface Device will be completed and a pilot production will be conducted.

Program Element: # 33401F
DOD Mission Area: COMSEC #364

Title: Communications Security (COMSEC)
Budget Activity: Intelligence and Communications #5

3. (U) FY 1983 Planned Program: The Program Office will continue to provide support to the development of equipment for compromising emanations testing. Investigation of techniques for signals security analysis will continue as a goal for FY 1983. Digital Voice Interoperability investigations will continue with emphasis on developing interfaces between systems operating at different data rates. Support will be provided to many other Air Force programs using voice communications over tactical and strategic radio, wireline and satellite systems. Increase of $200,000 results from transfer of civilian salaries from the Operations and Maintenance appropriation.

4. (U) FY 1984 Planned Program: Begin research into the feasibility of an optical sensor for Tempest testing and continue ongoing automated test system upgrades. Complete testing in intrusion resistant fiber optics testbed and prepare final results. Continue to provide technical support to other programs using narrowband secure voice processors. Specify acceptability criteria for the standard evaluation of secure voice systems.

5. (U) Program to Completion: This is a continuing program with emphasis shifting among efforts as Air Force priorities and resources dictate. Major emphasis will continue on narrowband voice processing requirements and compromising emanations testing equipment with increasing emphasis on signals security.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 35114F Title: Traffic Control and Landing Systems (TRACALS)
DoD Mission Area: Navigation and Position Fixing, #361 Budget Activity: Intelligence & Communications, #5

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2,997	5,280	5,060	3,907	Continuing	N/A
1956	TPN-19 Improvements	1,400	400				2,400
2026	System Support	200	300	300	295	Continuing	N/A
2148	LORAN C/D	300	1,700				26,700
2610	Berlin Long Range Radar	397	780	759			1,936
2681	GPN-22 Electronic Counter-Countermeasures	200	2,100	2,900			5,200
2760	Mobile Planar Array			401	1,312		1,713
2759	Advanced Military Landing System			700	2,300	47,400	50,400

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION: This program provides the Air Force with the Air Traffic Control and Landing equipment required for safe, efficient, worldwide, all weather Air Force flying operations. The mission need is to provide take off, enroute and landing guidance and surveillance in order to meet wartime sortie requirements. In peacetime, the need is to support training, logistics and other operational flying with maximum safety.

BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 request includes funds to sustain planning activities in the Traffic Control and Landing System Program Office (Project 2026) and to complete planning for acquiring a long range radar for Berlin using $65.1 million provided by the Federal Republic of Germany (Project 2610). Funds are requested to develop electronic counter-countermeasures for the AN/GPN-22 Precision Approach Radars to be deployed to Berlin (Project 2681). Project 2760 adapts the Federal Aviation Administration's Open Planar Array beacon antenna for use on Air Force Mobile Air Traffic Control Radars. Seven hundred thousand dollars are requested to begin the definition phase of a 15 year major program to convert the Air Force from reliance on Precision Approach Radar and the Instrument Landing System to use of the Microwave Landing System for all precision landing. Federal Aviation Administration, International Civil Aviation Organization, and North Atlantic Treaty Organization plans for existing systems will render the Air Force noninteroperable by the mid 1990's unless the Microwave Landing System is acquired in sufficient time. TRACALS program costs were estimated by Air Force Systems Command during FY 81 with the exception of the Advanced Military Landing System project. The FY 1983 funds requested for project 2759 will be used to do the necessary planning to cost this complex 15 year project.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	3,063	5,263	3,400		Continuing	N/A
Procurement (Other)	4,200	4,300	1,500		Continuing	N/A

Program Element: #35114F
DoD Mission Area: Navigation and Position Fixing, #361

Title: Traffic Control and Landing Systems (TRACALS)
Budget Activity: Intelligence and Communications, #5

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
Procurement (Other)	5,023	4,213	399	2,591	Continuing	N/A
Funds from Federal Republic of Germany for Berlin Radar Project 2610	(7,800)	(19,100)	(8,100)	(14,400)	(15,700)	(65,100)

Program Element: # 35114F   DoD Mission Area: Navigation and Position Fixing, #361

Title: Traffic Control and Landing Systems (TRACALS)   Budget Activity: Intelligence & Communications, #5

(U) DETAILED BACKGROUND AND DESCRIPTION: The TRACALS program was established to provide single management of the many related programs required to modernize the electronic equipments which comprise the Air Force Traffic Control and Landing System (TRACALS). Maximum use is made of state-of-the-art, off-the-shelf equipments to meet this goal. TRACALS research and development efforts are aimed toward the development of technology and equipment required to satisfy the Air Force's unique, military, worldwide, flying mission. Every effort is made to capitalize on the research and development activities of other federal agencies involved in air traffic control and navigation (primarily the Federal Aviation Administration). This assures standardization within and interoperability with the National Airspace System. This request represents a transition from a high investment phase of the program which modernized Air Force fixed base air traffic control surveillance and precision radars, procured a new family of Instrument Landing Systems and developed a tactical LORAN system to a program to reflect the needs of the 1990s. The advent of the Microwave Landing System and the Global Positioning System will have a major impact on the program in the 1985-1995 time frame. The Air Force currently relies on the Instrument Landing System for civil interoperability and precision landing at Main Operating Bases. Precison Approach Radar is maintained for NATO interoperability, mobile operations and, in the United States, for pilot proficiency. In accordance with International Civil Aviation Organization agreements, the Federal Aviation Administration will begin Microwave Landing System implementation in the mid-1980's. Instrument Landing Systems will be phased out beginning in the early 1990's. NATO plans to replace Precision Approach Radar with the Microwave Landing System as the standard interoperable landing aid by the late 1990's. To retain its current degree of interoperability the Air Force must implement the Microwave Landing System by 1998. This is a billion dollar effort over 15 years involving modification of 8000 aircraft, replacement of Instrument Landing Systems and Precision Approach Radars at all fixed bases and development of a mobile Microwave Landing System. The Air Force is participating with the Army and Navy in a Joint Chiefs of Staff study of interoperability requirements for a forward tactical landing system to fill the place previously planned for the Joint Tactical Microwave Landing System. To reduce development costs the Air Force will purchase the Federal Aviation Administration system for fixed bases in the Continental United States. FY 83 and 84 funds will basically support studies to define the most cost effective mix of equipment and transition timing along with some testing of Federal Aviation Administration ground systems and the Navy's multimode receivers. The Global Positioning System will basically impact Operations and Maintenance funding in the program as systems such as LORAN are phased out in the early 1990's. Other funds requested in this submission develop an electronic counter-countermeasure capability for the Precision Approach Radars in Berlin and adapt the Federal Aviation Administration's solution to false beacon returns (an open planar array antenna) to Air Force mobile radars. Funds requested for the Berlin Long Range Radar are additive to the $65.1 million provided by West Germany to replace the USAF facilities at Tempelhof.

Program Element: # 35114F
DoD Mission Area: Navigation and Position Fixing, #361

Title: Traffic Control and Landing Systems (TRACALS)
Budget Activity: Intelligence & Communications, #5

(U) RELATED ACTIVITIES: This program is related to, and through the mechanism of the Federal Radionavigation Plan, coordinated with the Federal Aviation Administration's plans for the National Airspace System. Key related programs are the Global Positioning System and national plans for the Microwave Landing System. Air Force requirements for Tactical Air Navigation (TACAN) and Long Range Navigation (LORAN) are expected to terminate when Global Positioning System equipment is available in nearly all Air Force and NATO aircraft (early 1990's) and funds in this Program Element for TACAN and LORAN are limited to those necessary to retain a capability until the Global Positioning System is fully implemented. National adoption of the Microwave Landing System will require replacement of all Air Force ground and airborne Instrument Landing System equipment. Present plans are to acquire versions of the Microwave Landing System to replace both the Instrument Landing System and the Precision Approach Radar. This will require a billion dollar investment over a 15 year period. Off-the-shelf equipment developed by the Federal Aviation Administration will meet Continental United States fixed base needs. Versions of the Microwave Landing System will have to be developed to provide survivability in high threat areas and a full capability transportable system will have to be packaged. The Air Force is working with the Army and Navy to define interoperability requirements for a forward tactical landing system in light of FY 82 budget decisions on the Army's Joint Tactical Microwave Landing System.

(U) WORK PERFORMED BY: The Air Force Electronic Systems Division, Hanscom AFB, MA; is responsible for the management of the projects included under this program. Contractors are: Raytheon, Waltham, MA; Sperry Gyroscope Division, Sperry Rand Corp, Great Neck, NY; ARINC Research Corp, Annapolis, MD; Texas Instruments Inc, Dallas, TX; General Electric Company, Syracuse, NY.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Requirements for replacing the Berlin Long Range Radar and modernizing operations centers were defined, funds were obtained from the Federal Republic of Germany under terms of the occupation agreement and the General Electric AN/FPS-117 radar was selected because of its superior logistics supportability and performance. Installation of two tactical LORAN systems began in Europe. Solutions have been identified for remaining LORAN problems and FY 1982 funds will correct them. Communications system improvements for the AN/TPN-19 Landing Control Central were designed, fabricated and testing begun. Design studies were initiated for the remaining directed improvements. The AN/TRN-41 lightweight airdroppable TACAN began entering the inventory to serve Military Airlift Command airdrop and Communications Command navigational aid survivability needs. Studies were performed resulting in an approach to assure precision approach radar service in Berlin in the event of Warsaw Pact jamming.

2. FY 1982 Program: Electronic counter-countermeasures for the Berlin Long Range Radar will be fabricated, fitted to the radar and tested. Radar installation at Tempelhof will begin. A contract will be let to develop and acquire an automated system for the Air Traffic Control at Tempelhof Central Airport. Remaining deficiencies on the tactical LORAN system will be corrected and a grid data management system to improve geodetic accuracy acquired. A contract will be let to develop electronic counter-countermeasures for the Precision Approach Radars in Berlin. Communications system and reliability and maintainability improvements to the AN/TPN-19 Landing Control Central will be delivered and tested.

Program Element: # 35114F Title: Traffic Control and Landing Systems (TRACALS)
DoD Mission Area: Navigation and Position Fixing #361 Budget Activity: Intelligence & Communications #5

3. FY 1983 Planned Program: The Berlin Long Range Radar will be commissioned. Full scale development will commence leading to an FY 1986 operational activation. Electronic counter-countermeasures for the Berlin precision approach radars will be fabricated and tested. Work will commence to develop a solution to false target radar beacon system returns experienced by the AN/TPX-42 interrogators in mobile radar systems. Planning will commence on an implementation strategy for acquiring an Advanced Military Landing System to overcome the high expense and operational limitations of the precision approach radar and the lack of mobility of the Instrument Landing System. Plans are to comply with previous guidance and use versions of the Federal Aviation Administration developed Microwave Landing System to satisfy Air Force requirements. This will be a billion dollar effort over 15 years. The increase in FY 83 funds for RDT&E reflects a decision to proceed with developing a detection capability for the Precision Approach Radars in Berlin against the 1985 jamming threat. Last year's descriptive summary noted that the FY 82/83 funds requested provided only and that the program was under review. The deletion of most FY 83 RDT&E related Other Procurement funds reflects deferral of acquisition of a second modified Precision Approach Radar for Berlin until FY 84 due to the more ambitious development program. The remaining $399 thousand completes the tactical LORAN program. NOTE: Program Element 35114F contains Other Procurement and Aircraft Procurement funds not related to ongoing RDT&E projects. These funds are not addressed in this summary.

4. FY 1984 Planned Program: Work will continue on developing an
A detailed transition program for Microwave Landing System implementation will be finalized based on the least cost alternative. A mobile open planar array antenna will be delivered, tested and a production decision made. The Air Force will acquire the Federal Aviation Administration's Flight Data Input/Output equipment to replace the current system which will no longer operate with the Federal Aviation Administration's computers.

5. (U) Program to Completion: This is a continuing program. Requirements are being defined for a replacement for the 1950's vintage AN/MPN-14 radar control centrals, for survivability of fixed air traffic control radars in high threat areas, for removing systems supplanted by the Global Positioning System, and to adjust to Federal Aviation Administration initiatives such as the Traffic Alert and Collision Avoidance System. At a minimum, the advent of the Microwave Landing System, the age of all but the AN/TPN-19 mobile air traffic control radars and the vulnerability of fixed base air traffic control radars will generate another period of high investment for this program.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Budget Data: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 63248F
DOD Mission Area: Engineering Technology (ATD), #553 (Previously Contained in #440)
Title: Concept Development
Budget Activity: Defense-Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING)($ in thousands)

Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	NA	NA	984	3,275	Continuing	NA

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: At any given time, a number of new, innovative ideas exists to significantly improve our military capabilities. Under normal procedures, several years are required for the best ones to achieve funding and mature to the point of entry into full-scale development. This activity applies immediate resources to a few ideas which offer greatest potential for quantum improvements in capabilities or to capitalize on enemy weakness, using streamlined management procedures under direct purview of the AFSC Commander. Objective is to achieve technical and concept validation for launch into FSD (if warranted) as soon as possible, and minimize cost/time spent on others. Provides opportunity to achieve early implementation of high payoff concepts and technology opportunities.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds to initiate and carry through to validation (or rejection) two concepts, chosen from list of over 200 innovations proposed by industry, government, and private sources. This very limited start is intended to prove the value of unique and accelerated procedures, versus "business as usual," for concepts which offer quantum improvements in capability. With success, activities will be expanded to support larger number of efforts in FY 84.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: 63248F   Title: Concept Development
DOD Mission Area: Engineering Technology (ATD), #553   Budget Activity: Defense-Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: Congress and other government authorities have frequently cited concern over lengthening time periods between the time new concepts are first proposed and the time of their entry into operational service. Often, over half of this period is consumed by initial evaluations and formal concept definition activities (prior to full-scale development), which have lengthy budget and procurement prerequisites. This PE is an AF Systems Command initiative to select a very few high-payoff concepts and apply immediate dedicated manpower to pursue them on an accelerated basis through validation. Although a large fraction of the activity will be supported from in-house resources (personnel, labs, etc.), funding is needed for materials, testing resources, and some essential contractor support. Where contracted effort is necessary, priorities will be established to support accelerated procedures. Recognizing this is only applicable for a very few concepts, the objective is to bring innovations which show greatest promise to the FSD point in several months, vice years. High-risk, high-payoff ideas will be pursued.

(U) RELATED ACTIVITIES: Concept Development consists of investigation and demonstrations that are required prior to the full-scale development of weapons systems. It relates advanced capability concepts and emerging technology to operational needs, and develops operational concepts with user Commands. Accelerated demonstrations/validations will be conducted as necessary to test or prove feasibility. The concept development phase is planned to result in proven innovations being transferred to new or existing programs in a matter of months, or proven sufficiently unsound as to be rejected.

(U) WORK PERFORMED BY: The primary activities are performed by Air Force Systems Command Product Divisions, Labs, and Centers. Efforts will be supplemented by assistance from user Commands and contracts with industry.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

(1) 1981 and Prior Accomplishments: Not Applicable

(2) FY 1982 Program: Not Applicable

(3) FY 1983 Planned Program: Includes funds to initiate two of the highest payoff efforts chosen from a list of over 200 candidates. Each effort will have a schedule commensurate with its scope; it is anticipated that the average project length will be 8-12 months.

(4) FY 1984 Planned Program: Approximately six additional concept projects will be initiated.

(5) Program to Completion: This is a continuing program.

(6) Milestones: To be established

(7) Resources: Not Applicable

(8) Comparison with FY 1982 Descriptive Summary: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63401F Title: Space Vehicle Subsystems
DOD Mission Area: Space Launch and Orbital Control, #410 Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	9,870	0	4,339	6,523	Continuing	Not Applicable
681D	Advanced Space Guidance Technology	4,564	0	1,965	2,653	Continuing	Not Applicable
682J	Advanced Space Power Supply Technology	1,375	0	1,700	2,400	Continuing	Not Applicable
688F	Advanced Satellite Secondary Propulsion Technology	150	0	374	1,170	Continuing	Not Applicable
2181	Advanced Space Computer Technology	3,781	0	0	0	Continuing	Not Applicable
2198	Advanced Space Technology Planning	0	0	300	300	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This applied, advanced technology program serves to define, develop and demonstrate new/improved space vehicle subsystem concepts/prototypes which support numerous DOD space programs and are essential for meeting DOD space mission needs in the late 1980s and 1990s. The primary objective of this program is to increase satellite survivability, autonomy, performance, reliability and lifetime. A secondary objective is accomplishment of the prime objective with lighter, less complex, and more economical subsystems than currently exist. Development efforts are in guidance, power supply, secondary propulsion, computer subsystems and the supporting technology planning.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This technology base program is required to support present and future military space programs with fully developed and proven subsystems to advance space program capabilities while minimizing cost, schedule and performance risks.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	9,900	0	0		Continuing	Not Applicable
Procurement: None						

(U) OTHER APPROPRIATION FUNDS: N/A

Program Element: #63401F Title: Space Vehicle Subsystems
DOD Mission Area: Space Launch and Orbital Control, #410 Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This is the Department of Defense's (DOD) only applied, advanced technology program for defining, developing, and demonstrating spacecraft subsystem concepts/prototypes applicable to multi-users and essential for meeting DOD space mission needs in the 1980s and 1990s. The guidance, power supply, secondary propulsion, and processor subsystems being developed by this program are the spacecraft support systems for the mission payload. Future payloads need: more precise orientation, greater survivability against natural and man-made threats, and greater operational autonomy. There are four projects within the Space Vehicle Subsystems program to meet these needs. Project 681D (Advanced Space Guidance Technology) defines, develops, and demonstrates space guidance, navigation, and control subsystems and components which (1) provide autonomous, non-radiating guidance capability and (2) improve inertial attitude reference accuracies. Project 682J (Advanced Space Power Supply Technology) defines, develops, and demonstrates power subsystems, including batteries, solar panels, and power management systems, to (1) increase nuclear, laser, and natural environmental survivability, (2) increase power output and lifetime, and (3) substantially reduce volume and weight. Project 688F (Advanced Satellite Secondary Propulsion Technology) defines, develops, and demonstrates new/improved propulsion concepts to (1) increase satellite life, (2) improve attitude control precision, and (3) reduce secondary propulsion system weight. Project 2181 (Advanced Space Computer Technology) defines, develops, and demonstrates selected computer, memory storage, data preprocessor, and software subsystems and components to (1) increase reliability and mission life, (2) decrease satellite ground terminal down-link requirements, (3) improve radiation hardening, (4) increase memory access capability, and (5) reduce weight, volume, and power requirements. Project 2198 (Advanced Space Technology Planning) develops the technology model and road maps t chieve improved space systems capabilities.

(U) RELATED ACTIVITIES: The following relationships exist with other activities. Project 681D (Advanced Space Guidance Technology) receives inputs from Program Element (PE) #62204F (Aerospace Avionics). Project 682J (Advanced Space Power Supply Technology) receives power system technology inputs from PE #62203F (Aerospace Propulsion). Project 688F (Advanced Satellite Secondary Propulsion Technology) receives secondary propulsion technology inputs from PE #62302F (Rocket Propulsion). Project 2181 (Advanced Space Computer Technology) provides technical assistance to Rome Air Development Center in the investigation of an On-Board Signal Processor with PE #62702F (Command, Control, and Communications) and PE #62301E, a Defense Advanced Research Projects Agency program element. The Space Vehicle Subsystems program is also performing a joint spacecraft autonomy study with PE #63438F (Satellite Systems Survivability) and flight tests its payloads via PE #63402F (Space Test Program).

(U) WORK PERFORMED BY: Air Force Space Division, Los Angeles, CA manages the program and executes Projects 681D and 2181. Project 682J is executed by the Air Force Aero-Propulsion Laboratory, Wright Patterson AFB, OH and Project 2181 is executed by the Air Force Rocket Propulsion Laboratory, Edwards AFB, CA. Principal contractors are: Project 681D--Martin Marietta Corp, Denver, CO (Space Sextant) and TRW, Redondo Beach, CA (Multi-mission Attitude Determination and Autonomous Navigation System). Project 682J--Hughes Aircraft Co, El Segundo, CA (Nickel-Hydrogen Battery and High Efficiency Solar Panel); Project 688F--Fairchild Aerospace, Long Island, NY (Pulsed Plasma Thruster).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: There have been many major accomplishments in this program, particularly in the power supply area. The Space Vehicle Subsystems program developed and demonstrated an advanced Nickel-Cadium battery which nearly doubled energy storage per pound at geosynchronous orbit. The Fleet Satellite Communications

satellites use this technology. Nickel-Hydrogen batteries have been developed and flight tested, resulting in a factor of four improvement in the amount of electrical energy storage per pound for geosynchronous missions. For low earth orbit missions, the improvement is even greater based upon superior recharge characteristics. The high performance capabilities of these Nickel-Hydrogen batteries have resulted in their selection for use in the Satellite Data System satellites. In the solar cell area, high efficiency, radiation hardened Gallium-Arsenide cells have been developed and flight tested, permitting a one-third reduction in solar panel sizes. An earlier solar cell development demonstrated higher efficiencies from Silicon cells than previously obtained. This advanced Silicon cell technology is being used for the solar panels in the Defense Satellite Communications System satellites. Both the solar cell and battery technologies developed lead to longer life systems. Other subsystems that have completed development within this program include the Flexible Rolled-Up Solar Array which is baselined for the NASA Large Space telescope and Multi-mission Modular Spacecraft, frictionless Momentum Wheel, Space Precision Attitude Reference System, Ultraviolet Radiometer, Velocity Vector Sensor Assembly, and the Optical Angular Motion Sensor.

(U) In FY 1981, the following activities took place: Project 681D (Advanced Space Guidance Technology) -- reconfiguration and qualification testing of key components of the Space Sextant attitude reference and navigation system were accomplished to prepare it for a test flight on the Space Shuttle Orbiter. Testing of the basic sensor arrays for the Multimission Attitude Determination and Autonomous Navigation (MADAN) system was completed and fabrication of some sub-assemblies was initiated. Project 682J (Advanced Space Power Supply Technology)--the fabrication of a hardened Gallium-Arsenide High Efficiency Solar Panel was continued as was the long life test of the Nickel-Hydrogen batteries. Project 688F (Advanced Satellite Secondary Propulsion Technology)--the extended life test of the mono-propellant thruster was successfully completed. Project 2181 (Advanced Space Computer Technology) -- the brassboard development of the Fault Tolerant Spaceborne Computer (FTSC) was completed.

2. (U) FY 1982 Program: Within Project 681D (Advanced Space Guidance Technology), the Space Sextant will be integrated and tested for a space flight demonstration on a Space Test Program test flight aboard the Space Shuttle Orbiter. The FY 82 work is accomplished with a combination of Space Vehicle Subsystems FY 81 funded work and Space Test Program (PE 63402F) FY 82 funded vehicle integration effort. FY 82 program funds were deleted to fund higher priority Air Force requirements.

3. (U) FY 1983 Planned Program: Within Project 681D (Advanced Space Guidance Technology), development of the MADAN system flight prototype will be initiated. Within projet 682J (Advanced Power Supply Technology), development of a common pressure vessel for a multi-celled Nickel-Hydrogen battery will be initiated to provide a 25% weight reduction compared with single cells; fabrication and qualification of a large area Gallium-Arsenide solar panel will be initiated to prepare for a high radiation belt space flight demonstration; and developments will be initiated for a new High Energy Density Rechargeable Battery (HEDRB) and a High Voltage Power Management System (HVPMS). Within Project 688F (Advanced Satellite Secondary Propulsion Technology), definition of a space flight demonstration will be initiated for the Millipound Pulsed Plasma Thruster. Within Project 2198 (Advanced Space Technology Planning) development of the Military Space Systems Technology Model (MSSTM) will be continued.

4. (U) FY 1984 Planned Program: Within Project 681D (Advanced Space Guidance Technology), development and ground testing of the MADAN system will be continued. Within Project 682J (Advanced Space Power Supply Technology), development

Program Element: #63401F Title: Space Vehicle Subsystems
DOD Mission Area: Space Launch and Orbital Control, #410 Budget Activity: Defense-wide Mission Support, #6

and testing of Nickel-Hydrogen common pressure vessel batteries, Gallium-Arsenide solar panels, and development work on the HEDRB and HVPMS projets will be continued. Within Project 688F (Advanced Satellite Secondary Propulsion Technology), planning and testing for a space flight demonstration program for the Pulsed Plasma Thruster will be conducted. Within Project 2198 (Advanced Space Technology Planning), development of the MSSTM will be continued.

5. (U) Program to Completion: Not applicable. This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Budget Data: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63402F   Title: Space Test Program
DOD Mission Area: Space Launch & Orbital Support, #410   Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in Thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	40,978	42,639	62,573	73,738	Continuing	Not Applicable
2617	Spacecraft Missions	20,000	19,300	19,500	10,500	Continuing	Not Applicable
2618	Secondary Missions	3,078	600	4,082	5,300	Continuing	Not Applicable
2619	Shuttle Experiment Support Equipment	15,100	19,739	33,491	51,438	Continuing	Not Applicable
2620	Shuttle Sortie Missions	2,800	3,000	5,500	6,500	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Space Test Program (STP) advances DOD space technology by providing spaceflight missions for demonstrating new system designs and concepts and for determining environmental effects on military space systems. This tri-Service program provides the only substantial spaceflight capability to perform fly-before-buy demonstrations of advanced technology designs. The STP is to be the pathfinder for exploiting the Shuttle as a manned space laboratory which should expedite the infusion of new technology into space systems through the use of simpler, incrementally-designed, man-aided experiments. The experience gained from this approach will be a key element in fully defining man's military role in space.

BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds for the following: completion of the total system checkout of Teal Ruby spacecraft after payload integration is completed; orbital support for a space environmental experiment being flown on a classified host vehicle; documentation of lessons learned from the first DOD Shuttle sortie mission for use by future DOD Shuttle users; initial integration support for the Talon Gold Missions; procurement of additional Shuttle experiment support equipment and modification, as appropriate, to existing support equipment to obtain a full complement of reusable hardware; and continuation of design activities for the next Shuttle sortie mission. The programmed funds are based primarily on contracted amounts and contractor cost estimates for work involved.

Program Element: #63402F
DOD Mission Area: Space Launch & Orbital Support, #410

Title: Space Test Program
Budget Activity: Defense-wide Mission Support, #6

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	41,060	47,700	65,500		Continuing	Not Applicable
Procurement - Not Applicable						

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63402F | Title: Space Test Program

DOD Mission Area: Space Launch & Orbital Support, #410 | Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: Our national security depends on the operation of space systems which are the product of a superior technology base. The role of the Space Test Program (STP) is to keep the United States at the forefront of space technology by providing the means to fully exploit the military potential of space through a broad based on-orbit research and test capability. The STP is a tri-Service activity which provides spaceflight missions for conducting feasibility demonstrations of advanced concepts and designs which will contribute to new and improved military space systems. The program simplifies the experimenter's job by centralizing management for the many tasks that are required to launch a payload: spacecraft and/or Shuttle experiment support hardware acquisition, payload integration, launch scheduling, support services, and secondary payload space arrangement on other DOD and National Aeronautics and Space Administration (NASA) spaceflights. The STP spacecraft and Shuttle sortie missions are designed around major experiments. Additional secondary experiments are then added as the launch configuration permits. Also, flight opportunities are sought for small secondary experiments on other DOD and NASA spaceflights, where the time to respond to such opportunities is often too short for programming in advance. This program was designated by DOD to be the pathfinder in exploiting the Shuttle as a manned space laboratory for DOD experiments. This approach should expedite the infusion of new technology into space systems through the use of simpler, incrementally-designed experiments aided by man. Brassboard models can be used on the Shuttle laboratory for testing critical system technologies and evaluating the capabilities of man in space testing. Through these early tests, design decisions can be made as to the proper mix of manned and automated operations on future spacecraft. These early brassboard tests can lead to the development of more complex experiments or directly to operational military space systems. Furthermore, mission success is enhanced because payloads can be returned for reflight as needed, and by proper design of experiments to incorporate a mission/payload specialist, practical workaround opportunities increase. The experience gained from this approach will be a key element in fully defining man's military role in space. STP will serve as the transition link to effective manned control and interaction of payloads, on-orbit checkout, and on-orbit repairs. The program is tri-Service documented (AFM 80-2/AR 70-43/OPNAV 76P-2) and was reoriented for the Space Shuttle era by a new DOD policy. The Air Force is DOD's executive agent for this program. The STP program element is comprised of four projects. Project 2617 (Spacecraft Missions) supports experiments which require flight on STP-developed spacecraft. Project 2618 (Secondary Missions) supports the spaceflight of small payloads flown in groups on a low cost free-flyer spacecraft, or piggy-back on a host DOD or NASA spacecraft. Project 2619 (Shuttle Experiment Support Equipment) is for the procurement of reusable equipment and corresponding analyses to support the flight of experiments on Shuttle sortie missions. This includes the procurement of hardware to use the Shuttle as a manned DOD laboratory to support experimentation. Project 2620 (Shuttle Sortie Missions) supports the integration efforts for the spaceflight of experiments on Shuttle sortie missions, initially defined as those in which the main experiment equipment remains in the Shuttle bay and is operated either by automatic control or by a mission/payload specialist during the short time the Shuttle is on orbit.

(U) RELATED ACTIVITIES: Atlas-F vehicles and their corresponding launch support is provided by Space Boosters, Program Element (PE) #35119F. Shuttle launch support and Inertial Upper Stage (IUS) systems are provided by Space Launch Support, PE #35171F. Payloads are supported by the following: Office of Naval Research; Naval Research Laboratory; Army Atmospheric Sciences Laboratory; Defense Advanced Research Projects Agency, PE #62301E, PE #62711E, and PE #62701E; National Aeronautics and Space Administration; Atmospheric Sciences, PE #61120F; Geophysics, PE #62101F; Materials, PE #62102F; Aerospace Propulsion, PE #62203F; Advanced Weapons, PE #62601F; Space Surveillance Technology, PE #63428F; Satellite

Program Element: #63402F
DOD Mission Area: Space Launch & Orbital Support, #410

Title: Space Test Program
Budget Activity: Defense-wide Mission Support, #6

Systems Survivability, Program Element (PE) #63438F; Space Vehicle Subsystems, PE #63401F; Systems Survivability PE #64711F; and Advanced Space Communications, PE #63431F.

(U) WORK PERFORMED BY: The United States Air Force, Headquarters Space Division, Los Angeles, CA, is responsible for spaceflight planning, engineering, procurement, and operational aspects required to execute the Space Test Program (STP). Systems engineering support is provided by the Aerospace Corporation, Los Angeles, CA. Current payload integration and/or spacecraft contractors are Rockwell International, Seal Beach, CA, and Lockheed Missiles and Space Company, Sunnyvale, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: There have been 33 launches since the first one in 1967: 15 primary and 18 secondary. The primary missions were launched by the STP using three Thor, eight Atlas, two Titan IIIC, one Delta, and one Scout launch vehicles. The secondary missions used space on other DOD and National Aeronautics and Space Administration flights. Ninety-nine payloads have been successfully launched to date. The most recent missions flown were successfully launched in 1979--two primary and one secondary. The primary missions launched were Spacecraft Charging at High Altitudes (SCATHA) free-flyer spacecraft and Gamma Ray Spectrometer free-flyer spacecraft. Other significant past STP missions include the following: Lincoln Laboratory's Experimental Satellite (LES 6) demonstrated feasibility of Ultra High Frequency (UHF) space communications; LES 8/9 proved new concepts to increase the survivability of future space communication systems; Timation III was a successful prototype of the Global Positioning System (GPS); and

During FY 81, the following activities were accomplished. Project 2617 (Spacecraft Missions) activities were to integrate and independently test most of the major modules on the Teal Ruby spacecraft structure and to continue to provide data reduction support for the SCATHA and Gamma Ray Spectrometer missions. One of the Project 2618 (Secondary Missions) activities was to provide for prelaunch checkout followed by orbital support of the Host Vehicle Pallet (HVP) mission being launched on a classified host vehicle. Of the two Navy experiments being flown on this mission, one is to study solar flare energy conversion and acceleration mechanisms from solar particle isotopes; the other is to assess the potential of stimulated wave-particle interactions as a means to affect communication systems through control of precipitation from radiation belts. Another project activity was to perform payload integration and begin testing of an Air Force space environmental experiment that will be flown on a Defense Meteorological Satellite Program spacecraft. Still another activity is providing data reduction support for a previous HVP mission. Project 2619 (Shuttle Experiment Support Equipment) is capitalizing on the reusable Shuttle sortie support hardware begun under the cancelled Program This hardware development will be continued under and for STP. The use of the hardware enables support of an important, early DOD Shuttle sortie mission not possible otherwise. Although the hardware is limited in capability, it is considered an early version of that needed for Shuttle exploitation with non-complex, man-aided experiments. Another project activity was to provide documentation on this first DOD Shuttle mission for use by all future DOD Shuttle users. The documentation covers common integration procedures for sortie payloads with the Space Transportation System, launch procedures, methods of training and operation, and "lessons learned."

Program Element: #63402F Title: Space Test Program
DOD Mission Area: Space Launch & Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

Under Project 2620 (Shuttle Sortie Missions), the design and mission planning efforts are being performed for flight of the first DOD Shuttle mission which will use the STP hardware being developed under STP Project 2619.

2. FY 1982 Program: During FY 82, the following activities are planned. The Project 2617 (Spacecraft Missions effort is to initiate the total system checkout of the Teal Ruby spacecraft after payload integration is completed. The Teal Ruby mission, known by its primary Defense Advance Research Projects Agency (DARPA) payload of the same name, carries Air Force, Army, and National Aeronautics and Space Administration secondary payloads as well. The DARPA experiment will demonstrate new infrared technologies and collect data needed for the design of future space-based aircraft and missile detection system Under Project 2618 (Secondary Missions), after prelaunch checkout is completed, orbital support will be provided for an Air Force experiment being flown on a Defense Meteorological Satellite Program spacecraft to learn how to better predict auroral conditions affecting communications systems. One Project 2619 (Shuttle Experiment Support Equipment) activity is to complete the development of the early version of reusable sortie hardware supporting the first DOD Shuttle mission. Another activity is to begin procurement of needed additional, reusable Shuttle sortie hardware and to make modifications, as appropriate, to existing sortie hardware. This will provide a full complement of reusable hardware in support of future sortie missions and will enable exploitation of the Shuttle as a manned space laboratory. Within Project 2620 (Shuttle Sortie Missions), all mission activities will be completed to support the flight of the Prior to launch, the payloads will be integrated on the early version sortie hardware and then tested. The composite structure will then be integrated on the Shuttle. Lessons learned will be documented for future DOD users. This mission is referred to by the name of its primary payload--

The Shuttle environment (contamination) data will help define the Shuttle environment for use in the design of future Shuttle sortie payloads. This mission will additionally provide DOD with the early experience needed to learn how to use the Shuttle effectively. Another project activity is to start the design activities for the future Shuttle sortie missions. Planning and design work will begin for the first DARPA Talon Gold mission, as well as, planning for the with a modified

(U) The reduction in FY 1982 program funds compared with those projected in the FY 1982 Descriptive Summary are a result of Air Force funding priorities at the program level. The primary impact of this reduction is cancellation of efforts to initiate a new mission and delay in the purchase of reusable equipment for Shuttle sortie missions.

3. FY 1983 Planned Program: Project 2617 (Spacecraft Missions) activity will complete total system checkout of the Teal Ruby Spacecraft and Under Project 2618 (Secondary Missions), the National Aeronautics and Space Administration (NASA) will provide technical support and flight acceptance testing for the Space Test Program experiments planned for launch from the Kennedy Space Center on the NASA Long Duration Exposure Facility reusable, free-flying satellite. The satellite launch and retrieval dates are subject to NASA scheduling. Current plans reflect an on-orbit mission of over 12 months. One experiment will allow determination of space environmental effects on spacecraft materials; another will examine the space effects on active/passive radiation-hardened fiber optics components. Planning and integration activities will be initiated for an experiment on radar propagation in

the ionosphere to be flown in FY 84 as a Host Vehicle Pallet (HVP) mission (HVP II) on a classified host satellite. Projects 2619 and 2620 activities will include and continuation of the Talon Gold I planning. Refurbishment of the will begin. Spacelab hardware will be obtained from or through NASA to support the flight of the Talon Gold payloads. Source selection will be initiated for the integration contract.

4. FY 1984 Planned Program: Project 2617 (Spacecraft Missions) activity will integrate the Teal Ruby spacecraft and its mounting structure on Under Project 2618 (Secondary Mission) additional payloads will be integrated onto NASA's Long-Duration Exposure Facility. Exact launch and retrieval dates are subject to NASA scheduling. Also, a radar propagation experiment will be flown on a Host Vehicle Pallet mission (HVP II) on a classified host satellite. Projects 2619 and 2620 will continue integration efforts for Talon Gold I and begin the effort of

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

Project: #2617 Title: Spacecraft Missions
Program Element: #63402F Title: Space Test Program
DOD Mission Area: Space Launch & Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This project supports the spaceflight of payloads on Space Test Program (STP) developed spacecraft. The missions are launched through STP use of expendable launch vehicles (Thor, Atlas, Titan, Delta, and Scout) or the Shuttle. Inertial Upper Stages (IUSs) are used for orbits requiring them. When practical, STP uses standardized boosters and spacecraft modules to increase the probability of mission success and minimize cost.

(U) RELATED ACTIVITIES: Atlas-F vehicles and launch support are provided by Space Boosters, Program Element (PE) #35119F. Shuttle launch support and Inertial Upper Stage (IUS) systems are provided by Space Launch Support, PE #35171F. Payloads are supported by the following: Office of Naval Research; Naval Research Laboratory; Army Atmospheric Sciences Laboratory; Defense Advanced Research Projects Agency (DARPA), PE #62301E, PE #62711E, and PE #62701E; National Aeronautics and Space Administration (NASA); Atmospheric Sciences, PE #61102F; Geophysics, PE #62101F; Materials PE #62102F; Space Surveillance Technology, PE #63428F; Satellite Systems Survivability, PE #63438F; Space Vehicle Subsystems, PE #63401; and Advanced Space Communications, PE #63431F.

(U) WORK PERFORMED BY: The United States Air Force, Headquarters Space Division, Los Angeles, CA is responsible for spaceflight planning, engineering, procurement, and operational aspects required to execute the program. Systems engineering support is provided by the Aerospace Corporation, Los Angeles, CA. The primary contractor for the Teal Ruby spacecraft is Rockwell International, Seal Beach, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Since 1967, 15 primary missions, successfully carrying 61 payloads, have been launched using three Thor, eight Atlas, two Titan IIIC, one Delta, and one Scout launch vehicles. The most recent missions were successfully launched in 1979: Spacecraft Charging at High Altitudes (SCATHA) on a Delta 2914 from Cape Canaveral Air Force Station and Gamma Ray Spectrometer on an Atlas-F from Vandenberg Air Force Base. The Air Force/Navy/NASA SCATHA mission is carrying 12 experiments to learn how to protect spacecraft in geosynchronous orbit from transient electrical outages and malfunctions caused from spacecraft charging, thus improving operational performance and their survivability. The Gamma Ray Spectrometer mission, known by its primary DARPA payload of the same name, carries six secondary payloads. The objective of the Gamma Ray spectrometer payload is to demonstrate the feasibility of a

In FY 1980, orbital support and data reduction support were continued for these latter missions. Also, the Teal Ruby spacecraft structure was completed and many of its modules were integrated on the Teal Ruby spacecraft and independently tested.

2. FY 1982 Program: Total system checkout of the Teal Ruby spacecraft will be initiated after the payloads have been integrated to spacecraft. The Teal Ruby mission, known by its primary Defense Advanced Research Projects Agency (DARPA) payload of the same name, also carries three secondary payloads. The Teal Ruby experiment objectives are: (1)

Project: #2617 Title: Spacecraft Missions
Program Element: #63402F Title: Space Test Program
DOD Mission Area: Space Launch & Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

One of the secondary payloads is to test the National Aeronautics and Space Administration's (NASA) Mercury Ion Thruster, a millipound thruster for long-term station-keeping applications. Another secondary payload is to test an Air Force experiment to demonstrate new laser communication technologies. The third payload is to test an Army Extreme Ultraviolet (EUV) photometer.

3. FY 1983 Planned Program: During this period, the total system checkout of the Teal Ruby spacecraft will be completed and the

4. FY 1984 Planned Program: New free-flying spacecraft missions will be planned based on experiment requirements, launch opportunities, and funding availability.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	20,000	19,300	19,500	10,500	Continuing	Not Applicable

8. (U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	21,800	14,900	14,000		Continuing	Not Applicable

(U) Reasons for the increases in FY 1982 and 1983 compared to that projected last year for this period include the following: the Teal Ruby spacecraft contractor's underestimate of efforts to resolve technical problems, delay in the Teal Ruby payload delivery due to payload development problems, and cost growth in some of the Teal Ruby spacecraft subcontracts.

Project: #2619 | Title: Shuttle Experiment Support Equipment
Program Element: #63402F | Title: Space Test Program
DOD Mission Area: Space Launch & Orbital Support, #410 | Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This project is for the procurement of reusable, basic standard equipment to enable economical use of the Shuttle to support DOD sortie experimentation and procurement of sophisticated, reusable equipment to support the use of Shuttle as a manned DOD space testing laboratory. Shuttle sortie missions are defined as those in which the main experiment/experiment support equipment remains in the Shuttle bay and is operated either by automatic control from the ground or by a mission/payload specialist during the short time the Shuttle is in orbit. All of the standard equipment (basic or sophisticated) will be designed to incorporate features compatible with "class cargo certification." The class cargo analytical certification process that will be performed is intended to minimize repetitive Shuttle integration verification analyses and tests (and the associated costs) by qualification of a worst-case requirements envelope to include experiment configuration, its position within the Orbiter and thermal, electromagnetic compatibility, contamination and safety requirements.

(U) RELATED ACTIVITIES: Maximum utilization will be made of hardware, software, and data developed or being developed by the DOD, National Aeronautics and Space Administration, European Space Agency, and others.

(U) WORK PERFORMED BY: The United States Air Force, Headquarters Space Division, Los Angeles, CA is responsible for the hardware procurements. Systems engineering support is provided by the Aerospace Corporation, Los Angeles, CA. The primary contractor for the present Shuttle sortie mission equipment is Lockheed Missiles and Space Company, Sunnyvale, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 Program and Prior Accomplishments: In FY 1981, two funding cuts occurred in the Space Test Program budget due to Air Force funding priorities: one in FY 1981 and one in FY 1982. Also, the opportunity arose then to capitalize on the reusable Shuttle sortie support hardware begun under the now cancelled Program [ ] The decision was made for the Space Test Program to continue the development of the Program [ ] hardware as an Experiment Support System (ESS) and to delay its original plans for full procurement of the sortie hardware needed to exploit the Shuttle as a manned space laboratory. Although the Program [ ] hardware is limited in capability, it is considered an early version of that needed for Shuttle exploitation with noncomplex, minimally manaided experiments. The use of this hardware enables support of an important, early DOD Shuttle sortie mission in 1982 not possible otherwise. Also, within this project, documentation on this first DOD Shuttle mission is being generated for all DOD Shuttle users. It will cover common integration procedures of sortie payloads with the Space Transportation System, launch procedures, methods of training and operation, and "lessons learned."

2. FY 1982 Planned Program: The development of the early version reusable sortie hardware, the [ ] will be completed and used to support the first DOD Shuttle mission - [ ] Also, planning action will begin to procure additional reusable Shuttle sortie hardware and to make modifications, as appropriate, to existing sortie hardware. This is to obtain a full complement of reusable hardware in support of future sortie missions.

3. FY 1983 Planned Program: The [ ] used for the flight of [ ] Procurement will begin to obtain the additional and upgraded hardware

Project: #2619 Title: Shuttle Experiment Support Equipment
Program Element: #63402F Title: Space Test Program
DOD Mission Area: Space Launch & Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

to provide a full complement of reusable Shuttle sortie equipment. Plans will be developed for the procurement of hardware to equip the Shuttle as a DOD space test laboratory. Action to obtain Spacelab hardware outright or by lease through NASA will be initiated to support the flights of the Defense Advanced Research Project Agency's (DARPA) Talon Gold payloads

4. (U) FY 1984 Planned Program: The procurement of upgraded and expanded hardware to support future sortie experiment missions will continue. Planning will continue on the procurement of hardware for the development of Shuttle as a DOD space testing laboratory. Actions will continue to obtain equipment for the support of the DARPA Talon Gold missions.

5. (U) Program To Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimate Costs
RDT&E	15,100	19,739	33,491	51,438	Continuing	Not Applicable

8. (U) Comparison With FY 1982 Budget Data:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimate Costs
RDT&E	12,900	24,700	38,100		Continuing	Not Applicable

The reductions in the FY 1982 and FY 1983 project funds compared with those projected in the FY 1982 Description Summary are a result of Air Force funding priorities at the program level. Some funds were transferred to Project 2617 to resolve Teal Ruby problems. A primary impact is to delay the purchase of some basic, Shuttle sortie mission equipment and the hardware needed for exploitation of the Shuttle as a manned laboratory. This action will delay some sortie missions. Fortunately, the use of residual hardware from Program [ ] will enable STP to fly another important early sortie mission even sooner. [ ]

Project: #2620 Title: Shuttle Sortie Missions
Program Element: #63402F Title: Space Test Program
DOD Missison Area: Space Launch & orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

DETAILED BACKGROUND AND DESCRIPTION: This project supports the spaceflight of Shuttle sortie missions, initially defined as those in which the main experiment equipment remains in the Shuttle bay and is operated either by automatic control or by a mission/payload specialist during the short time the Shuttle is on orbit. This project provides for the integration of DOD experiments with the [ ] as a sortie mission payload, the integration of the sortie mission payload by the National Aeronautics and Space Administration (NASA) (through the DOD payload integration contractor), mission/payload specialist training, on-orbit support, and [ ]

(U) RELATED ACTIVITIES: Shuttle launch support is provided by Space Launch Support, Program Element 35171F. Payloads flown are provided by the Military Services or DOD agencies.

(U) WORK PERFORMED BY: The United States Air Force, Headquarters Space Division, Los Angeles, CA, is reponsible for spaceflight planning, engineering, procurement, and operational aspects required to execute the program. Systems engineering support is provided by the Aerospace Corporation, Los Angeles, CA. The primary contractor for the first Shuttle sortie mission is Lockheed Missiles and Space Company, Sunnyvale, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 And Prior Accomplishments: Design and hardware modifications were made for flight of the Air Force Space Sextant experiment as a secondary mission on host Program [ ] hardware. The [ ] was previously scheduled for flight in 1981 on the Satellite Infrared Experiment (SIRE) spacecraft cancelled in 1979. Since Program [ ] was cancelled in early FY 1981, the [ ] will be flown as one of the experiments on the first Space Test Program Shuttle sortie mission using the Program [ ] This mission is known by the name of its primary payload- [ ] Other activities included examination of how various Space Test Program experiments could best exploit man and definition of the training that would be required for his use.

2. FY 1982 Planned Program: All mission integration activities will be completed for the flight of the first DOD payload on Shuttle. The payload will be [ ] Prior to launch, the payloads will be integrated on the [ ] and then tested. The composite structure will then be integrated on the Shuttle. Lessons learned will be documented for future DOD users. The primary mission payload, [ ] Another payload is the [ ] The Shuttle crew will have the capability to backup important mission tasks from a control panel in the Shuttle aft flight deck. Also, design activities will begin for the next Shuttle sortie mission.

Project: #2620 Title: Shuttle Sortie Missions
Program Element: 563402F Title: Space Test Program
DOD Mission Area: Space Launch & Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

3. FY 1983 Planned Program: Planning will begin for the integration of the experiment on the refurbished utilized for the flight of Source selection will be initiated for the integration contract. Planning will continue for the use of additional and upgraded hardware procured to provide a full complement of reusable Shuttle sortie equipment. as well as publication of lessons learned from the first DOD Shuttle mission. The Talon Gold integration contract will be awarded.

4. FY 1984 Planned Program: The integration contract will be awarded and planning and mission support activities for Talon Gold will continue. The procurement of upgraded and expanded hardware to support future missions will continue.

5. (U) Program To Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimate Costs
RDT&E	2,800	3,000	5,500	6,500	Continuing	Not Applicable

8. (U) Comparison With FY 1982 Budget Data:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional To Completion	Total Estimate Costs
RDT&E	4,900	7,300	12,700		Continuing	Not Applicable

(U) The reduction in FY 1982 and FY 1983 project funds compared with those projected in the FY 1982 Descriptive Summary are a result of Air Force funding priorities at the program level. Some funds were transferred to Project 2617 to resolve Teal Ruby problems. The primary program impact was to delay the purchase of much of the hardware needed for exploitation of the Shuttle as a manned laboratory, and programs such as Talon Gold.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63406F
DOD Mission Area: #410, Space Launch and Orbital Control

Title: Advanced Military Spaceflight Capability
Budget Activity: #6, Defense-wide Mission Support

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	Total for Program Element	0	0	2,670	3,366	Continuing	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This applied, advanced technology program will establish a technology base suitable for development of responsive, flexible, and economical military space transportation systems in the 1990's. The program includes concept studies to expand the conceptual base to include several alternative configurations for earth launched and orbit transfer vehicles; utility analyses to determine the values of these configurations in performing various military missions in space; and identification and solution of long lead technology problems.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This is a new start, technology base program. A Joint Mission Element Needs Statement (JMENS) exists for a Contingency Launch System (CLS). This technology development program will support this related JMENS which details the need for a military launch capability with enhanced responsiveness and survivability.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: N/A

(U) OTHER APPROPRIATION FUNDS: N/A

Program Element: #63406F
DOD Mission Area: #410, Space Launch and Orbital Control

Title: Advanced Military Spaceflight Capability
Budget Activity: #6, Defense-wide Mission Support

(U) DETAILED BACKGROUND AND DESCRIPTION: This is the Department of Defense's only applied, advanced technology program for defining, developing and demonstrating space launch and orbital transfer vehicle technology required for military space mission support in the 1990's. Both manned and unmanned vehicle concepts will be considered. In the area of launch vehicles, previous studies have defined a Reusable Aerodynamic Space Vehicle (RASV) and determined its technical feasibility. This RASV concept, Shuttle Derivative Launch Vehicle (SDLV) concepts , Ballistic Missile Derivative Launch Vehicle (BMDLV) concepts and other new concepts to be defined will be evaluated for utility in supporting the military space missions identified by ADCOM and SAC in operational studies. In the area of orbit transfer vehicles, previous studies have defined a reusable Orbit Transfer Vehicle and a Manned Orbital Transfer Vehicle. These and other new vehicle concepts will be evaluated for utility in conjunction with various launch vehicles and Space Station concepts as applied to military space missions. The vehicle concepts which show significant value will be evaluated for technology readiness to support a development effort. In those areas in which the supporting technology is found to be immature, technology development road maps will be developed to define technology goals, milestone dates, and related costs. The general areas of technology development will include airframe/spaceframe structures, thermal protection systems, primary propulsion, guidance and control, communications, ground support, operations, and life support systems.

(U) RELATED ACTIVITIES: The following relationships exist with other activities. This program will receive inputs from NASA development studies relating to the Reusable Orbit Transfer Vehicle, Manned Orbital Transfer Vehicle, Shuttle Derived Cargo Vehicle, and Space Operations Center (SOC) concepts; and from DOD development studies relating to the Maneuvering Reentry Research Vehicle (MRRV). Military Space Mission Analysis studies are being conducted by the AFSC Space Division, and Military Spaceflight Systems Concept Identification studies are being conducted by the Air Force Wright Aeronautical Laboratories. Defense Advanced Research Projects Agency (DARPA) will conduct studies and wind tunnel tests relating to hypersonic maneuvering vehicles.

(U) WORK PERFORMED BY: Air Force Space Division, Los Angeles, CA will manage the program. Technology development work will be conducted by the Air Force Wright Aeronautical Laboratories, Wright Patterson AFB, OH and the Air Force Rocket Propulsion Laboratory, Edwards AFB, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 81 and Prior: N/A

2. (U) FY 82 Program. N/A

3. (U) FY 83 Planned Program: FY 83 will be the first year that funds will be expended under this program element. Operational system definition studies will be conducted to define, for leading candidate spaceflight vehicles concepts, the methods, facilities, and support equipment necessary to operate the selected vehicle. This will include logistics, command, control, communication, and primary and alternate basing. Utility analyses will be initiated with emphasis on the military aspects of the total system concept, especially responsiveness and survivability. These studies will define the space operations architecture associated with each candidate concept. A technology development plan will be developed to identify the critical and promising technologies that must be pursued to enable the candidate concepts

to be realized. The technology development road maps that will be created will map out technology programs with specific goals, milestones and costs to achieve those goals.

4. (U) FY 84 Planned Program: Utility analyses will be continued to further refine and focus the system concept definitions. The bulk of the funding will be used for technology development projects in the laboratories aimed at developing and demonstrating critical subsystems or structures. The projects will focus on airframe/spaceframe structures, thermal protection systems, primary propulsion, guidance and control, communications, ground support, operations and life support systems.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES: N/A

7. (U) RESOURCES: N/A

8. (U) COMPARISON WITH FY 82 DESCRIPTIVE SUMMARY: N/A

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63438F — Title: Satellite Systems Survivability

DoD Mission Area: Space Launch and Orbital Support, #410 — Budget Activity: Defense Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	24,048	11,058	22,525	38,304	Continuing	Not Applicable
2611	Survivability Strategy and Policy	5,221	996	1,334	1,754	"	"
2612	Satellite Survivability	12,082	5,289	4,787	15,594	"	"
2613	Ground Station/Link Survivability	6,745	4,773	16,404	20,956	"	"

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops the necessary prototype hardware, software technology, and operational procedures that will provide non-program unique survivability capabilities for the military space systems of the United States. It is the basis to assure that those functions performed by our space systems critical to our national defense survive commensurate with their planned need in crisis and war. The program is structured to provide balanced survivability between all space systems elements: satellites, data-links, and operation centers.

BASIS FOR FY 1983 RDT&E REQUEST: Updates the Space Mission Survivability Implementation Plan as a baseline survivability architecture planning document. Begins development of a flight capable Satellite Defense System to counter the demonstrated Soviet ASAT threat. Begins development of surveillance sensor survivability techniques for the nuclear and laser threat, and development of laser threat avoidance techniques. Continues the ongoing effort to develop a validation model of the Transportable/Mobile Ground Station which will provide semiautonomous tracking, telemetry, and control data to remote tracking stations in emergency situations. Completes testing of a validation model of the Adaptive Sidelobe Cancellation System Cost estimates are based on System Program analyses and contractor cost proposals. Reduced FY 1982 (originally $38,500K) and FY 1983 funding slips all other survivability efforts a minimum of 18 months to two years relative to schedules presented in the FY 1982 Descriptive Summary.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	31,700	11,300	44,500	-	Continuing	Not Applicable

Program Element: #63438F   Title: Satellite Systems Survivability
DoD Mission Area: Space Launch and Orbital Support, #410   Budget Activity: Defense Wide Mission Support, #6

The significant reduction in FY 1983 funding relative to the amount shown in the FY 1982 Descriptive Summary reflects a reassessment of the priority of this program with respect to other Air Force needs.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63438F Title: Satellite Systems Survivability

DoD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense Wide Mission Support, #6

DETAILED BACKGROUND AND DESCRIPTION: Space systems are required to provide critical strategic and tactical support to national decision makers and military force commanders at all levels of conflict. They specifically provide missile attack warning, strategic and tactical navigation, surveillance, reconnaissance, forces command and control communications, and meteorological information. These systems provide support to strategic, tactical, and Rapid Deployment Forces on a global basis.

Failure to protect our space systems will most probably result in the denial of their critical support to the National Command Authority and our military forces during crisis and conflict.

This Program Element develops prototype systems, subsystems, technologies, and operational procedures for increasing the survivability of space systems (satellites, data links, and ground elements) against ground, air, and space-based conventional, nuclear, and hostile electromagnetic radiation threats. Initial integration of survivability systems into satellites and ground stations is also provided. Nuclear hardening technology developed in other programs is applied in this Program Element in support of survivability efforts. The program is divided into three projects. Project 2611 - Survivability Strategy and Policy--Examines the mission requirements of Department of Defense (DoD) space systems, evaluates their vulnerability to current and future threats, and determines the most cost effective methods to achieve required survivability. An overall Space System Survivability Architecture, including plans and programs, is developed to enhance survivability. Project 2612 Satellite Survivability--Develops systems, subsystems, technology, and operation procedures to counter the ASAT to DoD satellites. Develops non-program unique prototype initial operational capability survivability systems (see separate Descriptive Summary for Project 2612). Project 2613 - Ground Station/Link Survivability--This project develops systems, subsystems, technology and operational procedures to counter threats against space system data links and satellite command and control ground stations (see separate Descriptive Summary for Project 2613).

(U) RELATED ACTIVITIES: This program is part of the larger Space Defense Systems Program involving four functional areas; Space Surveillance (PEs 63428F & 12424F), Space Defense Systems and Operations (PEs 64406F & 12450F), Space Defense Command & Control Operations (PE 12311F), and Space Systems Survivability (PE 63438F). PE 63428F, Space Surveillance Technology, develops advanced sensors and prototype space systems to improve the U.S. surveillance and warning information processing system to meet the evolving needs of the Space Defense Systems Program. PE 12424F, SPACETRACK, provides for the production, deployment, and operational integration of surveillance and command and control components into the operational inventory. PE 64406F, Space Defense Systems (Antisatellite) supports the development of non-nuclear antisatellite capabilities. PE 12450F, Space Defense Operations, provides for the production and deployment of antisatellite systems selected for transition from engineering development to the operational inventory. PE 12311F, NORAD Combat Operations Center, develops the Space Defense Operations Center (SPADOC) to integrate and coordinate all elements of the Space Defense Systems Program and insure the appropriate command and control functions are available to employ the satellite survivabilities countermeasures developed under this program. PE 62601F, Advanced Weapons, and PE 64711F, Systems Survivability, develop nuclear hardening technology which is applied in PE 63438F.

Program Element: #63438F | Title: Satellite Systems Survivability
DoD Mission Area: Space Launch and Orbital Support, #410 | Budget Activity: Defense Wide Mission Support, #6

WORK PERFORMED BY: The Air Force Systems Command's Space Division, Los Angeles, CA, manages this program. General Electric, Valley Forge, PA, and TRW Space and Missile Systems Group, Redondo Beach, CA, are developing the laser Integrated Test System (managed for Space Division by the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, Ohio). TRW is also developing a Ford Aerospace and Communications Corporation, Sunnyvale, CA, is developing Ground Station and Link Survivability systems including a validation model Transportable Mobile/Ground Station. Hughes Aircraft Company, Fullerton, CA, is developing the Adaptive Sidelobe Cancellation System.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: sensor that detects and reports a on a satellite was developed and has been deployed on Space Mission Survivability Implementation Plans (SMSIP) were developed for all Space Division space programs. The Spacecraft Charging at High Altitude (SCATHA) space experiment was launched and analysis of data is continuing. Development of specifications began for the Space Defense Operations Center (SPADOC) to provide command and control of all space defense systems. Development of the Modular Responsive Defense System was initiated, and the program pursued through Preliminary Design Review. It was terminated at that point because of anticipated growth in size, weight, and prime power requirements. Technology applications of The Laser Countermeasures Demonstration Program was initiated to Development of an laser Integrated Test System to test laser hardened satellite materials and countermeasures was initiated. The Ground Station and Link Survivability Program to develop prototype systems to enhance the survivability of satellite operation centers, and space system data links was also started. Concept definition and preliminary design of a Development of a space system architecture for survival of critical space systems commensurate with requirements and the threat was also begun. Evaluation of current Department of Defense space systems to identify the most cost effective methods to achieve survivability was also initiated A physical site security program to enhance the physical security of current DoD satellite operation centers was also begun.

2. FY 1982 Program: Completes survivability effectiveness analyses for all DoD space systems. Updates the SMSIP commensurate with the architecture and effectiveness analyses. Continues data reduction from the Spacecraft Charging at High Altitude experiment. Continues the development of Continues development of a Continues development of an Emergency Remote Tracking Station (ERTS) as a proof-of-concept, limited capability, transportable/mobile satellite command and control ground station. Accelerates development of the Adaptive Sidelobe Cancellation System. Completes preliminary design of the survivable Transportable Mobile Ground Station (TMGS). Begins Program Office concept validation of the Satellite Defense System,

Program Element: #63438F Title: Satellite Systems Survivability

DoD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense Wide Mission Support, #6

3. FY 1983 Planned Program: Updates the Space Mission Survivability Implementation Plan and provides minor updates of the Survivability Architecture. Delivers the Adaptive Sidelobe Cancellation System and

Completes Preliminary Design Review for the Transportable Mobile Ground Station, and continues development toward the Critical Design Review. Continues development of the Integrated Flux Receiver. All other programs are delayed and reinitiated in FY 1986. The significant reduction in FY 1983 funding relative to the amount shown in the FY 1982 Descriptive Summary reflects a reassessment of the priority of this program with respect to other Air Force needs.

4. FY 1984 Planned Program: Completes a new survivability architecture and Space Mission Survivability Implementation Plan (SMSIP) update. Develops a Military Standard on spacecraft charging.

Continues the development of the Transportable Mobile Ground Station. Continues development of the Satellite Defense System. All other programs are delayed and reinitiated in FY 1986.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Budget Data: Not Applicable

Project: #2613 Title: Ground Station/Link Survivability
Program Element: #63438F Title: Space Systems Survivability
DoD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense Wide Mission Support, #6

DETAILED BACKGROUND AND DESCRIPTION: The Soviet Union has developed, and is continuing to develop, a formidable range of threats that could deny us the use of our military space systems. They have a capability

This project develops systems, subsystems, technology, and operational procedures to and provide backup capabilities to mitigate the effects of natural disasters.

(U) RELATED ACTIVITIES: Program Element 63431F, Advanced Space Communications Capabilities, develops technology, subsystems, and systems which could improve the antijam performance of follow-on Transportable/Mobile Ground Stations.

(U) WORK PERFORMED BY: The Air Force Space Division manages this effort. Ford Aerospace and Communications Corporation, Sunnyvale, CA, is developing Ground Station and Link Survivability systems including a validation model Transportable/Mobile Ground Station. Hughes Aircraft Company, Fullerton, CA, is developing the Adaptive Sidelobe Cancellation System. The Aerospace Corporation, El Segundo, CA, provides general systems engineering and technical integration.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Development of the Transportable/Mobile Ground Station began in FY 1980. The Transportable/Mobile Ground Station will provide semiautonomous tracking, telemetry, and control data to remote tracking stations in emergency situations. Development of the Adaptive Sidelobe Cancellation System, in FY 1979.

2. (U) FY 1982 Program: Continues development of the validation model Transportable/Mobile Ground Station and the Adaptive Sidelobe Cancellation System.

3. FY 1983 Planned Program: Continues development of the Transportable/Mobile Ground Station. Completes fabrication of the Adaptive Sidelobe Cancellation System, which is then

4. (U) FY 1984 Planned Program: Continues development of the Transportable/Mobile Ground Station.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

Project: #2613 — Title: Ground Station/Link Survivability

Program Element: #63438F — Title: Satellite Systems Survivability

DoD Mission Area: Space Launch and Orbital Support, #410 — Budget Activity: Defense Wide Mission Support, #6

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	6,745	4,773	16,404	20,956	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Budget Data:

RDT&E	5,900	2,800	12,900	-	Continuing	Not Applicable

(U) Increased emphasis on the Transportable/Mobile Ground Station and Adaptive Sidelobe Cancellation System was responsible for a greater expenditure of funds in Project 2613 in FY 1981 than predicted. The increased amount allotted for FY 1982 and FY 1983, relative to other efforts in the Program Element, provides additional support for these two projects which are necessary for an enduring satellite control capability.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63707F
DOD Mission Area: Global Military Environmental Support, #420

Title: Weather Systems (Advanced Development)
Budget Activity: Defense-wide Mission Support #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2,663	2,889	3,438	3,367	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force critically needs the ability to observe and collect essential weather information in battle areas not under friendly control. Employment of precision guided munitions requires specific environmental information unique to the weapon's sensing systems which is not available through present weather observing and forecasting techniques. This program develops the technology to gather required weather information and process it for use by battle staff planners and aircrews to insure effective employment of conventional or precision guided munitions under battlefield conditions.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request provides funds for development of prototype sensors to observe and collect battlefield weather data. This includes evaluation of platforms for delivery of weather sensor packages. The request also includes development of techniques to apply these data to present and planned advanced weapon systems such as precision guided munitions using infrared, visible, and millimeter (radar) wavelength sensors. Funding amounts are based on initial cost estimates by Air Force Systems Command.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	2,663	2,875	3,600		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63707F
DOD Mission Area: Global Military Environmental Support, #420

Title: Weather Systems (Advanced Development)
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: Accurate delivery of conventional and precision guided munitions depends heavily on environmental conditions. Conventional munition delivery is limited by visibility and clouds in tactical operations. Unique sensing systems employed by precision guided munitions require specific visibility and background information in their sensing regimes (infrared, millimeter wave, visible) for the combat zone. None of this information is available from present weather sensors under battlefield conditions. A capability to gather this critical information is required for uncontrolled or hostile battle areas, along with techniques (called tactical decision aids) which apply the information for effective delivery of present and planned weapons. Fixed/bare base support requirements have similiarly unique sensor needs which will be addressed.

(U) RELATED ACTIVITIES: Results of advanced development projects in this Program Element are implemented through Program Element 64707F, Weather Systems (Engineering Development) and Program Element 35111F, Weather Service (Other Procurement). FY 1982 Science and Technology Program Apportionment Review to the Office of the Under Secretary of Defense for Research and Engineering provided a forum for triservice coordination of efforts in battlefield forecasting techniques. The Defense Atmospheric Transmission Plan is the focal point for environmental support for precision-guided munitions delivery. Working level contact with the Army and Navy continues, avoiding unnecessary parallel development of techniques and systems. Finally, a workshop was held in August 1981 to coordinate defense electro-optical/millimeter wave environmental support for tactical operations.

(U) WORK PERFORMED BY: Program Management is provided by Air Force Geophysics Laboratory, Hanscom AFB MA. Technical work for this Program Element is accomplished by contractors such as Systems and Applied Sciences Corporation, Riverdale, MD, and Science Applications Incorporated, La Jolla, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 ACCOMPLISHMENTS: A laboratory model of a visibility meter has been designed, fabricated, and tested in an environmental chamber under a wide range of visibilities. A data distribution study has addressed communications for the deployment options, i.e., satellites, remotely piloted vehicles, artillery or rocket launched dropsondes or ground implants. To support delivery vehicle concepts, weight and power estimates have been established for sensor communication and relay subsystems. These estimates will define future payload constraints. A tactical decision aid for infrared systems is nearing completion. A preliminary rain/transmission model is complete. A simple and accurate insolation model, a component of the target-background contrast model is complete. A research grade system performance model is being transformed into an operational tactical decision aid. In addition, advanced development of severe storm analysis and forecast techniques using Dopper weather radar data was initiated.

2. (U) FY 1982 PROGRAM: Three major thrusts are planned for FY 1982. The first is the evaluation of data needs and deployment scenarios for delivery of tactical weather sensor packages into uncontrolled and hostile areas. Unmanned recoverable and expendable alternatives will be investigated to determine the most appropriate methods of delivery. The second major thrust is the completion of an operational tactical decision aid for infrared weapon systems. The third major thrust is analysis of the sensitivity of visible/TV, laser, and millimeter wave systems to environmental conditions and the specification of critical weather data for these weapons. Advanced development of Doppler weather radar analysis and forecast techniques will continue.

Program Element: #63707F | Title: Weather Systems (Advanced Development)
DOD Mission Area: Global Military Environmental Support #420 | Budget Activity: Defense-wide Mission Support #6

3. (U) FY 1983 PLANNED PROGRAM. Data needs, cost of sensor, platform, and data acquisition schemes will be compared with operational benefits to be derived through their use. Recommendations will be made on optimum system for deployment into hostile areas. A tactical decision aid for visible/TV weapon systems will be completed. Advance development of Doppler weather radar analysis and forecast techniques will continue.

4. (U) FY 1984 PLANNED PROGRAM: Sensors will be integrated into systems packages to satisfy requirements for tactical employment data. Development of tactical decision aids for laser systems will be completed. Development of tactical decision aids for millimeter wave systems will begin. Advanced development of Doppler weather radar analysis and forecast techniques will continue.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES: Not Applicable.

7. (U) RESOURCES: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63707F
DOD Mission Area: Global Military Environmental Support, #420

Title: Weather Systems (Advanced Development)
Budget Activity: Defense-wide Mission Support #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2,663	2,889	3,438	3,367	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force critically needs the ability to observe and collect essential weather information in battle areas not under friendly control. Employment of precision guided munitions requires specific environmental information unique to the weapon's sensing systems which is not available through present weather observing and forecasting techniques. This program develops the technology to gather required weather information and process it for use by battle staff planners and aircrews to insure effective employment of conventional or precision guided munitions under battlefield conditions.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request provides funds for development of prototype sensors to observe and collect battlefield weather data. This includes evaluation of platforms for delivery of weather sensor packages. The request also includes development of techniques to apply these data to present and planned advanced weapon systems such as precision guided munitions using infrared, visible, and millimeter (radar) wavelength sensors. Funding amounts are based on initial cost estimates by Air Force Systems Command.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	2,663	2,875	3,600		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64211F | Title: Advanced Aerial Target Development
DOD Mission Area: Aerial Targets, #452 | Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	16,698	12,254	13,856	14,193	Continuing	Not Applicable
469A	Firebolt	10,682	10,100	9,495	5,074		51,099
2535	QF-100 Full Scale Aerial Target	5,281	2,154				14,781
2459	Target Payload Systems	735		4,361	9,119	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Aerial target development is a key factor needed to insure combat effectiveness and crew proficiency in the employment of our tactical forces against enemy threats. The overall objective is to improve air-to-air weapon system accuracies and reliability by developing aerial target systems for aircrew training and weapon system evaluation. The targets being developed will help provide a proper mix of full-scale, subscale, and gunnery tow targets. Firebolt is being designed to simulate high altitude, high speed threats which our new weapons will encounter. The QF-100 will replace the depleting PQM-102 inventory of Air Force full scale targets. Target Payload Systems will increase effectiveness of targets by providing representative radar and infrared threat signatures and improved scoring systems.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Continues development of Firebolt. Firebolt flight test vehicles will be delivered, and Test and Evaluation flights will be conducted. QF-100 production deliveries will begin. QF-100 Full Operational Capability is scheduled for October 1983. Firebolt and QF-100 cost estimates are based on fixed price contracts and test center estimates for Firebolt ground and flight tests.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	15,067	12,300	13,900		Continuing	Not Applicable
Procurement (Missile)(PE 35116F)		16,500	47,300		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

		FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
Procurement (Missile)(PE 35116F)(Project 2535)		16,200	22,964	36,179	141,629	216,972*
(Quantity)		(21)	(38)	(52)	(111)	(300)
Military Construction	Not Applicable					
Operations and Maintenance	Not Applicable					

*Includes initial spares

Program Element: #64211F
DCD Mission Area: Aerial Targets, #452

Title Advanced Aerial Target Development
Budget Activity Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program includes full-scale development of the Firebolt high altitude high speed target vehicle and the conversion of the F-100 to the QF-100 Full Scale Aerial Target. The Firebolt project will provide threat simulations in the supersonic high altitude spectrum and replace the depleting inventories of BQM-34F and CQM-10B targets. The Full-Scale Aerial Target project will include design and integration of remotely controlled autopilot modifications, command and control telemetry devices, programmable maneuver profiles, and scoring systems. This program also provides for the advanced development and validation of target systems and subsystems and the development of technologies to continuously improve Air Force and Tri-Service threat simulation capabilities. The Target Payload Systems project provides for technology development at the system and subsystem level addressing deficiencies of existing targets. The project includes analysis, development, and test in the areas of infrared augmentation, radar augmentation, scoring technology, and vehicle technology. Tasks are elevated to project status when appropriate to provide for improved threat simulation with existing or advanced targets.

(U) RELATED ACTIVITIES: The Air Force, Army, and Navy are actively involved in the development of various target systems and subsystems. A Joint Logistics Commanders' Panel studied the Tri-Service requirements and recommended a division of tasks which will insure a cooperative effort. Tri-Service coordination through the Department of Defense Armament/Munitions Requirements and Development Committee ensures non-duplication of efforts. Following an initial evaluation of the Army MQM-107 and Navy BQM-74C subscale targets, the Air Force is further evaluating the suitability of an improved MQM-107 as a low cost alternative to the BQM-34 target. Air Force program office Memorandums of Agreement with the Army and Navy document the Tri-Service cooperation on Firebolt. The Navy has exercised a contract option for the manufacture of additional flight vehicles. Continuous coordination among the services is maintained to avoid duplication of effort in target systems and payloads development. When ready for production, Air Force targets are procured under PE 35116F, Aerial Targets. Project 2684, Missile Attitude Measurement System, is no longer included in PE 64211F as a separate project. Work in this area is now included within Project 2459. Project 2459, formerly named Target Auxiliary Systems, is now titled Target Payload Systems.

(U) WORK PERFORMED BY: The office of primary responsibility within the Air Force is the Armament Division, Eglin Air Force Base, Florida. Other Air Force organizations are also involved. The Air Defense Weapons Center, Tyndall Air Force Base, Florida, and White Sands Missile Range, New Mexico, conduct flight tests of the aerial target systems developed by Armament Division. The Air Force Test and Evaluation Center is responsible for Firebolt Operational Test and Evaluation. A number of contractors are involved. The Firebolt prime contractor is Teledyne Ryan Aeronautical, San Diego, California. Principal Firebolt subcontractors include Chemical Systems Division of United Technology Corporation, Brunswick Corporation, and Marquardt. The QF-100 prime contractor is Sperry Flight Systems, Phoenix, Arizona. Contractors involved in developing augmentation and scoring payload systems include Cartwright Engineering, Inc.; Santa Barbara Research Center; and Hayes International. Tracking and control systems for ground control of subscale and full scale targets are developed by Vega Precision Laboratory.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Firebolt and QF-100 full scale engineering development projects were continued in FY 1981. In December 1979, the Firebolt contract was awarded on the basis of competitive selection.

Program Element: #64211F
DOD Mission Area: Aerial Targets, #452

Title Advanced Aerial Target Development
Budget Activity Defense Wide Mission Support, #6

Firebolt Critical Design Review was conducted in July 1981. Development of the QF-100 was initiated in August 1979. Contractor flight test of the QF-100 was completed in February 1981, and Air Force Development Test and Evaluation flights began in April 1981. Target Payloads Systems efforts were continued in the areas of infrared and radar augmentation and bullet and missile scoring systems.

2. (U) FY 1982 Program: Firebolt Development Test and Evaluation will begin. The ground test vehicle for environmental, structural, and electromagnetic compatibility tests will be delivered and final assembly of flight test vehicles will begin. QF-100 Development Test and Evaluation will be completed and the first of two Firm Fixed Price production options will be exercised. Integration of the Navy's Laser Vector Scoring System into the QF-100 will be investigated.

3. (U) FY 1983 Planned Program: Firebolt test and evaluation will continue. QF-100 production deliveries will begin, and the FY 1983 production option will be initiated. Reduced FY 1983 procurement funding is due to delay of Firebolt production, previously planned for initiation in FY 1983, and reduced FY 1983 QF-100 production. Target Payloads Systems development of augmentation and scoring systems will be emphasized with particular attention to improved bullet scoring for gunnery tow targets, continued development of vector scoring for the QF-100 and investigation of its use for Firebolt and other subscale targets, and development of improved radar augmentation for subscale targets.

4. (U) FY 1984 Planned Program: Firebolt development will be completed. Competitive selection of a contractor for follow-on QF-100 production will be made. Target Payloads Systems efforts will continue. Integration of improved scoring systems for tow targets and subscale targets will be pursued. Integration of improved radar augmentation for Firebolt will be investigated. Improved infrared and radar augmentation for subscale targets and infrared and radar countermeasures for full scale and subscale targets will be developed.

5. (U) Program to Completion: This program is a continuing effort. Development of improved, more accurate payloads systems for aerial targets will be emphasized. In coordination and cooperation with the Army and Navy, further study for development of new target vehicles and subsystems will proceed to provide threat representative targets for training and weapons testing for the three Services.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

Project: #469A
Program Element: #64211F
DOD Mission Area: Aerial Targets, #452

Title: Firebolt
Title: Advanced Aerial Target Development
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Firebolt full scale engineering development program was preceded by technical feasibility flight demonstrations and advanced development which were terminated in FY 1977. In November 1977, the Air Force documented and validated the required operational capability for a high altitude, high speed target. Competitive award of a Fixed Price Incentive Firm contract for full scale engineering development was made in December 1979. Firebolt provides threat simulation in the high altitude, high speed regime for evaluation of weapons systems and aircrew training. Firebolt is needed to replace the converted CQM-10B (BOMARC) targets upon their depletion and to provide the improved performance needed to simulate the characteristics of current and emerging threats.

(U) RELATED ACTIVITIES: The advanced development program which preceeded Firebolt was conducted in the High Altitude Supersonic Target Project under Program Element 63232F. Development of improved payloads for Firebolt as well as other targets is conducted under the Target Payload Systems Project of this Program Element (64211F). Firebolt is a tri-service program with the Air Force as lead service. Memoranda of Agreement between the Air Force Aerial Targets Program Office and the corresponding Army and Navy offices document the tri-service coordination.

(U) WORKED PERFORMED BY: The office of primary responsibility within the Air Force is the Armament Division, Eglin Air Force Base, Florida. The Air Force Test and Evaluation Center is responsible for Firebolt Operational Test and Evaluation. Flight tests will be conducted at the Air Defense Weapons Center, Tyndall Air Force Base, Florida. The prime contractor for Firebolt is Teledyne Ryan Aeronautical, San Diego, California. Chemical Systems Division of United Technology Corporation, Brunswick Corporation, and Marquardt are subcontractors. Firebolt will be compatible with Vega Precision Laboratory's Drone Tracking and Control System.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The contract for full scale engineering development was awarded in December 1979. Preliminary Design Review was held in October 1980, and Critical Design Review was held in July 1981. Hardware fabrication, payload integration, subsystem testing, and hardware-in-the-loop six degree of freedom computer simulations were initiated.

2. (U) FY 1982 Program: Development test and evaluation will begin. The ground test vehicle for environmental, structural, and electromagnetic compatibility tests will be delivered, and final assembly of flight test vehicles will begin. Under a contract option, production of additional flight vehicles for the Navy will begin.

3. (U) FY 1983 Planned Program: Test and evaluation will continue. Flight tests will be conducted. Delivery of the contract option flight vehicles for the Navy will begin.

4. (U) FY 1984 Planned Program: Operational test and evaluation will be conducted. Firebolt readiness for rate production will be assessed.

Project: #469A
Program Element: #64211F
DOD Mission Area: Aerial Targets, #452

Title: Firebolt
Title: Advanced Aerial Target Development
Budget Activity: Defense-wide Mission Support, #6

5. (U) Program to Completion: Development of Firebolt will be completed. When programmed and authorized, Firebolt will be produced to meet tri-service requirements.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	10,682	10,100	9,495	5,074		51,099

8. (U) Comparison with FY 1982 Descriptive Summary:

	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	8,300	10,100	9,400		5,300	48,848
Procurement (Missile)(35116F)			13,600		Continuing	Not Applicable

The increased RDT&E funding represents partial restoration of reductions made as part of the FY 1981 Supplemental and FY 1982 Amendment budget submissions. Originally planned initiation of production in FY 1983 is no longer funded due to competing priorities and budget constraints.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64227F — Title: Flight Simulator Development
DOD Mission Area: Non-System Training Devices, #430 — Budget Activity: Defense-Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 81 Actual	FY 82 Estimate	FY 83 Estimate	FY 84 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5,549	11,258	5,439	8,456	Continuing	Not Applicable
2325	Simulator Development Activities	1,353	1,458	2,000	4,100	Continuing	Not Applicable
2360	Tactical Combat Trainer	4,001					Not Applicable
2769	Simulator Update Dev	0	9,800	3,439	3,356	Continuing	Not Applicable
2851	Standard DMA Data Base Transformation Program				1,000	5,500	6,500
2269	Electro-Optical Viewing Sys	195	0	0	0	0	8,100

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a continuing program element for the engineering development of aircrew flight simulation techniques and training devices. The objective of this element is to adapt flight simulation technology developed in the laboratories and industry for satisfying current training requirements. Prototype training devices and subsystems developed under this element will be evaluated for training effectiveness and supportability prior to follow-on production decisions and/or integration with training devices in acquisition.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Continues joint Air Force/Navy effort to complete the demonstration of a flight simulator visual system that costs less than current systems through integration of existing components to test an eye-slaved high resolution, high detail area-of-interest image inset into a lower resolution background: this approach uses components developed by the Singer-Link Corp. and by the GE Corp. These efforts will make cost effective use of technology developed during the Tactical Combat Trainer (TCT) project (funds for development of the TCT were removed during the FY 82 budget formulation). Other efforts to make use of existing technology to reduce the procurement costs and risks associated with flight simulation include: modifying the Digital Imaging Facility to investigate simulation of advanced, high resolution, synthetic aperture radars that are being introduced into the inventory; continuing investigations into the relationship between simulator handling qualities and pilot performance to more effectively quantify and verify simulator performance requirements, and to improve and shorten simulator testing (e.g., electronic warfare simulation testing); and investigating prototype development efforts for application on simulators for advanced aircraft. Completes prototype development of updates to existing KC-135 communications/navigations subsytem, and the Simulator for Electronic Warfare Trainer. These updates consist primarily of conversion from analog to digital simulations for increased reliability and improved training. The validity of cost estimates are based on parametric analysis and documented contract proposals.

Program Element: #64227F
DOD Mission Area: Non-System Training Devices, #430

Title: Flight Simulator Development
Budget Activity: Defense-Wide Mission Support, #6

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 81	FY 82 Estimate	FY 83 Estimate	FY 84 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	5,640	18,600	16,100	-	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

3010 (PE 11142F)			4,100	-	1,900	6.0

(U) DETAILED BACKGROUND AND DESCRIPTION: This Program Element was started to conduct programs and activities normally accomplished as part of the development phase of the acquisition cycle, but are inappropriate to fund with procurement funds programmed for simulator acquisitions. The B-52 Aerial Refueling Part Task Trainer (ARPTT), KC-135 Boom Operator Part Task Trainer (BOPTT), and the B-52 Electro-Optical Viewing System (EVS), were developed, and the Tactical Combat Trainer visual system was initiated under this element. The project funds simulator activities that are conducted on a continuing basis in the areas of systems requirements, trade-off analysis, modular design studies, test instrumentation data reduction, and sensor simulation. The project for Simulator Update Development funds prototype development of significant updates to existing simulators to comply with budget guidance.

(U) RELATED ACTIVITIES: Projects in this element rely on the technologies from inter-service coordination of technology base programs. This element relies heavily on the Air Force Human Resources Laboratory technological base programs. Specific programs which support this element include the following: PE 62205F, Training and Simulation Technology; PE 63227F, Advanced Simulator Development; PE 63715F, Innovations in Education and Training.

(U) WORK PERFORMED BY: The Deputy for Simulators, Wright-Patterson Air Force Base, OH is the in-house organization responsible for the majority of this element. Remaining in-house efforts include several tasks within the Simulator Development Activity project.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 81 and Prior Accomplishements: A B-52 Aerial Refueling Part Task Trainer (ARPTT), KC-135 Boom Operator Part Task Trainer (BOPTT) were developed to evaluate the feasibility of substituting ground training of airborne training in aerial refueling tasks. The prototype B-52 Electro-Optical Viewing System (EVS) was developed for real time simulation of the B-52 EVS (forward looking infra-red, low light level television) display using the Defense Mapping Agency (DMA) Digital Data Base and Computer Generated Imagery for the B-52 Weapon System Trainer. This System is being incorporated into the production B-52 trainers. Future efforts planned include investigations into development of a standard DMA Data Base Transformation Program(s) for radar, visual, and electro-optical sensor simulations to reduce software support costs, and development of a wide field-of-view visual system for tactical combat applications.

Program Element: #64227F
DOD Mission Area: Non-System Training Devices, #430

Title: Flight Simulator Development
Budget Activity: Defense-Wide Mission Support, #6

2. (U) FY 1982 Program: Efforts will be concentrated on improving software processing of digital data used in image display systems and in studies to determine approved methods for processing digitally generated radar data. Development of updates to existing KC-135 simulator and Simulator for Electronic Warfare Trainer will be initiated.

3. (U) FY 1983 Planned Program: Initiate development of a digital radar land area system for advanced and synthetic aperture radars. Continue research into visual display systems. Fidelity and new content studies will be conducted for both aircraft and fighter visual simulation requirements. Complete prototype updates to the KC-135 simulator and to the simulator for Electronic Warfare Trainer.

4. (U) FY 1984 Planned Program: Initiate development of a standard DMA data base transformation program. Complete handbook on instructional system requirements. Continue sensor simulation efforts.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 "DESCRIPTIVE SUMMARY": The reduction in total funding requirements in FY 82 and FY 83 is due to cancellation of the updates to the B-52D and F-106 simulators.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64411F (63411F) Title: DOD Space Shuttle
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		246,265	266,000	355,629	293,068	425,035	2,191,300

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: To increase the effectiveness of defense space operations, this program will: (1) Support the National Aeronautics and Space Administration development and assure the utility to the Department of Defense of the Space Transportation System; (2) Transition critical national defense satellites to the Shuttle; (3) Develop the Inertial Upper Stage; and (4) Acquire general purpose Shuttle launch and landing facilities at Vandenberg Air Force Base, CA. The Air Force, as the Department of Defense executive agent, is responsible for the planning, development, integrated logistics support and activation activities necessary to achieve these objectives.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Continues the acquisition of the Vandenberg Ground Support System leading to an initial launch capability in October 1985. Continues the Inertial Upper Stage full scale development phase to provide an initial launch capability in late 1982. Costs for the Vandenberg and Inertial Upper Stage developments have increased significantly from earlier projections. Continues acquisition of airborne support equipment, payload integration equipment, and the Shuttle Payload Integration Facility in preparation for Department of Defense Shuttle launches from Kennedy Space Center. Implements the "Controlled Mode" for secure Department of Defense mission operations at Johnson Space Center, Houston, TX to support a first secure launch in 1983. Controlled mode modifications to Kennedy Space Center and Goddard Space Flight Center - similar to those at Johnson Space Center - continue for protection of classified Department of Defense information and operations at those facilities.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

		FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	(PE 64411F)	245,865	266,000	256,500		Continuing	Not Applicable
Procurement (Missile)	(PE 12449F)	117,034	212,365	113,916		Continuing	Not Applicable
Procurement (Other)	(PE 12449F)	16,978	6,487	7,289		Continuing	Not Applicable
Military Construction	(PE 12449F)	98,500*	43,190	21,810		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:****

		FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
Procurement (Missile)	(PE 12449F)	117,000	200,665	135,954	74,350	96,204	858,220
Procurement (Other)	(PE 12449F)	16,978	6,445	6,741	4,213	11,086	86,100
Military Construction	(PE 12449F)	98,500*	36,190**	82,200	66,576	58,276	612,600***

* Does not include other MILCON reprogrammed to fund overrun for Vandenberg launch pad (13,700)
** Does not include a $17.4M unfunded requirement for modifications to the launch pad.
*** Includes reprogramming in FY 80 (63,700 and 5,200) and FY 81 (13,700)
**** Does not include operational funding which is reported separately in PE 35171F, Space Launch Support

Program Element: #64411F (63411F) Title: DOD Space Shuttle
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Space Task Group, established by the President in 1969, recommended that a Space Transportation System be developed to provide more flexible and effective access to space at lower costs than current expendable launch vehicles. In January 1972 the President authorized the National Aeronautics and Space Administration to proceed with the development of the reusable Space Shuttle as a national means for transporting payloads to and from space. The Space Transportation System consists of the Space Shuttle Vehicle which will carry payloads to low earth orbit and return to land on a runway; upper stages to transfer payloads from low earth orbit to higher orbits; and associated ground and airborne support systems. The Space Shuttle Vehicle consists of the Orbiter (the winged, recoverable spacecraft the size of a DC-9), an External Tank containing fuel and oxidizer for the Orbiter's main engines, and a pair of recoverable Solid Rocket Boosters which will provide initial boost acceleration for the vehicle. The reusable Orbiter will carry the payload (spacecraft and, if required, upper stage) into orbit in its 15x60 foot payload bay. The system will have the capability to boost 32,000 pounds of payload to a near-polar (98°) orbit, or 65,000 pounds into an Easterly (28.5°) orbit. After reentry, the Orbiter will land on a runway using a high speed, unpowered approach. The Orbiter and Solid Rocket Boosters will be recovered, refurbished, and reused. The facilities at the two launch bases; Kennedy Space Center, FL and Vandenberg Air Force Base, CA; accomplish the recovery, refurbishment, and reintegration of the major components of the Space Shuttle Vehicle to prepare it for its next launch. The National Aeronautics and Space Administration mission control center at Johnson Space Center will be used for mission planning and control until the Department of Defense acquires a dedicated capability in late 1987 (the Consolidated Space Operations Center).

(U) The Air Force participates in the Shuttle program to assure that critical national defense missions will continue to be effectively supported. Although the National Aeronautics and Space Administration is responsible overall for the Space Transportation System, the Air Force defines Department of Defence operational and support requirements and assesses the effect of Shuttle design changes on Department of Defense national security missions. The Air Force addresses the unique Department of Defense needs to assure the maximum operational utility of the expanded space mission capability offered by the Shuttle. In addition, the long term advantages of the Shuttle to the Department of Defense appear to be substantial -- particularly in the areas of payload retrieval, on-orbit repair, assembly of very large structures in space, and the availability of an orbital test bed -- modes of operation unavailable without the Shuttle.

(U) To minimize the operational impact of modifying Department of Defense payloads and to make early effective use of the Shuttle, the Department of Defense and the National Aeronautics and Space Administration agreed that the Air Force will develop an expendable upper stage for use with the Shuttle - this stage is called the Inertial Upper Stage. The Inertial Upper Stage will also be used on the Titan III launch vehicle for certain Department of Defense payloads. The Inertial Upper Stage will be used on Shuttle by both the Department of Defense and the National Aeronautics and Space Administration for all large, high altitude payloads.

(U) The Department of Defense has also agreed to acquire and operate the Space Shuttle launch and landing facilities at Vandenberg Air Force Base, CA with an initial launch capability date of October 1985. This agreement was reached after an extensive study determined that Department of Defense and National Aeronautics and Space Administration requirements could not be satisfied from one launch site, and that use of a second site at Vandenberg was necessary for polar orbit missions. The heavier near-polar missions cannot be accomplished from the Kennedy Space Center, FL

Program Element: #64411F (63411F) Title: DOD Space Shuttle
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support #6

since that would require overflight of the continental United States while sub-orbital and result in the large Shuttle external tank being released on a ballistic trajectory over the Sino-Soviet land mass for impact in the Indian Ocean.

(U) RELATED ACTIVITIES: This program is directly related to, and paced by, the National Aeronautics and Space Administration Space Shuttle development program. Under current agreements, the National Aeronautics and Space Administration will fund for all Shuttle Orbiters, provide the general purpose launch and landing facilities at Kennedy Space Center, FL and perform Shuttle mission control at Johnson Space Center, Houston, TX. The Department of Defense portion of the program will include the development of the Inertial Upper Stage, the acquisition and operation of Space Shuttle facilities at Vandenberg Air Force Base, and funding for the unique Department of Defense security requirements levied on the National Aeronautics and Space Administration-developed Space Transportation System elements. A joint National Aeronautics and Space Administration/United States Air Force Space Transportation System Committee, co-chaired by the Assistant Secretary of the Air Force (Research, Development, and Logistics) and the Associate Administrator for Space Transportation System Acquisition (National Aeronautics and Space Administration), assures that the Space Transportation System will meet the needs of both agencies. Department of Defense payload planning efforts are addressed by the Department of Defense Space Shuttle User Committee which includes representatives of the Army, Navy, Air Force, Office of the Secretary of Defense, and Joint Chiefs of Staff. The Air Force Director of Space Systems and Command, Control, Communications chairs this body and also has the responsibility for research and development efforts involving Air Force payloads, expendable launch vehicles and the Shuttle program. Inertial Upper Stage production, Vandenberg operation and maintenance, and Shuttle flight charges paid to the National Aeronautics and Space Administration for United States Air Force users are funded under Program Element 35171F (Space Launch Support). Inertial Upper Stage flight equipment and operation and Shuttle flight charges for other Department of Defense users are funded by the users program element. Titan III/Inertial Upper Stage integration is funded under Program Element 35119F, Space Boosters. Related activities for near term utilization of the Space Shuttle sortie mode capabilities are being pursued by the Space Test Program under Program Element 63402F. The Air Force is planning a Consolidated Space Operations Center, funded under Program Element 35130F, to eliminate the vulnerabilities represented by the single critical control nodes of the Satellite Test Center (payload control) and Johnson Space Center (Shuttle control).

(U) WORK PERFORMED BY: The Air Force Space Division, El Segundo, CA of the Air Force Systems Command is the development agency for the Air Force Space Shuttle activities. The Aerospace Corporation, El Segundo, CA provides Space Division with general systems engineering support. Martin Marietta (Denver), Vandenberg Air Force Base, CA, completed the contract for the detailed design and is the integrating contractor for the Vandenberg Shuttle facilities and for development and procurement of necessary unique support equipment and software. The National Aeronautics and Space Administration is the procuring agent for all Vandenberg support equipment and software common to both Kennedy Space Center and Vandenberg (Air Force funded). The United States Army Corps of Engineers is the construction agent for all facilities at Vandenberg. Various construction contractors are employed for the actual construction (through the Corps of Engineers). Rockwell International, Downey, CA and United Space Boosters, Huntsville, AL provide expertise on the Orbiter and the Solid Rocket Boosters respectively in support of the Vandenberg Shuttle facilities design and activation. Martin Marietta is also under contract to provide engineering services in support of payload integration activities. Boeing Aerospace Corporation, Seattle, WA was awarded the contract for Inertial Upper Stage full scale development and is also performing spacecraft to Inertial Upper Stage integration activities. TRW Systems, Redondo Beach, CA is supporting development of the secure Shuttle mission control capability at the Johnson and Kennedy Space Centers. International

Program Element: #64411F (63411F) Title: DOD Space Shuttle
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support #6

Business Machines, Houston, TX is under contract to evaluate specialized Orbiter flight software for Department of Defense missions.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Preliminary Department of Defense system level requirements for the Space Transportation System were developed in 1971 and continue to be refined.

(U) Inertial Upper Stage: After completion of the Validation Phase and following a March 1978 Defense Acquisition Review Council Milestone II Review, the Full Scale Development Phase began. The Department of Defense standard two stage Inertial Upper Stage configuration was baselined at the system Critical Design Review during 1979. The development of a three stage, planetary version of the Inertial Upper Stage was begun with funding provided by the National Aeronautics and Space Administration. Problems with development of the Inertial Upper Stage rocket motors and the flight software caused a stretch in the development program and increased the development cost -- but did not impact user launch needs. The full scale development contract will continue into 1983 for completion of the two stage Inertial Upper Stage development and the flight of the first two Inertial Upper Stages (one on Titan III and one on Shuttle). Also included in the full scale development contract is the production of nine vehicles (four funded by the Department of Defense and five funded through the National Aeronautics and Space Administration). The procurement of long lead materials for the eight vehicle follow-on production began, with funding provided by the National Aeronautics and Space Administration; Program Element 35171F, Space Launch Support; and Program Element 34111F, Special Activities. Development was terminated on the three stage planetary Inertial Upper Stage configuration in 1981 per National Aeronautics and Space Administration request. The planetary cancellation also reduced the long lead buy from eight sets to four reflecting the deletion of the planetary Inertial Upper Stage vehicles. These changes in the Inertial Upper Stage program compound the already existing cost growth in both the development and unit procurement costs. Modifications to the Solid Motor Assembly Building began at Cape Canaveral Air Force Station, FL to allow Inertial Upper Stage launch processing.

(U) Vandenberg Air Force Base: Engineering design activities for the Vandenberg Ground Support System began in 1976 and are continuously updated to reflect the operational experience now being gained from the Shuttle flights at Kennedy Space Center. The multi-year construction program began in January 1979 with modifications to the existing Manned Orbiting Laboratory launch pad. Construction of the second (1980) package of Vandenberg Air Force Base Shuttle facilities is well underway: the Orbiter Maintenance and Checkout Facility, the first cell of the Hypergolic Maintenance and Checkout Facility, utilities, and modification to the launch pad to incorporate provisions for handling a thrust augmented Orbiter. Construction began on the facilities in the third (1981) military construction package: the Solid Rocket Booster Refurbishment and Subassembly Facility, the Airfield and Mate/Demate Facility, the External Tank Storage and Checkout Facility, transportation upgrades, and logistics facilities. Construction is complete on the the Launch Control Center (part of the 1979 launch pad package), Titan III solid rocket motor storage facility relocation (1980 package), and the Mate/Demate Facility (part of the 1981 Airfield package). Design of unique Department of Defense ground support equipment and software development for the launch processing system continues. Procurement of unique ground support equipment continues and procurement

Program Element: #64411F (63411F) Title: DOD Space Shuttle
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support #6

(through the National Aeronautics and Space Administration) continues for ground support equipment and launch processing equipment common to Vandenberg Air Force Base and Kennedy Space Center. Equipment installation and checkout continues for the Launch Control Center and the North Vandenberg launch processing system computers. A review of the Vandenberg program in July 1981 identified significant increases in the estimated total cost for the program and new facilities essential to operations from Vandenberg. The major new facilities identified are the Shuttle Assembly Facility, which is required to stack the Space Shuttle Vehicle on the launch pad (the previous design approach being invalidated), and Toxic Waste Disposal facilities, which are required to comply with California law. "Stacking" the Space Shuttle Vehicle requires lifting the Orbiter off its transporter, rotating it from the horizontal to the vertical, translating the Orbiter to the previously stacked and integrated Solid Rocket Boosters and External Tank, and mating the Orbiter to the three thrust mounts on the External Tank.

(U) Operations Capability: Payload integration activities continue to support early Department of Defense Shuttle flights. Design and development continues on interface verification equipment to support early Department of Defense flights from Kennedy Space Center. The Shuttle Payload Integration Facility is being developed to provide payload processing for Department of Defense missions launched from Kennedy Space Center. This "off-line" processing capability constitutes additional modifications to the Titan III Solid Motor Assembly Building (also being modified to process the Inertial Upper Stage). Modifications to allow the Johnson Space Center to conduct classified Department of Defense Shuttle missions (termed "Controlled Mode") are underway with installation and checkout of the "Controlled Mode" hardware and software in progress at Johnson Space Center (the schedule is paced by the requirement to avoid disrupting on-going Shuttle flights). Studies of the Kennedy Space Center and Goddard Space Flight Center security requirements showed the need for "Controlled Mode" modifications similar to those being done at Johnson Space Center. Goddard is the mission planning and system control center for the Tracking and Data Relay Satellite System -- the primary Shuttle command and control link and a multi-user payload data relay satellite -- planned to support civil and Department of Defense space operations. Those modifications are in progress at both centers. Independent software validation and verification activities continue for all aspects of Shuttle software development under Department of Defense management. Conceptual studies of large space structures were completed and indicated that such structures are technically achievable when mission requirement dictate.

2. (U) FY 1982 Program: Development of the two-stage Inertial Upper Stage continues with the planned flight and subsequent analysis of the first Titan III/Inertial Upper Stage. Delivery of three of the nine pre-production vehicles is planned. Inertial Upper Stage production continues (funded by Program Element 35171F, Space Launch Support, for Air Force payloads; by the user for other Department of Defense programs; and through the National Aeronautics and Space Administration for civil/commercial missions). The Vandenberg Ground Support System construction equipment installation and checkout continues toward an Initial Launch Capability in October 1985. The construction funded in the 1982 program includes the Solid Rocket Booster Retrieval and Disassembly Facility, launch pad modifications, the Integrated Operations Support Center, flight crew facilities, and the Space and Missile Test Organization Management and Engineering Facility. Significant cost increases occurred in the Vandenberg development and procurement funding estimates due to increased concurrency with the Kennedy (East Coast) launch site development, design problems in the launch pad and the difficulty in hiring engineers. Construction of the Shuttle Payload Integration Facility at Cape Canaveral Air Force Station, FL will be completed.

Program Element: #64411F (63411F) Title: DOD Space Shuttle
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support #6

Modifications to Kennedy, Goddard, and Johnson Space Centers to allow classified processing ("Controlled Mode") will be completed to support the first classified mission in 1983. Payload integration activities continue.

3. (U) FY 1983 Planned Program: Inertial Upper Stage full scale development is completed. With the flight and subsequent analysis of the first Shuttle/Inertial Upper Stage launch in 1983 (a National Aeronautics and Space Administration mission). Inertial Upper Stage flights continue using pre-production vehicles. Inertial Upper Stage production continues (funded by the user programs). The Vandenberg Ground Support System construction, equipment installation, and checkout continue toward the October 1985 first launch capability. Construction is begun on the Shuttle Assembly Facility (the remaining element of the launch pad facilities). Construction is completed on most of the major facilities: Orbiter Maintainance and Checkout Facility, External Tank Storage and Checkout Facility, and the Launch Pad (except the Shuttle Assembly Facility). Ground system test begins for the Launch Control Center. The Shuttle Payload Integration Facility at Kennedy Space Center reaches its Initial Operational Capability. "Controlled Mode" at Johnson Space Center reaches its Initial Operational Capability for the first Department of Defense dedicated flight. Payload integration continues on schedules compatible with the launch requirements of the individual payloads.

4. (U) FY 1984 Planned Program: The construction and activation of the Vandenberg launch and landing site continues toward the October 1985 launch capability date. Construction will be complete on all major facilities comprising the Vandenberg capability. Equipment installation will be complete and ground system testing will have begun for all major facilities except the Solid Rocket Booster Disassembly Facility (at Port Hueneme, CA). Construction will begin on the Hazardous Waste Disposal facilities, the Thermal Protection System support facility and the modifications to the launch pad to control ice buildup on the External Tank after it is fueled. Secure operations modifications continue at Johnson, Goddard, and Kennedy Space Centers. Payload integration activities continue.

5. (U) Program to Completion: Initial Vandenberg construction and activation is completed for the October 1985 launch capability. If necessary, a final construction package will be used to remove Shuttle processing restrictions and allow growth to higher launch rates as mission requirements dictate and incorporation of the National Aeronautics and Space Administration selected option for a thrust augmentation capability (required to achieve specified performance for near polar missions). Secure operations modifications are completed on both coasts. Primary mission control responsibility for defense missions transitions to the Consolidated Space Operations Center (Johnson Space Center capability for secure operations is retained as a backup).

6. (U) Milestones:

		Date
A.	Vandenberg Air Force Base Design Criteria Start	Oct 75
B.	Inertial Upper Stage Validation Phase Start	Sep 76
C.	Inertial Upper Stage Full Scale Development Start	Apr 78
D.	Vandenberg Air Force Base Construction Start	Jan 79
E.	Kennedy Space Center Security Modifications Complete	Jun 82
F.	Inertial Upper Stage Initial Launch Capability (Titan III)	*(Apr 82) Sep 82
G.	Inertial Upper Stage Initial Launch (Shuttle)	*(Jul 82) Jan 83

Program Element: #64411F (63411F) Title: DOD Space Shuttle
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support #6

H.	Johnson Space Center Controlled Mode Initial Operational Capability	*(Mar 82) Mar 83
I.	Kennedy Space Center Shuttle Payload Integration Facility Operational Capability	*(Dec 82) Jun 83
J.	Goddard Space Flight Center Security Modification Initial Capability	*(Apr 83) Jul 83
K.	Goddard Space Flight Center Security Modification Final Capability	Dec 84
L.	Johnson Space Center Controlled Mode Final Operational Capability	*(Dec 82) Jun 85
M.	Vandenberg Air Force Base Initial Operational Capability	*(Aug 84) Oct 85
N.	Vandenberg Air Force Base Thrust-Augmented Launch Capability	*(Jul 86) Oct 85
O.	Vandenberg Air Force Base Full Operational Capability	*(Jul 86) TBD

*Date presented in FY 82 Descriptive Summaries.

(U) Explanation of Milestone Changes:

F,G The initial launch capability for both the Titan III and Shuttle versions of the Inertial Upper Stage have slipped due to late deliveries of vendor parts to the prime contractor for qualification testing and due to software development, testing and payload/launch vehicle delays.

H,I,J Delays were made to adjust the requirement for these capabilities to the dates required to support the first dedicated Department of Defense flight -- which had also delayed.

H,L The Controlled Mode capability at Johnson Space Center schedule is driven by the requirement to avoid impacting the concurrent Shuttle test and early operational flights.

M The Vandenberg initial launch date was delayed due to the growing engineering impact of the concurrency between the early operations at Kennedy Space Center and the design/construction/procurement activities for Vandenberg, design problems with Vandenberg, and difficulties in hiring sufficient engineers to accomplish the tasks at Vandenberg.

N The date for the thrust-augmented launch capability was advanced reflecting the latest National Aeronautics and Space Administration estimate of the Shuttle performance as of that date compared to our requirements.

O Full operational capability at Vandenberg will be delayed until the mission requirements dictate a need for additional capability.

Budget Activity: Program-wide Management and Support, #6
Program Element: #64411F - Space Shuttle

Test and Evaluation Data:

1. (U) Development Test and Evaluation: The National Aeronautics and Space Administration and the Air Force are each developing, acquiring and operating a portion of the common-use hardware and facilities of the Space Shuttle Program. The National Aeronautics and Space Administration has the development and operation responsibilities for the Space Shuttle Vehicle, the East Coast Shuttle launch and landing facilities at Kennedy Space Center FL and the Mission Control Center at Johnson Space Center TX. The Department of Defense is developing the Inertial Upper Stage and will develop and operate the West Coast Shuttle launch and landing facilities at Vandenberg Air Force Base CA. The Air Force is also funding those modifications to the existing National Aeronautics and Space Administration facilities and equipment required to allow classified operations to be conducted (i.e.,"Controlled Mode" at Johnson Kennedy and Goddard Space Centers). The Air Force is planning a Consolidated Space Operations Center funded under PE 35130F for an operational capability to augment and backup the present satellite control capabilities of the Satellite Control Facility, Sunnyvale CA (late 1986 IOC) and to provide a dedicated Department of Defense Shuttle control capability. Air Force test and evaluation activities are being conducted as a combined Development Test and Evaluation/ Operational Test and Evaluation program.

(U) Department of Defense Assessment of National Aeronautics and Space Administration Segments: The Air Force Systems Command -- with Air Force Test and Evaluation Center participation and support from other Air Force agencies -- will assess the capability and the availability of the National Aeronautics and Space Administration developed segments to support Department of Defense requirements. This evaluation activity consists primarily of monitoring and evaluating major Space Transportation System verification events conducted by the National Aeronautics and Space Administration.

(U) Air Force test participation began with monitoring of the Approach and Landing Tests conducted at Edwards Air Force base CA from February 1977 to March 1978. These tests successfully demonstrated the low speed flying and manual landing characteristics of the Orbiter vehicle as well as the adequacy of the ferry capability of a modified Boeing 747 Shuttle Carrier Aircraft. Subsequently, the Mated Vertical Ground Vibration Test, conducted at the Marshall Space Flight Center from March 1978 to February 1979, was monitored. This test provided the initial data base required to validate the analytical model used to design and verify the structural capability of the Space Shuttle Vehicle and, subsequently, update the predictive models used to calculate the environments seen by Department of Defense payloads while in the Shuttle payload bay.

(U) Progress of the Space Shuttle Main Engine development has been continuously monitored since January 1978 due to its critical role in Space Shuttle Vehicle performance and schedule. The engine is certified for operations at 100% (Rated Power Level) which is adequate for the test program flights. The engines performed flawlessly at that level on the first two flights. The engine requires, however, certification at 109% (Full Power Level) to achieve the full operational payload delivery requirements while maintaining the required abort options. The engine has performed at Full Power Level (109% of Rated Power Level) in tests; however, hardware design and reliability problems have caused major program delays. The Main Propulsion Test at the National Space Technology Laboratories MS began in April 1978 and, by January 1981, had completed all test objectives vital for the first flight (April 1981). Testing at Full Power Level is proceeding but a number of problems have been encountered. Additional Main Propulsion Test firings at Full Power Level (109%) are required in 1982 to certify readiness of the Space Shuttle Main Engines for full operational capability.

(U) The Shuttle Avionics Integration Laboratory at Johnson Space Center is used to verify avionics hardware and software compatibility and to provide confidence in the ability of these subsystems to successfully perform the flight sequences planned for the Orbital Flight Test program and subsequent missions. This on-going program started in March 1979 and has been successful in identifying and correcting a number of hardware and software configuration discrepancies. The Air Force will continue monitoring the test progress and results from this activity.

(U) The most realistic source for test data is the Orbital Flight Test program now underway. The Air Force test organizations and personnel were involved in many aspects of the flights. The first two Shuttle flights were successful and have demonstrated the basic Shuttle system concept. However, there are several areas of concern in system performance and availability which we must continue to evaluate for impacts on defense operational use of the Shuttle. The indications from STS-1 are that payload lift capability could be about 3000 pounds lower than predicted; this assessment should be reviewed once analysis of the STS-2 data is complete. The STS-1 launch resulted in unacceptable overpressure on the launch pad at Solid Rocket Booster ignition; modifications to the Kennedy Space Center launch pad reduced this pressure to acceptable levels on STS-2. The National Aeronautics and Space Administration is conducting scale model testing in order to evaluate the impacts on the Vandenberg Shuttle launch pad. Some aerodynamic concerns remain which could influence the Orbiter center-of-gravity envelope and cross-range capability (and thus payload lift capability). Both flights indicated that the underside of the Shuttle was not as hot on reentry as predicted, but that some localized "hot spots" occurred on the "leeside" (i.e. topside) of the vehicle. The National Aeronautics and Space Administration is making some changes to these areas to prevent impacts to the Shuttle cross-range capability. Our involvement will continue through the remainder of the Orbital Flight Test program (two more flights scheduled through mid-1982). These flights will conclude the Air Force participation in formal National Aeronautics and Space Administration verification activities. Since all Department of Defense concerns will not be answered during the Orbital Flight Tests, Air Force test activity will continue through an adequate number of operational flights to complete the test objectives.

(U) IUS Test Program: A Defense Systems Acquisition Review Council Milestone II review of the Inertial Upper Stage program was held in March 1978 and recommended proceeding with full scale development. The Boeing Aerospace Company is on contract for the full scale development phase. The Defense Systems Acquisition Review Council also recommended production of an initial quantity of nine Inertial Upper Stage vehicles (five National Aeronautics and Space Administration four Department of Defense) to meet planned flight schedules. Because of the high cost and immediate operational need of Department of Defense developed Space Transportation System flight hardware (there will be no dedicated test launches of an Inertial Upper Stage), a combined Development Test and Evaluation/ Operational Test and Evaluation

Budget Activity: Program-wide Management and Support, #6
Program Element: #64411F - Space Shuttle

program is being conducted. The Inertial Upper Stage test and evaluation focuses on system performance, reliability, maintainability, and compatibility with the Space Transportation System.

(U) Vehicle component qualification testing of the Inertial Upper Stage began in August 1979 and was completed in November 1981. The primary problem which delayed the qualification program was the unavailability of high reliability space-qualified electronic piece parts. Structural qualification testing of the Titan configuration was initiated in April 1980 and completed in September 1980. Structural qualification of the Space Transportation System configuration started in September 1981 and was completed in December 1981. The Inertial Upper Stage Qualification Test Vehicle has been completed and the vehicle, using inert solid rocket motors, has been stacked. Qualification Test Vehicle testing started in October 1980 and was completed in December 1981; these tests confirmed the system's ability to function in the specified vibration, pyro-shock, and thermal-vacuum environments.

(U) In the Inertial Upper Stage software area, the flight software was developed by TRW and tested at the Boeing Aerospace Corporation facility in Kent WA. The Titan flight software has been designed, coded and has completed test at Boeing. Martin Marietta Corporation is performing the independent verification and validation. The mission data loads are being designed for the first three Department of Defense spacecraft and for the first National Aeronautics and Space Administration-sponsored Tracking and Data Relay Satellite. Development and validation and verification testing of the operational software for the Titan configuration Inertial Upper Stage will be complete in Jul 1982.

(U) Propulsion system development testing is proceeding. To date, seven solid rocket motor cases have been burst tested and four cases have been skirt tested. IUS motor case development and verification have been sucessfully completed Motor case efficiency is at the state-of-the-art level and case burst data show little scatter. Skirt ultimate loads have been demonstrated four times. In addition to the four full scale nozzle firing tests, six large and seven small Inertial Upper Stage development motors (including one spin motor) have been successfully fired at the Arnold Engineering and Development Center TN. Two motor firings included the Extendable Exit Cone (deployed prior to the test). These firings completed the motor development program. In the qualification program, one burst test and twelve additional motor (six small and six large) firings remain. The firings began in November 1981 with the successful firing of a large motor. The qualification program for the Titan configuration will be complete in July 1982 and continue through September 1982 for the Shuttle configuration. The problem of propellant cracking in the boot area of the solid rocket motor has been solved and confirmed by cold X-rays of four qualification motors (two of each size). Casting of the flight motors has commenced.

(U) The first flight vehicle has completed acceptance testing (October 1981 -- 19 days ahead of schedule) and is now at Cape Canaveral Air Force Station. The ground test portion of the Inertial Upper Stage program will conclude with a series of environmental simulation tests to be performed on the Qualification Test Vehicle at Boeing and with processing of the Inertial Upper Stage Pathfinder vehicle through each of the steps at Cape Canaveral Air Force Station and Kennedy Space Center required to process an Inertial Upper Stage for an operational launch. The Pathfinder Vehicle was delivered to Cape Canaveral Air Force Station in July 1981 and has begun the processing flow for facility activation. Testing will begin on the launch pad in Spring 1982.

Budget Activity: Program-wide Management and Support, #6
Program Element: #64411F - Space Shuttle

(U) Vandenberg Air Force Base Ground Support System Testing: The Martin Marietta Aerospace Company is on contract to complete the requirements definition, equipment specification, and facilities design criteria for the Vandenberg Air Force Base launch and landing site for the Space Shuttle. Facilities construction and equipage is in progress with Martin as the prime contractor. Ground Support System testing will focus on compatibility of ground processing with the Space Shuttle Vehicle, ground operations, supportability, Air Force manpower/resources, and contractor support. The test program will include acceptance testing of facilities, installation and ground system tests of support equipment, and integrated system tests of the Ground Support System with the flight vehicle hardware, leading to an Initial Shuttle Launch Capability date of October 1985. Ground System Tests (individual facility testing) begin in late 1983. Integrated Systems Testing (combined flight vehicle and ground systems) begins in early 1984 and completes with the recovery of the first Solid Rocket Booster set after the first launch.

(U) A combined test program is planned to satisfy both development and operational test and evaluation objectives. In addition to the testing planned on Air Force designed unique ground support equipment for Vandenberg, the Air Force will ensure that the National Aeronautics and Space Administration designed common support equipment meets Department of Defense requirements, and will modify and test that equipment when appropriate. Much of the ground processing data obtained at Kennedy Space Center will be applicable to Vandenberg Air Force Base due to the similarity of Space Transportation System equipment, facilities, and procedures. The Vandenberg launch capability will be developed to meet early launch requirements while providing a moderate growth capability (through an additional increment of facilities and equipment) to approximately ten launches per year as national launch requirements dictate. The Ground Support System evaluation will continue through the attainment of the ten launches per year capability.

(U) Operations Capability Development: All the activities (other than Inertial Upper Stage and Vandenberg) necessary to provide an orderly transition of Defense payloads to the Space Transportation System are included in this area: Inertial Upper Stage flight planning and control; incorporation of Department of Defense security requirements in National Aeronautics and Space Administration Shuttle systems, development of the facilities, hardware, and analytical services needed to integrate Department of Defense payloads into the Shuttle, and the documentation and services needed to effectively support Department of Defense Shuttle users. Test and evaluation for these activities is being planned as needed to support overall program milestones.

2. (U) Operational Test and Evaluation: Air Force test activities are being conducted as part of a combined Development Test and Evaluation/Operational Test and Evaluation program in which the Air Force Test and Evaluation Center will participate with the Air Force Systems Command in National Aeronautics and Space Administration activities, will independently evaluate and report on Department of Defense test activities, and will work with Air Force Systems Command to provide an overall systems level assessment of the Space Transportation System capability to meet Department of Defense requirements.

Budget Activity: Program-wide Management and Support, #6
Program Element: [illegible]4411F - Space Shuttle

(U) Department of Defense Assessment of National Aeronautics and Space Administration Segments: Air Force Test and Evaluation Center will participate with Air Force Systems Command in monitoring and observing the National Aeronautics and Space Administration test activity and assessing the capabilities of the Space Transportation System. This evaluation activity primarily consists of monitoring National Aeronautics and Space Administration Space Transportation System verification efforts, conducted at the Kennedy Space Center FL; Johnson Space Center TX; and Edwards Air Force Base CA. The primary focus of Air Force involvement in National Aeronautics and Space Administration activity is to determine the availability and the capability of the Space Transportation System to support Department of Defense requirements. For the first flight (April 1981), all Kennedy Space Center ground flow activity and launch operations, Johnson flight operations, and Edwards Air Force Base landing operations were observed by the combined Air Force Test and Evaluation Center/Air Force Systems Command test team. Test reports were published on all significant operations. Due to the developmental nature of the first flights, no overall assessment was possible; but, the areas of performance and launch rate were flagged as requiring in-depth review.

(U) Inertial Upper Stage Test Program: Inertial Upper Stage test and evaluation will focus on system performance, reliability and maintainability, and compatibility with the Titan III(34)D and the Space Transportation System and payloads. Inertial Upper Stage test activity is being performed at the Boeing facilities in Kent WA and Cape Canaveral Air Force Station FL. The actual buildup and checkout of the Inertial Upper Stage is handled by contractor personnel. Air Force Test and Evaluation Center will provide an independent evaluation and assessment of the Inertial Upper Stage tests. Air Force Test and Evaluation Center and Air Force Systems Command are currently conducting a combined Development Test and Evaluation/Operational Test and Evaluation program by observing Inertial Upper Stage factory testing and Inertial Upper Stage pathfinder test vehicle processing at Cape Canaveral Air Force Station. Air Force Test and Evaluation Center is collecting information to support an Inertial Upper Stage production decision currently scheduled for March 1982.

(U) Vandenberg Air Force Base Ground Support System Test Program: The Ground Support System testing will focus on compatibility of ground processing equipment with the Space Shuttle Vehicle, ground operations, supportability, Air Force manpower/resources, and contractor support. Much of the ground processing data obtained at Kennedy Space Center will be applicable to Vandenberg Air Force Base due to the similarity of the Space Transportation System equipment, facilities, and procedures. The Operational Test and Evaluation test team will initially be located at Cape Canaveral Air Force Station to begin collecting data for the Ground Support System and will subsequently transition to Vandenberg Air Force Base during Fiscal Year 1984. The Ground Support System evaluation will continue through the Vandenberg full operational capability date. Air Force Test and Evaluation Center will provide an independent evaluation and assessment of the Vandenberg Air Force Base Ground Support System.

(U) Operations Capability Development: Air Force Test and Evaluation Center will participate in testing of the other Department of Defense segments and provide independent assessments of operational suitability and effectiveness.

Budget Activity: Program-wide Management and Support, #6
Program Element: #64411F - Space Shuttle

3. System Characteristics: The key performance parameters of the National Aeronautics and Space Administration and Department of Defense developed segments are shown below:

NASA SEGMENT - SPACE SHUTTLE VEHICLE

ITEM	OBJECTIVE	CURRENT ESTIMATE	DEMONSTRATED	REMARKS
Payload to 160 nautical miles 28.5° inclination	65,000 pounds	65,000 pounds *	14,000 pounds (Orbiter Vehicle 102)	Baseline Reference Mission 1
Payload to 150 nautical miles 98° inclination	32,000 pounds	28,300 pounds * 33,500 pounds **		Baseline Reference Mission 4

* - Mature OV-103 Performance (requires improvements in Space Shuttle Main Engine thrust and Space Shuttle Vehicle weight)
** - Mature OV-103 Performance with Performance Augmentation (Filament Wound Cases for the Solid Rocket Boosters)

AIR FORCE SEGMENT - INERTIAL UPPER STAGE

ITEM	OBJECTIVE	CURRENT ESTIMATE	DEMONSTRATED	REMARKS
Payload to Geosynchronous (Shuttle Version)	5,000 pounds	5,087 pounds		With Extendable Exit Cone
Payload to Geosynchronous (Titan Version)	4,000 pounds	4,040 pounds		With Extendable Exit Cone
Reliability	0.96 (goal) 0.98 (threshold)	0.985		
Accuracies (3σ)				
Position	$\pm$ 92 nautical miles	$\pm$ 44 nautical miles		Shuttle Version at Geosynchronous altitude
Velocity	$\pm$ 78 feet/second	$\pm$ 46 feet/second		
Inclination	$\pm$ 0.12°	$\pm$ 0.073°		

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64707F
DOD Mission Area: Global Military Environmental Support, #420

Title: Weather Systems (Engineering Development)
Budget Activity: Defense-Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands) 1/

Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT	3,593	3,786	4,064	8,417	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The increasing emphasis on Air Force operations during night and bad weather periods makes the rapid and accurate determination of weather conditions of increasing importance. The Air Force needs to use weather as a force intensifier. This requires an upgrade in weather support equipment. Several development projects are required to make this upgrade possible. These include: development of equipment to process, display, and disseminate weather data and forecasts in fixed-base and tactical weather stations; development of a Doppler weather radar; and testing of tactical decision aids which assess weather effects on precision guided munitions.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds for: continued full scale development of the Automated Weather Distribution System which will upgrade fixed-base and tactical weather stations; continued Air Force contribution to the joint Department of Defense, Commerce, and Transportation development of a Doppler weather radar (Next Generation Weather Radar); and continued testing of tactical decision aids developed to support precision guided munitions based on infrared sensors. Funding amounts are based on initial cost estimates by Air Force Systems Command for Automated Weather Distribution System and tactical decision aids as well as initial cost estimates by the joint agency system program office for Next Generation Weather Radar.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	3,793	3,795	5,600		Continuing	Not Applicable

(U) OTHER APPROPRIATIONS: Not Applicable.

Program Element: #64707F DOD Mission Area: Global Military Environmental Support, #420

Title: Weather Systems (Engineering Development) Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The efforts in this program element will fund development of equipment and techniques bringing a long overdue upgrade of Air Force Air Weather Service support. This upgraded weather support will make weather a force intensifier on the battlefield and will develop greatly improved severe storm detection and warning through joint agency efforts. The following are addressed: AUTOMATED WEATHER DISTRIBUTION SYSTEM which will automate most weather data handling tasks within each Air Weather Service weather station at major Air Force Bases, some Army installations, and Air Force tactical facilities. This system will use a minicomputer to accelerate data handling, incorporate more efficient forecast preparation techniques, and speed dissemination of precise and up-to-date weather intelligence. Once observations, forecasts, and weather warnings become available, the system will display them to the forecaster and local users. ADVANCED WEATHER RADAR will provide a greatly improved storm detection and warning capability through a Joint Department of Defense, Commerce, and Transportation development and procurement program (called Next Generation Weather Radar). A joint program office has been formed with representatives from each of the participating agencies. This radar will detect severe surface wind, hail, tornadoes, and turbulence using Doppler techniques; automate thunderstorm tracking; accelerate severe thunderstorm identification; and improve warning accuracy and timeliness through use of interactive warning-preparation techniques. BATTLEFIELD WEATHER SYSTEMS will support employment of weapons using visible, infrared, and radar sensors. The Air Weather Service does not have the capability to provide the detailed and effective projections of weapon system performance in current or forecast target weather conditions for the modern family of precision guided munitions. Tactical decision aids will provide the needed capability. This program element provides funds for testing, evaluation, and implementation of tactical decision aids with specific weapon systems.

(U) RELATED ACTIVITIES: Program Element 64707F began in FY 1981 as an outgrowth of Project 2093, Weather Systems, PE 64708F, Other Operational Equipment. PE 63707F, Weather Systems (Advanced Development), accomplishes advanced development projects whose results support PE 64707F. Funds for procurement of systems developed in PE 64707F are included in PE 35111F, Weather Services.

(U) WORK PERFORMED BY: Program management for Automated Weather Distribution System is provided by Electronic Systems Division, Hanscom Air Force Base, MA. Development of the Advanced Weather Radar is pursued by the Joint System Program Office for Next Generation Weather Radar which is located within Department of Commerce.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 ACCOMPLISHMENTS: Automated Weather Distribution System development began with preparation of request for proposal, study of contractor versus blue suit maintenance trade-offs, preparation of contract strategy, source selection planning, and issue of draft request for proposal to industry for comment. Advanced Weather Radar (or Next Generation Weather Radar) development consisted of system definition study by both government experts and contractors and

Program Element: #64707F		Title: Weather Systems (Engineering Development)
DOD Mission Area: Global Military Environmental Support, #420		Budget Activity: Defense-wide Mission Support, #6

preparation of system definition phase request for proposal. Finally, testing of tactical decision aids supporting infrared weapons began with Air Force Systems Command and Air Weather Service representatives participating in weapon systems tests by the Air Force Test and Evaluation Center. Minor funding (less than $10K) supporting cooperative efforts with Department of Commerce continued in an effort to evaluate low cost system candidates for Wind Sounding and Improved Weather Reconnaissance systems.

2. (U) FY 1982 Planned Program: Automated Weather Distribution System development will continue with submission of request for proposal to industry and initiation of source selection. Advanced Weather Radar (or Next Generation Weather Radar) development will continue with evaluation of alternative system design proposals and award of multiple contracts for system definition studies. Evaluation and testing of tactical decision aids to support infrared systems will continue

3. (U) FY 1983 Planned Program: Automated Weather Distribution System development will continue with development of the prototype system which will consist of a minicomputer, associated communications equipment, and the software required for rapid and efficient forecast preparation. Advanced Weather Radar (or Next Generation Weather Radar) development will continue with development of a prototype Doppler weather radar system. Evaluation and testing of tactical decision aids to support infrared systems will be completed. This year's estimate for FY 1983 was reduced and FY 1984 was increased to adjust to program office funding requirements for execution of the approved schedule.

4. (U) FY 1984 PLANNED PROGRAM: Automated Weather Distribution System development will continue with software development and hardware/software integration in preparation for test and evaluation in FY 1985. Development of a Doppler weather radar prototype system will also continue.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES: Not Applicable.

7. (U) RESOURCES: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64735F
DOD Mission Area: Other Test and Evaluation Support, #454

Title Range Improvement
Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in Thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	11,909	22,615	25,311	22,933	Continuing	Not Applicable
2152	Mission/Engineering Support	1,800	3,200	2,900	2,700		
2285	Threat Systems	8,109	15,815	11,911	13,033		
2286	Instrumentation	2,000	3,600	4,000	1,200		
6510	Flight Test Simulators	-0-	-0-	6,500	6,000		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Wartime experience has shown that a disproportionate number of losses occur among aircrews during their first ten combat missions. There is a continuing requirement to reduce those losses by more realistic training and testing. Additionally, the growing costs of modern weapon systems makes it imperative that the effective utilization of test and training resources be improved as much as possible. This program contributes to the qualitative improvement of combat operational forces by developing instrumentation and threat simulator systems to increase the effectiveness of Development and Operational Test and Training and large-scale exercises world wide.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request includes funds for four projects. The Mission/Engineering Support project primarily funds a Systems Engineering Technical Assistance contractor who conducts engineering and management evaluations and writes system specifications and statements of work. Instrumentation funds continued development of the Air Combat Maneuvering Instrumentation, the Advanced Time-Space-Position-Instrumentation and the Missile End Game Evaluation Study. Threat Systems will fund completion of the AN/MSQ-T13, I-Band Communications Data Link Jammer, and Antiaircraft Artillery Visual Cueing. Development will continue on the Ground Control Intercept Command and Control, the AN/MSQ-T11, the Laser Weapon System and the Low Altitude Threat Radar. The Flight Test Simulators project is being transferred from Program Element 64738F to consolidate threat simulator hardware developments. This project develops prototype threat simulators to test Air Force weapons systems such as Airborne Self-Protection Jammer, B-1B, LANTIRN, HAVE EXIT and TR-1. Cost estimates resulted from detailed independent cost analyses.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: ($ in Thousands)

FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
12,600	22,700	26,200	13,500	Continuing	Not Applicable

Program Element: #64735F

DOD Mission Area: Other Test and Evaluation Support, #454

Title Range Improvement

Budget Activity: Defense-wide Mission Support, #6

(U) OTHER APPROPRIATION FUNDS:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
Procurement, Other (PE #27429F)	39,673	4[illegible],167	68,217	81,400	Continuing	Not Applicable *
Procurement, Other (PE #11897F)	14,058	1[illegible],699	37,965	44,466	Continuing	Not Applicable *
Procurement, Aircraft (PE #27429F)	6,400	6,800	4,300	8,200	Continuing	Not Applicable *

* Includes initial spares

Program Element: #64735F
DOD Mission Area: Other Test and Evaluation Support, #454

Title Range Improvement
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: A Presidential Blue Ribbon Defense Report, Government Accounting Office (GAO) Reports and other documents identify deficiencies in the Air Force ability to conduct Operational Test and Evaluation (OT&E) and training in a realistic combat environment. These deficiencies have a direct impact on the combat effectiveness and survivability of strategic and tactical aircrews and weapon systems. Much of the current OT&E and training is still conducted in an environment which provides little realistic threat simulation. This program, and the associated procurement programs, is a part of the Air Force's overall Range Improvement Program. This program conducts full-scale engineering development efforts to increase realism in development and operational testing and training. It conducts numerous low cost efforts in instrumentation and simulation as a part of the integrated "Range Improvement Plan" noted above. The program will pay high dividends in eliminating the test and training deficiencies which currently exist. The end result will be improved weapon system effectiveness, increased aircrew combat proficiency and a reduction in anticipated aircrew and weapon system combat losses.

(U) RELATED ACTIVITIES: This program element, in conjunction with the procurement programs in PE 11897F and PE 27429F, forms the integrated USAF Range Improvement Program. This program is coordinated with the other services' range modernization plans.

(U) WORK PERFORMED BY: This program is managed by the Armament Division, Eglin AFB FL. Major contractors include Cubic Corp, San Diego CA; General Dynamics Corp, Ft Worth TX; Emerson Electric Corp, St Louis MO; and Metric Corp, Ft Walton Beach FL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In conjunction with the Navy, this program funded nonrecurring engineering associated with development of Air Combat Maneuvering Instrumentation (ACMI) now in operation in several locations. Also funded were ACMI related improvements for use in joint Navy/Air Force Air Combat and Air Intercept Missile Evaluations. Testing was completed on a remote television scoring system to provide weapon scoring on unmanned ranges. The majority of the work relating to Modular Threat Emitter, and a Radar Bomb Scoring System for the Strategic Air Command was completed. The Air Force and Navy have jointly developed a low-cost rocket simulating surface-to-air missile launches to train aircrews. Development is complete on the AN/MST-T1IA Multiple Emitter System capable of duplicating 63 threat signals.

2. (U) FY 1982 Program: Development programs being completed are the Missile End Game Evaluation Study, Envelope Scoring, Tactical Strategic Command and Control, D-band Communications Data Link Jammer, and Modular Threat Emitters. New developments include I-Band Communications Data Link Jammer, Laser Weapon System, Modular Threat Emitter Update, Ground Control Intercept Command and Control, Low Altitude Threat Radar, Unmanned Threat Emitter, the AN/MSQ-T11 and Antiaircraft Artillery Visual Cueing. These initiatives are required to provide our operational aircrews realistic training against modern Soviet electronic warfare systems.

Program Element: #64735F
DOD Mission Area: Other Test and Evaluation Support, #454

Title: Range Improvement
Budget Activity: Defense-wide Mission Support, #6

3. (U) FY 1983 Planned Program: Development will be completed on the AN/MSQ-T13 Update, Antiaircraft Artillery Visual Cueing and the I-Band Communications Data Link Jammer. Work continues on Air Combat Maneuvering Instrumentation, Missile End Game Evaluation Study, Advanced Time Space Position Instrumentation, the AN/MSQ-T11A, Ground Control Intercept Command and Control, Laser Weapon System, Modular Threat Emitter, and Low Altitude Threat Radar. Within the Flight Test Simulator project, development work begins on the Back Trap radar, continues on the SADS VIII and Modular Generic radars, and is complete on the SADS VI radar. Flight Test Simulators was added to the program element to consolidate threat simulator hardware developments.

4. (U) FY 1984 Planned Program: During this period, development work will be complete on the Advanced Time Space Position Instrumentation, the AN/MSQ-T11A, Ground Control Intercept Command and Control and the Modular Threat Emitter. Work continues on the Low Altitude Threat Radar and SADS VIII. New development starts include On Board Electronic Warfare System and Look Down, Shoot Down Radar.

5. (U) Program to Completion: This is a continuing effort.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

Project: # 2285
Program Element: # 64735F
DOD Mission Area: Other Test and Evaluation Support, #454

Title: Threat Systems
Title: Range Improvement
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: Operational range deficiencies exist in the USAF ability to conduct operational training and testing and evaluation under realistic combat conditions. Realistic test and training programs increase the survivability of new weapon systems and the improved combat readiness of strategic, tactical, and air defense aircrews. This project corrects test and training deficiencies by developing threat radar systems to simulate enemy surface-to-air missile fire control radars, antiaircraft artillery radars, early warning and acquisition radars, jamming equipment, and air defense command and control systems. Different degrees of duplication are built into threat radar simulators to satisfy Air Force testing and training requirements at the lowest cost. An emitter simulates the threat system's emitter characteristics. An emitter-receiver simulates the threat radar's radio frequency characteristic and provides some representation of its basic receiver and/or displays. An emitter-receiver-processor is an electrical representation of the threat radar system. A replica is a functional representation of the complete threat system.

(U) RELATED ACTIVITIES: Hardware developments under this project are coordinated with procurements programmed under Program Elements: 11097F, Training Offensive; and 27429F, Range Improvement Equipment. This project relates to PE 64738F, Protective Systems which requires enemy threat simulators for Development, Test and Evaluation of electronic countermeasures (ECM).

(U) WORK PERFORMED BY: Tasks under this project are managed by the Armament Division, Eglin AFB FL. The major contractors are General Dynamics, Fort Worth TX; Metric Systems, Fort Walton Beach FL; American Electronics Laboratory, Philadelphia PA; Tasker Division of Whittaker, Chatsworth CA; and Martin-Marietta, Denver CO.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: A study of a command, control and communication systems used by the enemy in air defense was completed and a prototype simulator of enemy threat radars (such as the AN/MSQ-T13 and AN/MSY-T1) was built. Work was initiated on the Modular Threat Emitters. Duplicates of tactical command and control systems to be used in aircrew ECM training were developed and the equipment was tested. Work on the D-Band Communication Data Link Jammer was initiated and the Threat Training Systems Study was completed. Simulator Validation continues from previous years.

2. (U) FY 1982 Program: Development will be completed on the D-Band Communication Data Link Jammer, Tactical/Strategic Command and Control Systems, Modular Threat Emitter, and Antiaircraft Artillery Visual Cueing. Work continues on the AN/MSQ-T13. New simulator developments will include Ground Control Intercept Command and Control, I-Band Communications Data Link Jammer, Laser Weapon System, Modular Threat Emitter, Low Altitude Threat Radar, Unmanned Threat Emitter and the AN/MST-T1A.

Project: # 2285
Program Element: # 64735F
DOD Mission Area: Other Test and Evaluation Support, #454

Title: Threat Systems
Title: Range Improvement
Budget Activity: Defense-wide Mission Support, #6

3. (U) FY 1983 Planned Program: Continuing efforts include Ground Control Intercept Command and Control, I-Band Communications Data Link Jammer, Laser Weapon System, Modular Threat Emitter Update and the Low Altitude Threat Radar. Efforts being completed include the AN/MSQ-T13 and the AN/MSQ-T11A.

4 (U) FY 1984 Planned Program: During this period, development work will be completed on the AN/MSQ-T11A, Ground Control Intercept Command and Control and the Modular Threat Emitter Update. Work will continue on the Low Altitude Threat Radar. New developments include the On Board Electronic Warfare System.

5. (U) Project to Completion: This is a continuing project.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	8,109	15,900	12,187	13,600	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	8,800	15,500	19,800		Continuing	Not Applicable

Project: # 6510
Program Element: # 64735F
DOD Mission Area: Other Test and Evaluation Support, #454

Title: Flight Test Simulators
Title: Range Improvement
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: There is a continuing and expanding need to flight test and evaluate new and/or modified electronic warfare (EW) equipment to counter new Soviet defensive systems prior to a production decision. These tests must be conducted in a simulated threat environment and require many threat radars. In the past, the adaptability of airborne ECM systems was quite limited. However, new Radar Warning Receiver (RWR) signal processing schemes are highly adaptive and make it extremely difficult to construct a test for such equipment without a large number of instrumented threat systems. This project was transferred from PE 64738F, Protective Systems, to consolidate threat simulator hardware developments.

(U) RELATED ACTIVITIES: Hardware developments under this project are coordinated with procurements programmed under Program Elements: 11897F, Training Offensive; and 27429F, Range Improvement Equipment. This project relates to PE 64738F, Protective Systems, which requires enemy threat simulators for Development, Test and Evaluation of electronic warfare jammers and radar warning receivers.

(U) WORK PERFORMED BY: Tasks under this project are managed by the Armament Division, Eglin AFB FL. The major contractors are General Dynamics, Fort Worth TX; Metric Systems, Fort Walton Beach FL; RCA, Moorstown NJ; and the Georgia Institute of Technology.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Program: Not Applicable

3. (U) FY 1983 Planned Program: The Generic Radar will be completed. Work will continue on the SADS VIII

4. (U) FY 1984 Planned Program: Work continues on the SADS VIII. New development starts include the Look Down, Shoot Down Radar.

5. (U) Project to Completion: This is a continuing project.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	-0-	-0-	6,500	6,000	Continuing	Not Applicable

Project: # 6510 Title: Flight Test Simulators
Program Element: # 64735F Title: Range Improvement
DOD Mission Area: Other Test and Evaluation Support, #454 Budget Activity: Defense-wide Mission Support, #6

8. (U) Comparison with FY 1981 Budget Data:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	-0-	-0-	6,500	6,000	Continuing	Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64747F Title: Electromagnetic Radiation (EMR) Test Facilities
DOD Mission Area: Other Test and Evaluation Support, #454 Budget Activity: Defense-Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	TITLE	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3,756	3,088	7,487	7,459	Continuing	Not Applicable
1209	Nuclear Effects Simulation Test Facilities	2,428	1,700	6,100	6,100	Continuing	Not Applicable
2064	HAVE NOTE	1,328	1,388	1,387	1,359	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Nuclear weapon detonations generate electromagnetic pulses which can damage electronic components. Nonnuclear electromagnetic emissions such as jamming, may also result in component damage. The equipment malfunctions resulting from these electromagnetic environments may cause a significant reduction in weapon system effectiveness. This program element provides funds to operate and maintain test facilities and analysis capabilities to determine the ability of weapon systems to operate in nuclear (Project 1209) and non-nuclear (Project 2064) electromagnetic environments.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The requirement to test weapon system survivability in nuclear and nonnuclear electromagnetic environments is continuing. Examples of systems which are planned for testing in simulated nuclear electromagnetic pulse environments include the E-4B (Airborne Command Post), Ground Launched Cruise Missile, F-16, TACAMO, EC-135 and MX-ALCC Missile. Examples of systems to be analyzed in nonnuclear electromagnetic radiation environments include the Low Level Laser Guided Bomb and the High Speed High Altitude Target. The estimated costs are based on past program experience, adjustments for expected cost growth and the workload projected to support the above projects.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	3,000	3,327	3,661		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #64747F
DOD Mission Area: Other Test and Evaluation Support, #454

Title: Electromagnetic Radiation (EMR) Test Facilities
Budget Activity: Defense-Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program is for development, acquisition and baseline support of test facilities which simulate the nuclear and nonnuclear electromagnetic environments in which the weapon systems may be required to operate. The principal nuclear simulation facilities are the vertically and horizontally polarized electromagnetic pulse dipoles and the in-flight electromagnetic pulse simulation facility (TRESTLE). These facilities are used to test aircraft and missile systems in various operational configurations. Additional capabilities include portable electromagnetic pulse generators for remote site tests and a laboratory used for testing of individual electronic components. The nonnuclear effort provides facilities for assesing the susceptibility of weapon systems to nonnuclear electromagnetic radiation. This radiation comes from hostile or friendly sources such as radios, radars, jammers, or other electronic devices. These sources can illuminate the weapon for lengthy periods of time such as when the weapon is enroute to the target. The principal nonnuclear test facility is the Electromagnetic Compatibility Analysis Facility, an anechoic chamber where air-launched weapons can be radiated by a variety of signals. The data collected during testing is also used to update test methods and acquisition specifications, design standards, and maintenance technical orders to insure that the weapon system is immune to those radio frequency emanations which it may encounter during its life cycle from stockpile to target. Weapon systems program offices arrange for testing time and provide test resources and test costs.

(U) RELATED ACTIVITIES: Nuclear Effects Simulation Test Facilities, Project 1209, is related to Program Element 64711F, Systems Survivability (Nuclear Effects). Work performed under Program Element 64711F develops weapon system nuclear effects survivability assessment, testing and hardening techniques, while Project 1209 is directed at implementing a testing capability for one nuclear effect, electromagnetic pulse. The Air Force Weapons Laboratory is responsible for coordinating these efforts. Project 2064 (HAVE NOTE) is the Air Force implementation of the Office of the Under Secretary of Defense Research & Engineering directed Special Electromagnetic Interference Project which directs all three services to test their air-launched weapons and share test results and conclusions. Tri-service reviews are held periodically.

(U) WORK PERFORMED BY: Project 1209 is managed by Air Force Systems Command through the Air Force Weapons Laboratory, Kirtland Air Force Base, NM. Dynalectron, Washington, DC, is the facilities support contractor. Project 2064 is managed by Air Force Systems Command through the Rome Air Development Center, Griffiss Air Force Base, NY. The test support contractor is Alantic Research Corp., Washington, D.C. Hardness criteria development for acquisition specifications and standards is performed by Electrical Engineering Station, Georgia Institute of Technology, Alanta, GA.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: In Project 1209, checkout testing on TRESTLE was completed and operational testing began in March 1980 on a B-52G. Past dipole test have included F-16, E-3A, E-4B, Navy C-130Q Take Charge and Move Out (TACAMO) aircraft, and Air Launched Cruise Missile. Work has also been performed in developing fiber optic sensor, development of a new impulse generator for testing trailing wire antennas and improving data system software. In project 2064, anechoic chamber improvements have been completed. A handbook for electromagnetic radiation hardening was completed and development of design standards/specifications was initiated.

Program Element: #64747F | Title: Electromagnetic Radiation (EMR) Test Facilities
DOD Mission Area: Other Test and Evaluation Support, #454 | Budget Activity: Defense-Wide Mission Support, #6

2. (U) FY 1982 Program: In Project 1209, testing of the B-52 will continue. Testing of the TACAMO, FB-111 and F-14 is scheduled. Improvements to instrumentation, data acquistion systems and pulse generators will continue. In project 2064, testing is scheduled for the Infrared Maverick, Sidewinder(AIM-9P) and Low Level Laser Guided Bomb. An electroptical/infrared targeting system will be installed in the anechoic chamber. An Automatic Data Acquisition and Control System will be developed to improved testing efficiency. Guidance on EMR hardening to system project offices is continuing.

3. (U) FY 1983 Planned Program: In Project 1209, electromagnetic pulse testing of the E3A, TACAMO and F-18 is scheduled. Upgrades of the facilities are planned to meet the defined threat levels and provide testing capability of the Trailing Wire Antenna on the E4B and EC-135. In Project 2064, testing of Wide Area Anti-Armor Munitions, Low Level Laser Guided Bomb and Laser Guided Hard Structure Munitions is scheduled. Facility improvement which enhance test capabilities will continue under both projects. Additional funds for improvements of facilities under Project 1209 have been programmed for FY 83, 84 and 85, and are reflected in the resources line of this summary.

4. (U) FY 1984 Planned Program: In Project 1209, electromagnetic pulse testing of the EC-135 and E-4B is scheduled Additional systems, including the E-3A, MX, GLCM and B-52 Offensive Avionics System will be tested. In Project 2064, testing will be conducted on the Advanced Medium Range Air-to-Air Missile and Wide Area Anti-Armor Munitions. Facility improvements which enhance test capabilities will continue under both projects.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64755
DOD Mission Area: Other Test and Evaluation Support, #454

Title: Improved Capability for DT&E
Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	(7738)	(24039)	46,478	59,423	86,200	192,101
2870	Aeropropulsion Systems Test Facility (ASTF) Activation	(1738)	(2189)	12,700	17,050	3,800	33,550
2871	Global Positioning System/Time-Space Positioning Information (GPS/TSPI)	0	(400)	0	0	35,000	35,000
2872	ARIA Phased Array Antenna System (APATS)	(2700)	(8100)	12,348	28,376	17,900	58,624
2873	Integration Facility for Avionics System Testing (IFAST)	(300)	(5100)	5,800	1,443	200	7,443
2874	Integrated Flight Data Processing System (IFDAPS)	(700)	(3100)	4,530	4,554	1,500	10,584
2875	Advanced Range Data System (ARDS)	0	0	0	0	21,100	21,100
2876	Global Positioning System/Sonobuoy Missile Impact Location System (GPS/SMILS)	(600)	(650)	2,000	2,000	3,000	7,000
2880	ARIA Upgrade	(1700)	(4300)	9,100	6,000	3,700	18,800

Note: Funds shown in parenthesis are currently funded in Program Element (PE) 65807F. Funds shown in FY 83 and out were transferred to PE 64755F from PE 65807F.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the engineering, development, acquisition and installation of significant new test range and instrumentation systems required for development test and evaluation. The new systems are required to obtain adequate capability to test and evaluate weapon and support systems currently in development.

Program Element: #64755F Title: Improved Capability for DT&E
DOD Mission Area: Other Test and Evaluation Support, #454 Budget Activity: Defense-Wide Mission Support, #6

(U) BASIS FOR FY 1983 RDT&E REQUEST: This program directly supports the RDT&E range and test centers operated and maintained under PE 65807F (Arnold Engineering Development Center, Armament Division, Air Force Flight Test Center and the 4950th Test Wing) and 78032F (Western Space and Missile Center). These projects are being transferred from PE 65807F in FY 83 to increase management visibility on major improvement and modernization programs. The basis for the FY 1983 request is a combination of range/center cost estimates, prices of current similar systems and contractor proposals.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

(U) DETAILED BACKGROUND AND DESCRIPTION: This Program Element resulted from the need to improve management visibility on major improvement and modernization (I&M) projects at Air Force Research, Development, Test and Evaluation ranges/centers. OSD directed these programs, with applicable funding, be transferred from PE 65807F to PE 64755F effective in FY 1983. In addition to increasing visibility of range/center I&M efforts, this transfer also clarifies the funding used to develop and acquire new or improved capabilities at the ranges/centers versus that used primarily for operation and maintenance type of expenditures (PE 65807F).

(U) RELATED ACTIVITIES: The improvement and modernization program is directly related to the Test and Evaluation Support (PE 65807F) Program as discused above. In addition, the improved capabilities benefit all system test programs which come to the DT&E ranges/centers.

(U) WORK PERFORMED BY: The I&M projects contained in this Program Element are the responsibility of the applicable range/center commander and his staff. Major contractors performing work on these efforts are identified under the separate project descriptions.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: See attached project descriptions.

Project: 2870 | Title: Aeropropulsion Systems Test Facility (ASTF)
Program Element: #64755 | Title: Improved Capability for DT&E
DOD Mission Area: Other Test and Evaluation Support, #454 | Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Aeropropulsion Systems Test Facility (ASTF) was funded under the FY 1977 Military Construction Program. This facility will be a unique national test asset for integrated aerodynamic and propulsion testing of turbine engines. Facility construction is currently scheduled for completion in late FY 1984. Approximately fourteen months have been allocated after construction completion to perform facility checkout and initial systems testing, or activation, of ASTF.

(U) RELATED ACTIVITIES: The ASTF will become part of the test capability available to qualified users at the Arnold Engineering Development Center. This Center is described under Project 2109 of PE 65807F.

(U) WORK PERFORMED BY: The AEDC commander and his staff provide the overall planning, programming, budgeting and administration of all test facilities at Arnold. ARO, Inc is the operating contractor responsible for ASTF activation and initial operation.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Program: Not Applicable

3. (U) FY 1983 Planned Program: Initial checkout tests will be performed on the installed electrical systems and in the air supply and exhaust areas.

4. (U) FY 1984 Planned Program: Testing described in FY 1983 will continue. Checkout of test areas and initial buildup in test cells for simulator testing will begin.

5. (U) Program to Completion: Final checkout and initial systems testing will be performed in FY 1985. The Initial Operational Capability (IOC) for ASTF is currently projected for late FY 1985. After IOC, ASTF operation and maintenance will be funded in accordance with DODD 3200.11 within Program Element 65807F.

6. (U) Milestones:

Construction Completion	July 1984
Initial Operational Capability	Sept 1985

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	(1,738)	(2,189)	12,700	17,050	3,800	33,550

8. (U) Comparison with FY 1982 Budget Data: Not Applicable

Project: #2872
Program Element: #64755
DOD Mission Area: Other Test and Evaluation Support, #454

Title: ARIA Phased Array Telemetry System (APATS)
Title: Improved Capability for DT&E
Budget Activity: Defense-Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: APATS is a phased array telemetry system with a multiple beam electronically steered antenna needing no mechanical tracking devices. Present goals are to have APATS track up to four separate targets simultaneously, versus the current ARIA single target capability, with gain and noise factors comparable to those with the present seven foot dish. Capabilities will also include reception of two telemetry links per target, for a total of eight links. This system will significantly enhance ARIA's capability to perform its mission, primarily by allowing a single aircraft to handle missions which presently require two, three, or even four aircraft. The program is in the contract definition phase.

(U) RELATED ACTIVITIES: The APATS capability will support multiple reentry vehicle (RV) weapon systems such as MX and Trident. APATS will also be able to support Space Shuttle and other orbital systems.

(U) WORK PERFORMED BY: The 4950th Test Wing, Wright-Patterson AFB, OH will operate the system and participate with the Electronic Systems Division, Hanscom AFB, MA who will provide the system program office (SPO) functions. The three competing contractors are E-Systems, Electrospace and Raytheon.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable (65807F effort in 1981).

2. (U) FY 1982 Program: Not applicable (65807F effort in 1982).

3. (U) FY 1983 Planned Program: Full-scale engineering development will be in its early stages during FY 1983. Preliminary Design Review (PDR) will occur approximately the second quarter of the fiscal year.

4. (U) FY 1984 Planned Program: Full-scale engineering development will continue. Initial Operational Capability (IOC) is planned in the final quarter of the fiscal year.

5. (U) Program to Completion: Three additional APATS systems will be acquired. Final Operational Capability will occur in early FY 1987.

6. (U) Milestones: Not Applicable.

Project: #2872
Program Element: #64755F
DOD Mission Area: Other Test and Evaluation Support, #454

Title: ARIA Phased Array Telemetry System (APATS)
Title: Improved Capability for DT&E
Budget Activity: Defense-Wide Mission Support, #6

7. (U) RESOURCES ($ in thousands):

Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	(2,700)	(8,100)	12,348	28,376	17,900	58,624

8. (U) Comparison with FY 1982 Descriptive Summary: This program element commences in FY 1983. Previous effort on this project was accomplished in Program Element 65807F.

Project: 2873 Title: Integration Facility for Avionics Systems Testing
Program Element: #64755F Title: Improved Capability for DT&E
DOD Mission Area: Other Test and Evaluation Support, #454 Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The IFAST is a three story Avionics Test Facility which will contain four program test areas and central support systems including an automated data processing complex. Lessons learned from past Development Test and Evaluation (DT&E) programs at the Air Force Flight Test Center (AFFTC) have proven the need for appropriate onsite avionics support facilities to implement "test-before-fly" techniques. Substantial savings can be realized with IFAST by reducing the number of tests and time required to adequately assess avionics systems capabilities. The test programs of the eighties will not permit costly "fly-fix-fly" test programs.

(U) RELATED ACTIVITIES: The IFAST will be available to support all programs at the AFFTC; however, the design is oriented toward support for programs with offensive, digital avionics. The design is planned to achieve maximum software capability with the Air Force Avionics Laboratory.

(U) WORK PERFORMED BY: AFFTC, Edwards AFB, CA is acquiring the IFAST capability. The major contractor is Northrop Corporation, Hawthorne, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Program: This program was initiated under PE 65807F. Because of a shortfall in improvement and modernization funds, only a low level of initial design work will be completed in FY 82. The program will shift to PE 64755F after FY 82.

3. (U) FY 1983 Planned Program: The FY 1983 effort will entail design reviews, inplant development and onsite integration at Edwards AFB, CA.

4. (U) FY 1984 Planned Program: Continuation of inplant development and onsite integration will result in establishing the initial operational capability.

5. (U) Program to Completion: Final operational capability is planned for FY 1985.

6. (U) Milestones: Date

	Milestones	Date
A.	Contract Award	March 1982
B.	Preliminary Design Review	September 1983
C.	Critical Design Review	May, April 1983

Project: 2873
Program Element: #64755F
DOD Mission Area: Other Test and Evaluation Support, #454

Title: Integration Facility for Avionics Systems Testing
Title: Improved Capability for DT&E
Budget Activity: Defense-wide Mission Support, #6

D. Inplant Development September 1982 - December 1983

E. Onsite Integration March 1983 - January 1984

F. Initial Operational Capability April 1984

G. Final Operational Capability April 1985

7. (U) Resources:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	(300)	(5,100)	5,800	1,443	200	7,443

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable

Project: #2680 Title: ARIA Upgrade
Program Element: #64755 Title: Improved Capability for DT&E
DOD Mission Area: Other Test and Evaluation Support, #454 Budget Activity: Defense-Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The ARIA Upgrade project consists of seven tasks that contribute to the enhancement of ARIA capabilities. These ARIA tasks are the 707 Reconfiguration, Receiver Upgrade, Sonobuoy Missile Impact Location System (SMILS), Digital Multiplexer, Satellite Communications Upgrade, Calibration Upgrade, and Solid State Amplifiers.

(U) RELATED ACTIVITIES: In addition to these activities, the ARIA fleet will be significantly improved through the ARIA Phased Array Antenna System, Project 2872.

(U) WORK PERFORMED BY: The 4950TW, Wright-Patterson AFB, OH has overall responsibility for this task. Required instrumentation/equipment will be acquired from a variety of sources.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable (65807F effort in 1981).

2. (U) FY 1982 Program: Not applicable (65807F effort in 1982).

3. (U) FY 1983 Planned Program: Work will be accomplished on all seven ARIA Upgrade tasks. Efforts on the Communications Upgrade, Digital Multiplexer, Solid State Amplifiers and Calibration Upgrade will be completed. Completion of design efforts and intial aircraft modification will be performed for the 707 Reconfiguration and SMILS Upgraded receivers will be tested.

4. (U) FY 1984 Planned Program: Work will continue on ARIA 707 Reconfiguration and SMILS. Receiver testing and installation will be completed.

5. (U) Program To Completion: Work will continue on ARIA 707 Configuration and SMILS.

6. (U) Milestones: Not applicable

7. (U) Resources ($ in thousands):

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	(1700)	(4300)	9,100	6,000	3,700	18,800

8. (U) Comparison with FY 1982 Descriptive Summary: This program element commences with FY 1983. Previous effort on this project was accomplished in Program Element 65807F.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 65101F
DOD Mission Area: Technical Integration/Studies & Analyses, 440

Title: Project AIR FORCE
Budget Activity: Defense-Wide Management & Support, 6

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	12,902	13,748	16,231	16,954	Continuing	Not Applicable
65101F	Project AIR FORCE	12,902	13,748	16,231	16,954	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element is devoted to assisting Air Force decision-making by furnishing information and objective findings derived from independent research and analysis of aerospace problems. The program objective is to recommend methods and techniques for consideration in the development and enhancement of aerospace power. The program funds a Federal Contract Research Center operated by The Rand Corporation.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Project AIR FORCE is a level of effort program providing improved decision-making capability for the Air Force through the creation and application of modern analytic methods. The work focuses on the future roles of air forces with emphasis on the issues which will influence decisions in the 1980's and beyond. New research efforts during FY 1983 will primarily reflect USAF interests in such issues as integrated national security strategy development, strategic force sustainability, wartime readiness assessement, future tactical force requirements, improved system acquisition and support, etc. A manning level of 150 Members of the Technical Staff (MTS) was approved by OUSDR&E in 1976; however, subsequent inflation reduced the effort to 137 by FY 81. In November 1980 and 1981, respectively, senior Air Force leadership indicated support for the 150 MTS level for Project AIR FORCE for FY 83 and beyond. Requests were submitted during the annual budget review and program cycle to include additional funding necessary to meet the 150 MTS support level.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	12,470	14,100	15,100		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: # 65101F
DOD Mission Area: Technical Integration/Studies and Analyses, 440

Title: Project AIR FORCE
Budget Activity: Defense-Wide Management Support, 6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides the Air Force a broad program of long-term study and research on problems in the development and employment of aerospace power. The program's continuing independent and objective research contributes to the analysis and expansion of available policy, support and operational alternatives, and assists the Air Force in making better decisions on major issues. Over the years, the Air Force has implemented many recommendations from this program. Some have resulted in cost savings, some have increased existing force effectiveness, others have allowed the Air Force to seize technological opportunities, and still others have helped the Air Force to better understand the nature of future military threats. Current research is directed toward four program areas: National Security Strategies, an area which focuses on issues of strategic policy as it relates to both major powers and third world areas, and encompasses Soviet/Chinese studies; Force Employment, which includes research on the techniques, systems, and tactics required to achieve projected military objectives; Technology Applications, an area which focuses primarily on the application of advanced technological development to military uses; and Resource Management, which addresses the means by which personnel, systems acquisition, and logistics management policies may be improved to better support the Air Force. A board of Air Force General Officers provides guidance on the overall program and sponsors new research topics as needs arise.

(U) RELATED ACTIVITIES: Project AIR FORCE studies and analyses are conducted to assist Air Force senior managers in the decision-making process. The efforts span functional and organizational boundaries and often result in broad recommendations concerning overall future Air Force actions. As a result, the research conducted under this program relates to a wide spectrum of activities in the Air Force. To assure relevance and to prevent unnecessary duplication of effort, each newly proposed research effort is reviewed by a cross-functional group of senior officers and by the Air Force Assistant Chief of Staff for Studies and Analyses; in addition, the results are published and deposited with the Defense Technical Information Center.

(U) WORK PERFORMED BY: The Director of Operational Requirements, DCS/Research, Development and Acquisition, Headquarters USAF, is the Executive Agent and is responsible for the administration of the Project. All work is performed by The Rand Corporation, Santa Monica, California.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The FY 1981 and prior year programs produced these results:

National Security Strategies: Rand produced reports on a long-term study on USSR strategic perceptions as they relate to the balance of power; they completed work on defense suppression as an element affecting the outcome of war in Central Europe; and they completed research on the role that economic constraints play in the evaluation of Soviet military power.

Force Employment: Rand has accomplished significant work in analysis of USAF requirements for tactical aircraft and is producing from this a recommended acquisition strategy to improve and update tactical capability; work continues in areas associated with command and control and in the simulation of strategic battle for SAC.

Technology Applications: This program continues work in space related issues and is also looking at the use of technological solutions to tactical and mobility problems.

Program Element: # 65101F
DOD Mission Area: Technical Integration/Studies and Analyses, 440

Title: Project AIR FORCE
Budget Activity: Defense-Wide Management & Support, 6

Resource Management: Rand has done important work in logistics management issues with a view toward improving USAF ability to support USAF forces in theater warfare. Additionally, work continues in manpower and systems acquisition management. Taken together, these programs have produced meaningful results which enable the Air Force to address problems in a manner that encompasses the many ramifications associated with any complex issue rather than focusing only on narrow scope views that might produce misleading results.

2. (U) FY 1982 Program: The following activities are being conducted:

National Security Strategies Program. Research on nuclear deterrence and strategy questions is being increased, and research on Third World issues and the development of a leverage strategy for the Middle East/Persian Gulf region is continuing. Special emphasis will be placed on low-level conflict and terriorism. Rand will initially concentrate on the Caribbean Basin and Latin America.

Force Employment Program. This relatively new program will be broadened to include research on chemical and directed energy weapons as seen from both US and Soviet Union perspectives. It will be tied into a thorough study of Soviet sortie generation capabilities and vulnerabilities.

Technology Applications Program. This research will include further examination of advanced technologies that have substantial potential benefit to the Air Force. Rand will recommend the key development activities required to achieve needed capabilities.

Resource Management Program. A major effort within this program in FY 1982 will build on the pioneering work in capability assessment for tactical forces already developed under Project AIR FORCE. The scope of the effort will go beyond the current concentration on spares and include both base and depot repair functions. Another effort will examine how to effectively incorporate support and maintainability into weapon system planning, development and test and evaluation.

3. (U) FY 1983 Planned Program: The emphasis will be on broad, long-term issues and problem areas that are of top priority to the upper levels of Air Force management. The research conducted will be cross-functional and will be interrelated among the four major program areas. Specific study subjects will derive from the FY 82 program and from the priorities established by the board of general officers which directs and controls the program. The program will continue to focus on strategic issues and the management policies necessary to deploy and sustain a strategic force. The increase from $15,100M to $16,231 for FY 1983 is the result of requests submitted to raise the level of effort to 150 Members of the Technical Staff.

4. (U) FY 1984 Planned Program: The program will evolve from FY 1982 and FY 1983 under careful planning by the Air Force Advisory Group. Only projects which are not duplicated elsewhere and are strongly needed by the Air Force will be included. Demands for research continue to exceed available resources. Our annual prioritization process continually selects only those study projects considered critical to stay within the 150 MTS funding level.

Program Element: # 65101F
DOD Mission Area: Technical Integration/Studies and Analyses, 440

Title: Project AIR FORCE
Budget Activity: Defense-Wide Management & Support, 6

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65304F
DOD Mission Area: Command Management Support, #471

Title: Acquisition and Command Support Telecommunications and General Support
Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4,447	4,682	4,764	5,034	Continuing	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides essential communications services to: Headquarters, Air Force Systems Command (AFSC); Aerospace Medical Division (AMD); Aeronautical Systems Division (ASD); Electronic Systems Division (ESD); Space Division (SD); and the Ballistic Missile Office (BMO).

(U) BASIS FOR FY 1983 RDT&E REQUEST: This is a continuing program which provides the following: switchboards at ESD and SD; local tielines; equipment rentals; mobile radios for command/disaster control/security policy; and official toll calls, AFSC postage, and printing charges. This request includes the use of approved inflation rates and additional communication requirements for the new Defense Metropolitan Area Telephone System (DMATS) at ESD and the increase in postage rates and tariff.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,350	4,800	5,300			

(U) OTHER APPROPRIATIONS FUNDS: Not Applicable.

Program Element: #65304F
DOD Mission Area: Command Management Support, #471

Title: Acquisition and Command Support Telecommunications and General Support
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides communication support to Air Force Systems Command (AFSC), Aerospace Medical Division (AMD), Aeronautical Systems Division (ASD), Electronic Systems Division (ESD), Space Division (SD), and the Ballistic Missile Office. It includes:

(U) The base communications administrative switchboards at ESD and SD; local tieline into commercial systems; recurring charges including associated equipment rentals, main telephone lines, extension telephones, and key systems; and dedicated support to the AFSC Advanced Management and Information System and AFSC Network.

(U) Command and control voice network and administrative tielines circuits between HQ AFSC, Divisions, Centers and Ranges; circuits between SD and the National Ranges used to transmit launch information from the ranges to the program offices; and the telephone lines required to support the program offices.

(U) Funds to lease/maintain non-tactical radios for command/disaster control/Civil Engineering/security and maintenance expediter nets at ASD and SD.

(U) Official tolls, Wide Area Telephone Service, and message unit charges for local calls from the bases to surrounding civilian communities. There are no free calls off stations.

(U) AFSC postage and printing charges.

(U) RELATED ACTIVITIES: This program element is in direct support of the Acquisition and Command Support, Program Element 65806F.

(U) WORK PERFORMED BY: American Telephone Company, New York, NY; RCA Corporation, New York, NY; Western Union Corporation, Mohwah, NJ; New England Telephone and Telegraph Company, Boston, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplianments: This is a continuing program.

2. (U) FY 1982 Program: This program continues funding for leased communication lines, switchboards and associated equipment required to carry-out the AFSC mission. Other requirements include: non-tactical radios, AFSC postage and franked envelope printing charges, and implementation of the Advanced Management and Information System and AFSC network systems.

Program Element: #65304F
DOD Mission Area: Command Management Support #471

Title: Acquisition and Command Support Telecommunications and General Support
Budget Activity: Defense-wide Mission Support, #6

3. (U) FY 1983 Planned Program: Provides funding for continuation of communication support to Air Force Systems Command (AFSC) and its divisions and offices. While deletion of some circuits and addition of others will occur, requirement increase is for allowance for escalation due to inflation, the new Defense Metropolitan Area Telephone System (DMATS) at ESD; and increases in postal charges and tariffs.

4. (U) FY 1984 Planned Program: Provides funding for continuing operation, maintenance, and leased costs of circuits and communications services.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestone: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison With FY 1982 Budget Data: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65306F Title: Ranch Hand II Epidemiological Study
DOD Mission Area: Technical Integration/Studies and Analyses, #440 Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	-	3,885	840	5,234	26,141	36,100
2767	Epidemiological Study of Ranch Hand Personnel	-	3,885	840	5,234	26,141	36,100

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The study is required to determine long-term health effects of exposure of Air Force (Ranch Hand) personnel and veterans to Herbicide Orange in Vietnam. This program has been directed by the White House through a 16 September 1980 memo from Mr. Eizenstat, Assistant to President Carter for Domestic Affairs and Policy, to Secretary Brown. On 27 March 1981 the Office of Management and Budget approved the questionnaire and confirmed the new administration's desire to continue the study as directed. The Air Force Ranch Hand personnel are the only population whose frequency and duration of exposure to the herbicide are known with any accuracy.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This is a continuing program with a potential 20-year commitment. Reviews will occur after the completion of the initial physical examination and questionnaire administration (FY 83) to determine if the study results and participation justify continuing the study. Additional reviews will occur at 5-year points. Cost estimates were developed by taking each segment of the study (Project Management, Mortality Study, Questionnaire Development and Administration, Physical Examinations and the Data Base Management System) and projecting requirements based on many reviews at all levels of command.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Research Development Test and Evaluation	1,800	3,900	4,600	-	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Operations and Maintenance	1,550	-	-	-	-	-

Program Element: #65306F Title: Ranch Hand II Epidemiological Study
DOD Mission Area: Technical Integration/Studies and Analyses, #440 Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force has made the commitment to Congress and to the White House to conduct an epidemiological study of possible health effects on Air Force personnel (Ranch Hand) who conducted aerial herbicide missions in Vietnam. The purpose of this investigation is to determine whether long-term health effects exist and can be attributed to occupational exposure to Herbicide Orange. The extensive use of herbicides in Vietnam between 1962 and 1970 was terminated when it became known that a contaminant, tetrachlorodibenzo-P-dioxin (dioxin), was present in the herbicides and that this contaminant caused congenital abnormalities when administered to pregnant rodents. Subsequent extensive research into the toxicity of dioxin in animals remains equivocal. The scientific literature on the toxicity of the components of Herbicide Orange reveals that the two main ingredients have extremely low toxicity, distinctly different than dioxin. Dioxin has been shown to be embryotoxic at markedly lower doses in animals. Only recently have comprehensive prospective studies in humans been undertaken. Most previous epidemiological studies dealing with dioxin exposure in humans have suffered from weaknesses in design, statistical power and references. These studies have only validated a link between dioxin exposure and the subsequent development of a minor skin disease. The public's perception of the toxicity of Herbicide Orange/dioxin is generally different than that of the scientific community. A review of veteran's claims submitted to the Veterans Administration supports this fact and reveals that Ranch Hand personnel were potentially at greatest risk; therefore, an epidemiological investigation of these personnel will be conducted to attempt to elicit any adverse health effects from their exposure. This is potentially a 20-year program involving a comparison of Ranch Hand personnel to other crew members and support personnel serving in Vietnam, who were not exposed to herbicides for mortality rates, present and past health status, and future follow-up health status at 3-, 5-, 10-, 15- and 20-year time periods.

(U) RELATED ACTIVITIES: This is only one of several Federal studies designed to provide information regarding alleged claims of adverse health effects from Vietnam veterans exposed to Herbicide Orange. These studies, including the Air Force study and the Center for Disease Control birth defects study, are being coordinated by an Interagency Working Group, established by the White House, which has program review authority and could require certain changes that would impact funding, scheduling or both.

(U) WORK PERFORMED BY: This program is being conducted by the Aerospace Medical Division through the United States Air Force School of Aerospace Medicine, Brooks Air Force Base, TX. Contractors include the National Opinion Research Center NY, NY (questionnaire development), Louis Harris and Associates NY, NY (questionnaire administration) and Kelsey-Seybold Houston, TX (physical examinations).

Program Element: #65306F Title: Ranch Hand II Epidemiological Study
DOD Mission Area: Technical Integration/Studies and Analyses, #440 Budget Activity: Defense-wide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1981 and Prior Accomplishments: The study protocol was established, the study population ascertainment effort was completed, matching the control group with the exposed group was completed, the baseline mortality study is well underway, contracts for the development and administration of the questionnaire were awarded, contact letters were sent to potential participants and initial questionnaire administration was started. It should be noted that FY 81 funds were provided by Operations and Maintenance appropriations.

2. (U) FY 1982 Program: The program includes administration of the questionnaire, contracting and completion of the physical examinations, continuation of the mortality study, and continuation of data base management system.

3. (U) FY 1983 Planned Program: The planned program includes data acquisition and analysis of questionnaire results, analysis of physical examination data, adaptive changes to the questionnaire/physical examination as required, and continuation of the mortality study and data base management system. This reflects a program shift of one year resulting from the requirement to obtain Office of Management and Budget approval of the questionnaire prior to pretest. The FY 83 estimate in the FY 82 Descriptive Summary included questionnaire and physical examination administration; however, this requirement and the associated costs shifted to FY 84.

4. (U) FY 1984 Planned Program: This is the 3-year follow-up phase repeating questionnaire administration and physical examinations, as modified from the FY 81-82 data, to determine any changes in health status. The mortality study and data base management system are continuing.

5. (U) Program to Completion: This is a continuing program with follow-up health status and mortality rate determinations at the 5-, 10-, 15-, and 20-year time periods. Data analysis and adaptive changes to questionnaire or physical exam will occur in the intervening time periods. The FY 82 Descriptive Summary indicated this to be a continuing program because of the difficulty in estimating costs over a 20-year time period; however, estimates are shown in this FY 83 Descriptive Summary.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65708F
DOD Mission Area: Master Range & Test Facilities, #451

Title: Aircraft Navigation System Verification
Budget Activity: Defense Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1,577	1,694	15,590	18,095	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Through FY 1982, this program provided for standardized verification of aircraft inertial and inertially aided navigation systems prior to their consideration for use by DOD agencies. Beginning in FY 1983, several associated efforts which were previously accomplished in Program Element (PE) 65807F are being consolidated within this program to provide better management visibility of the 6585th Test Group (TG) activities. These efforts include the rocket sled testing of missile guidance, aircraft escape and weapon fuze subsystems. In addition, the program will include radar signature evaluation work at the Radar Target Scattering Facility (RATSCAT). The consolidated program will provide DoD with single point visibility of these critical test efforts needed to insure the candidat systems work as intended before they enter production.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The facilities operated by the 6585TG are an essential part of testing modern weapon systems. Standardized tests of inertial and other DoD navigation systems in cargo, helicopter and fighter test beds will be performed by the Central Inertial Guidance Test Facility (CIGTF) personnel. The data from these tests provides DoD with a common baseline to evaluate the performance of inertial systems, including the new ring laser gyro technology applications. Work will also continue through NATO and international technical committees to develop test standards for use throughout the free world. Measurement of radar target backscatter, antenna gain and radiation pattern will be obtained in the unique RATSCAT outdoor electromagnetic laboratory facility. These tests will provide essential radar characteristics data to DoD and Government sponsored programs. The 6585TG also operates the high speed test track used for testing navigational systems, environmental effects on reentry systems and aircraft escape systems under high speed, high acceleration conditions. Finally, the Test Group provides airspace management and liaison for Air Force testing at the Army's White Sands Missile Range. The major increase in funding in FY 83/84 compared to the FY 1982 Descriptive Summary is the result of an OSD directed transfer of 6585th Test Group functions from PE 65807F to this Program Element for improved management visibility and control. Previously, PE 65708F efforts included only navigation system verification at CIGTF. The primary basis for the FY 1983 request is a combination of past operations costs and facility use projections.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	1,580	1,700	1,835	2,000	Continuing	Not Applicable

(U) OTHER APPROPRIATIONS FUNDS: Not Applicable.

Program Element: #65708F Title: Aircraft Navigation System Verification
DOD Mission Area: Master Range & Test Facilities, #451 Budget Activity: Defense Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program was initially implemented based on DoD direction to test new aircraft inertial and inertially aided navigation systems at the CIGTF. In FY 1982, DoD directed that beginning in FY 1983 all facility operations under the 6585TG at Holloman AFB, NM be combined in this Program Element to provide improved management visibility and control of these operations. This direction combined institutional funding of operations, maintenance, improvement, modernization and personnel for CIGTF, RATSCAT and the Track into one Program Element. These facilities are unique national assets and part of the DoD Major Range and Test Facility Base.

(U) RELATED ACTIVITIES: Test support and airspace management is provided to all Services at RATSCAT, CIGTF and the sled track. Project 688G at CIGTF provides development and support funds for the Completely Integrated Reference Instrumentation System (CIRIS) and the Airborne Reference Instrumentation System (ARIS). These facilities are available to all military Services, other qualified governmental agencies and private industry on a reimbursement basis.

(U) WORK PERFORMED BY: Overall planning, programming, contracting support and funding are provided by the Armament Division (AD) Commander and staff at Eglin AFB, FL. The 6585th Test Group Commander manages day-to-day activities. The primary contractor, Dynalectron of Washington, D.C., operates and maintains the RATSCAT. CIGTF and the sled track are operated primarily with government employees.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 81 and Prior Accomplishments: More than twenty navigation systems have completed verification tests. These include the Singer 2400 and the Litton LN-39 selected for the F-16 and the A-10 respectively. The Standard Precision Navigator completed verification testing in 1976. Standard Inertial Navigation System screening tests were successfully completed on three systems during 1978. Qualification testing on the three Standard Inertial Navigation Systems was completed in FY 1980. Work was completed in FY 1981 on the verification of the Delco Carousel IVE High Accuracy Navigation System and on the Honeywell Ring Laser Gyro Navigator. With the completion of the Honeywell Ring Laser Gyro Navigation System tests, the Department of Defense has common standardized test results to evaluate this new technology in comparison to the spinning mass technology currently in use. The evaluation of the Marine TPQ-27, Radar Bomb Scoring System was completed using the Automatic Reference Instrumentation System (ARIS). The use of the ARIS in the TPQ-27 tests resulted in more accurate ballistic tables being developed than had been possible with previous instrumentation systems. Two Completed Integrated Reference Instrumentation System palletized equipment stations for cargo testbed and two pod versions were fabricated. A pod version is to use for a fighter testbed and the second to provide the reference in support of the Strategic Offensive Avionics Program. The FY 1981 efforts at RATSCAT primarily involved the B-1, QF-100 and classified programs. Improvement and modernization activities were focused on background noise reduction and instrumentation radar improvements. The Track facility supported 31 separate programs including the F-15, F-16, A-10, B-1 and F-111. ACES II and A-7K escape systems testing continued a trend of testing every Air Force escape system over the past 20 years. In addition, MX and Inertial Upper Stage (IUS) guidance testing was conducted.

Program Element: #65708F | Title: Aircraft Navigation System Verification
DOD Mission Area: Master Range & Test Facilities, #451 | Budget Activity: Defense Wide Mission Support, #6

2. (U) FY 1982 Program: Verification testing of the Singer High Accuracy Navigation System and the Litton Ring Laser Navigation System will be completed. Verification testing of Litton High Accurary Navigation Systems will begin. Completed Integrated Reference Instrumentation System/Automatic Reference Instrumentation System development will be completed with the addition of new recorders and Global Positioning System interface equipment. Verification of the Singer and Raytheon Ring Laser Gyro Navigation Systems will begin. Flight testing of the B-52 Offensive Avionics System using the CIRIS will continue. The RATSCAT facility is scheduled to support the Strategic Reentry Program, HAVE POINT, AMRAAM, selected production aircraft and classified programs. Facility upgrades will be initiated on the pit 6 and 7 rotators, data processing equipment, an automatic radar measurement system and an environmental measurement system. Also, a major RATSCAT upgrade planning effort is being initiated in PE 65807F to meet critical long range national defense needs. The Track facility will continue support of escape system testing including the HBU-X lap belt, F-111 crew module and Automatic Inflation Modulation parachute. Inertial guidance testing of MX and IUS and blast interaction tests on ALCM and impact testing of munitions will be performed.

3. (U) FY 1983 Planned Program: Support of all 6585th TG activities currently funded in PE 65807F will be transferred to this Program Element effective in FY 1983. The long range RATSCAT modernization study will be completed. Activities previously funded within this program element will continue. One additional High Accuracy Ring Laser inertial Navigation System will undergo verification testing. The expected candidate is built by Raytheon. When their system completes testing the Department of Defense will have unbiased standard performance data on a high ring laser gyro systems which will allow DoD to determine the capability of this technology to meet military navigation requirements before committing to it for a major new weapons system or update. The use of the CIRIS in the Offensive Avionics Program will continue.

4. (U) FY 1984 Planned Program: Many of the FY 1983 programs will continue. No major changes in the type of test support provided are planned. Initial hardware procurement for the RATSCAT modernization programs will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65806F
DOD Mission Area: General Management Support, #471

Title: Acquisition and Command Support
Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	236,045	241,702	269,229	274,306	Continuing	Not Applicable
	Hq, Air Force Systems Command* (AFSC) Support Activities	13,305	9,625	14,181	14,340	Continuing	Not Applicable
	Aeronautical Systems Division* (ASD)	99,980	101,499	108,702	109,881	Continuing	Not Applicable
	Electronic Systems Division (ESD)*	55,290	52,331	60,242	61,551	Continuing	Not Applicable
	Aerospace Medical Division (AMD)*	13,073	13,307	14,525	15,014	Continuing	Not Applicable
	Space Division (SD)*	36,467	36,119	39,942	40,960	Continuing	Not Applicable
	Armament Division (AD)*	12,246	21,099	23,275	23,865	Continuing	Not Applicable
	Ballistic Missile Office (BMO)	7,685	7,722	8,362	8,695	Continuing	Not Applicable

*Funding for Headquarters Air Force Systems Command and the Division Commanders Management Staff is shown in Program Element (PE) 65898F (Management Headquarters - Research and Development).

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Acquisition and Command Support (ACS) provides the resources to support the various staff functions, the technical mission, and support activities at each of the organizations listed above. Categories of cost include pay and the related costs of civilian personnel, travel, transportation, rents, utilities, contractual services, supplies, and equipment.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This program provides the resources to support the various staff functions, the technical mission, and support activities of each of the organizations listed above. FY 1983 funding is increased over the appropriated level to insure minimum level support in FY 1983, including the annualization of the 1 October 1981 civilian pay raise, and repricing of non-personnel support costs due to inflation, including the impact funding at Armament Division as a result of the redesignation of AD from a Test Center to a Divison. This resulted in transferring the various staff elements not directly associated with a Test and Evaluation mission from PE 65807F to PE 65806F effective in FY 1982. FY 1983 program includes resources for the operation and maintenance of Ft. MacArthur, CA which will be acquired by the Air Force on 1 Oct 1982.

Program Element: #65806F
DOD Mission Area: General Management Support, #471

Title: Acquisition and Command Support
Budget Activity: Defense-wide Mission Support, #6

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	228,552	260,000	267,000		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #65806F
DOD Mission Area: General Management Support, #471

Title: Acquisition and Command Support
Budget Activity: Defense wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element provides the resources to support various staff functions the technical mission and base support functions of Aeronautical Systems Division (ASD), Electronic Systems Division (ESD), Aerospace Medical Division (AMD), Space Division (SD), Ballistic Missile Office (BMO), and the Armament System Program Offices of the Armament Division (AD), Eglin AFB, FL. Starting in FY 1979, the Procurement and Plans Offices of AD Armament Systems Program Offices were transferred into this program element from Program Element 65807F (Test and Evaluation Support) as a result of a management engineering team survey. In FY 1978, the transfer of Headquarters, Air Force Systems Command (HQ AFSC) and the 6590th Support Squadron to PE 65898F (Management Headquarters Research and Development) was accomplished. Additional staff functions were transferred from PE 65807F to PE 65806F in FY 82 when Eglin AFB was redesignated from a Test Center to a Division.

(U) RELATED ACTIVITIES: This program supports nearly all Air Force RDT&E program elements and the procurement programs assigned to AFSC. Communication support for this element is in PE 65304F (Acquisition and Command Support (ACS) Telecommunications and General Support). Management activities at HQ AFSC and Divisions are supported in PE 65898F (Management Headquarters - R&D).

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson AFB, OH, - responsible for management of aeronautical systems acquisition. Electronic Systems Division, L.G. Hanscom AFB, MA - responsible for command, control, and communications systems. Aerospace Medical Division, Brooks AFB, TX - provides biomedical support for aerospace systems. Space Division, Los Angeles AFB, CA - plans, programs, and manages space systems. Armament Systems Program Offices, Armament Division, Eglin AFB, FL - manages the validation, development, and production of nonnuclear air armament systems. Ballistic Missile Office, Norton AFB, CA - plans, programs, and manages the DoD ballistic missile programs. HQ AFSC Activities, various locations - provide support to HQ AFSC. Ft. MacArthur, CA - provides a living community for military personnel assigned to Los Angeles AFS, CA.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments : Not applicable

2. (U) FY 1982 Program: This is an in-house effort by the organizations cited above which support many program elements and projects in the Research, Development, Test and Evaluation community, and procurement of weapon, space, missile and avionic systems.

3. (U) FY 1983 Planned Program: The main cost of this program is for pay of personnel. Seventy-three percent of the total is for pay of personnel. FY 1983 reflects an increase above the FY 1982 Budget Submission because of approved inflation for petroleum, oil and lube (POL) and the associated impact on other areas of expense. The largest increase, however, is due to the annualization of the 1 October 1981 civilian pay raise.

Program Element: #65806F | Title: Acquisition and Command Support
DOD Mission Area: General Management Support, #471 | Budget Activity: Defense-wide Mission Support, #6

4. (U) FY 1984 Planned Program: Major changes are foreseen in the nature of this element for support of the Space Transportation System, Space Defense System, and Missile-X program, and the B-1 bomber aircraft program.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1981 Budget Data: Not Applicable

Project: N/A
Program Element: #65806F
DOD Mission Area: General Management Support, #171

Title: Headquarters Air Force Systems Command (AFSC) Support Activity
Title: Acquisition and Command Support
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The mission of AFSC is to advance aerospace science and technology, apply it to aerospace systems development and improvement, and acquire qualitatively superior aerospace systems and equipment needed to accomplish the Air Force mission. The following organizations funded from this program element provide support to the AFSC: 6591st Computer Services Squadron, provides data automation services to HQ AFSC; 6592nd Management Engineering Squadron, provides AFSC field commands base level manpower and organization services to include developing and maintaining manpower standards; 6593rd Field Printing Squadron provides composition, lithograph, duplicating, printing and bindery services for HQ AFSC, and other units. This program funds for pay and related costs of civilian personnel, travel, transportation, rents, contractual services, supplies, and equipment.

(U) RELATED ACTIVITIES: This program element directly supports HQ AFSC's management headquarters which is funded from Program Element 65898F (Management and Headquarters - Research and Development). Communication Support is funded in Program Element 65304F (ACS Telecommunications and General Support). Audiovisual support is funded in PE 65890F (Audiovisual).

(U) WORK PERFORMED BY: Major contracts include: Honeywell Corporation, McLean, VA, for automatic data processing equipment rental; Xerox Corporation, Arlington, VA, for lease of reproduction equipment.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Program: This is an in-house effort by the organizations cited above which support many program elements and projects in the Research, Development, Test and Evaluation community, and procurement programs.

3. (U) FY 1983 Planned Program: This is a level of effort program, the main cost of which is for pay of personnel. Forty percent of the total is for pay of personnel. The cost increase from last year's Budget Submission is explained in the program element descriptive summary.

4. (U) FY 1984 Planned Program: Major changes are foreseen in the nature of this element in the near term for support of the Space Transportation System, Space Defense System and Missile-X programs.

5. (U) Program to Completion: Continuing Program

6. (U) Milestones: Not applicable

Project: N/A
Program Element: #65806F
DOD Mission Area: General Management Support, #471

Title: Headquarters Air Force Systems Command (AFSC) Support Activity
Title: Acquisition and Command Support
Budget Activity: Defense-wide Mission Support, #6

7. (U) Resources: ($ in thousands)

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
RDT&E: Funds*	13,305	9,625	14,181	14,340	Continuing	N/A

*Excludes reimbursements

8. (U) Comparison with FY 1981 Budget Data:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Costs
RDT&E*	12,683	14,417	14,480		Continuing	N/A

*Excludes reimbursements

Project: Not Applicable
Program Element: #65806F
DOD Mission Area: General Management Support #471

Title: Aeronautical Systems Division (ASD)
Title: Acquisition and Command Support (ACS)
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: ASD manages acquisition of aeronautical systems, subsystems, and related equipment programs and projects until transfer of responsibility to Air Force Logistics Command (AFLC); accomplishes systems engineering and technical direction to designated programs and provides general engineering support in applicable disciplines; exercises overall responsibility for Development, Test and Evaluation (DT&E) for assigned advanced and engineering development; and exploits exploratory and advanced development products, including foreign technology. ASD has responsibility for approximately 27 program offices, including major programs such as the B-1, F-16, F-15, A-10, and Strategic Systems; and has project office responsibility for numerous system projects.

(U) RELATED ACTIVITIES: ASD establishes technology needs with the Air Force Systems Command (AFSC) laboratories for exploratory and advanced development required to satisfy new capabilities or eliminate deficiencies; provides engineering support to AFLC; ensures, in collaboration with AFLC, that logistic support considerations are an integral part of systems, subsystems, and equipment acquisition; performs flight tests and related modifications in support of ASD and AFSC laboratories/projects in the exploratory and advanced development areas of propulsions avionics, flight dynamics, weightlessness, electronic warfare, life support systems, and materials; furnishes flight test support to the Department of Defense (DoD) agencies, National Aeronautics and Space Administration (NASA), and Federal Aviation Administration (FAA) as directed; manages the international, DoD, Air Force, and AFSC engineering standardization programs in support of ASD, AFSC laboratories, and AFSC divisions; evaluates and applies intelligence provided by Foreign Technology Division (FTD) which is relevant to ASD development and production programs and projects; and manages all phases of procurement and production including management of government-owned industrial facilities, systems, Research and Development (R&D), services, material transportation, supplies, and support as delegated by HQ AFSC. Related Program Elements are: 65304F, ACS Telecommunications and General Support; 65807F, Test and Evaluation Support (TES), which finances the 4950th Test Wing activities; management functions are provided in 65898F, Management Headquarters; and audiovisual services are funded in PE 65890F, Audiovisual.

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson AFB, OH. Major contractors include: Synergy Inc., Enon, OH, provides computer operators; Systems Research Laboratories, Dayton, OH provides computer maintenance; Foreman Industries, Inc., Dayton, OH, provides installation, modification and repair services; Control Data Corp., Minneapolis, MN, provides computer rentals and support; Burroughs Corp., Paoli, PA, provides computer rental; Xerox Corp., Rochester NY, provides reproduction equipment; and 230 other contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable

2. (U) FY 1982 Program: This is an in-house effort by the organization cited above which supports many program elements and projects in the Research, Development, Test and Evaluation community, and procurement programs.

Project: N/A
Program Element: #65806F
DOD Mission Area: Other Management Support #471

Title: Aeronautical Systems Division (ASD)
Title: Acquisition and Command Support (ACS)
Budget Activity: Defense-wide Mission Support, #6

3. (U) FY 1983 Planned Program: This is a continuing program, the main cost of which is for pay of personnel. Ninety percent of the total is for pay of personnel. The cost increase from last year's Budget Submission is explained in the program element descriptive summary.

4. (U) FY 1984 Planned Program: No major changes are foreseen in the nature of this element at this time.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	99,980	101,499	108,702	109,881	Continuing	Not Applicable

8. (U) Comparison With FY 1982 Budget Data:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	96,218	104,891	106,955		Continuing	Not Applicable

*Excludes Reimbursements

Project: N/A
Program Element: #65806F
DOD Mission Area: General Management Support, #471

Title: Electronic Systems Division (ESD)
Title: Acquisition and Command Support (ACS)
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: ESD plans and manages the acquisition and related engineering development of command, control and communications, and intelligence electronic systems, subsystems, and equipment; plans and conducts research and exploratory and advanced development programs in areas of information sciences, intelligence for command, control and communications; accomplishes assigned engineering development; exploits exploratory and advanced development products, including foreign technology; manages the operations of the Electromagnetic Compatibility Analysis Center; and manages assigned Foreign Military Sales (FMS) programs. ESD has responsibility for approximately 25 Program Offices and major programs such as Traffic Control Approach and Landing System Joint Exploitation and Disseminiaton of Intelligence, Airborne Warning and Control System (AWACS), Over the Horizon Radars, Advanced Airborne Command Post, and Tactical Long Range Navigation. ESD also has project office responsibility for over 100 projects.

(U) RELATED ACTIVITIES: The ESD establishes technology needs with the Air Force Systems Command (AFSC) laboratories for exploratory and advanced development required to satisfy new capabilities or eliminate deficiencies; renders assistance to Headquarters, United States Air Force in preparation of automatic data processing equipment specifications; acts as contracting agent for MITRE support to the Department of Defense; monitors and controls MITRE support to the Air Force; acquires, analyzes, evaluates, and applies intelligence relevant to ESD acquisition programs and projects; and contributes results of intelligence analysis and evaluations to AFSC intelligence projects. A related Program Element is 65304F, ACS Telecommunications and General Support.

(U) WORK PERFORMED BY: Electronic Systems Division, Hanscom AFB, MA. Major contractors include: Multi-Service Maintenance, Boston, MA; Arpin Van Lines, Providence, RI; Sherman Disposal Inc., Roxburn, MA; Charles Bank Laundry, Cambridge, MA; Parkway Inc., Tweksburry, MA.; Service Filter Co., Boston, MA; Univac Corp., Boston, MA; D. Bough and Associates, Stoughton, MA.; Bay State Storage, Cambridge, MA; and 63 other contractors.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable

2. (U) FY 1982 Program: This is an in-house effort by the organizations cited above which supports many program elements and projects in the Research, Development, Test and Evaluation community, and procurement programs.

3. (U) FY 1983 Planned Program: This is a level of effort program, the main cost of which is for pay of personnel. Sixty-six percent of the total is for pay of personnel. The cost increase from last year's Budget Submission is explained in the program element descriptive summary.

Project: N/A
Program Element: #65806F
DOD Mission Area: General Management Support #471

Title: Electronic Systems Division (ESD)
Title: Acquisition and Command Support (ACS)
Budget Activity: Defense-wide Mission Support, #6

4. (U) FY 1984 Planned Program: No major changes are foreseen in the nature of this element at this time.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

7. (U) Resources: ($ in thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	55,290	52,331	60,242	61,551	Continuing	Not Applicable

8. (U) Comparison With FY 1982 Budget Data:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	51,914	58,467	60,825		Continuing	Not Applicable

* Excludes Reimbursements

Project: N/A
Program Element: #65806F
DOD Mission Area: General Management Support, #471

Title: Aerospace Medical Division (AMD)
Title: Acquisition and Command Support (ACS)
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The AMD plans and executes the Air Force Systems Command (AFSC) exploratory, advanced, and engineering development programs to provide biomedical support for aerospace systems; advanced aerospace biotechnology; determines the personnel hazards of aerospace environments and establishes human tolerance to them; extends human capabilities and enhances integration of man in weapon systems; provides biomedical support for the personnel subsystems; improves Air Force health services; and provides technical or management assistance in these areas to support studies, analysis, development planning, acquisition, test, evaluation, modification or operation of aerospace systems and related equipment. Specifically, the AMD: provides the principal Air Force interface with scientific, industrial, educational, and government agencies and acts as AFSC focal point in the areas of AMD technical responsibility; executes assigned projects for and works closely with other major commands, Army, Navy, Defense Advanced Research Projects Agency, National Aeronautics and Space Administration, Defense Nuclear Agency, Health, Education and Welfare, and other government agencies; supports foreign aerospace technology activities as provided in the Consolidation Intelligence Program; maintains a competent and comprehensive in-house research, development, test, and evaluation capability; conducts research and development to sustain and effectively use man in aerospace and ground operational environments; plans and conducts educational programs including graduate level courses, aerospace, and clinical medicine and related subjects; provides base health services for the Lackland Military Training Center; and provides the focal point with the Command and government-owned, contractor operated chambers under the jurisdiction of AFSC. AMD's 6570th Air Base Group operates and maintains Brooks AFB and provides support to AMD's Air Force School of Aerospace Medicine and Wilford Hall United States Air Force Medical Center. Support is also provided to the Headquarters, Air Force Human Resources Laboratory, the United States Air Force Occupational and Environmental Health Laboratory, HQ USAF Medical Service Center, and the 6906 Electronic Security Squadron.

(U) RELATED ACTIVITIES: AMD related activities are Aerospace Biotechnology (Program Element (PE) 62202F), Personnel Utilization Technology (PE 62703F), Satellite Control Facility (PE 35110F), Other Health Activities (PE 87714F), and ACS Telecommunications and General Support (PE 65304F): PE 86761F, Education and Training - Health Care; PE 87711F, Care in Regional Defense Facilities; PE 87794, Real Property Maintenance Activities - Health Care; PE 87795F, Base Communications Health Care; PE 89732F, Off Duty and Volunteer Education Programs; PE 27593F, Chemical Biological Defense; PE 91515F, Official representation; PE 88716F, Other Personnel Activities, PE 87792F, Station Hospitals and Medical Facilities; PE 87715F, Dental Care Activiti[illegible] PE 65898F, Management Headquarters.

(U) WORK PERFORMED BY: Aerospace Medical Division Brooks AFB, TX. Major contracts include: DIV Laundry Dry Cleaning, Antonio, TX; San Antonio Real Property Maintenance Agency (SARPMA), K-P Food Service, Pasadena, MI.; International Business Investments, San Antonio, TX.; Purolator Courier Service, San Antonio, TX.; Baxar Fire and Safety Co., San Antonio, TX.; Cordova's Display Center, San Antonio, TX.; Harolds Plumbing Co., San Antonio, TX.; and Hubert Muller Architect/Engineering Service, San Antonio, TX.

Project: N/A
Program Element: #65806F
DOD Mission Area: General Management Support, #471

Title: Aerospace Medical Division (AMD)
Title: Acquisition and Command Support (ACS)
Budget Activity: Defense-wide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Program: This is an in-house effort by the organization cited above which supports many program element and projects in the Research, Development, Test and Evaluation community, and procurement programs.

3. (U) FY 1983 Planned Program: This is a level of effort program, the main cost of which is for pay of personnel. Twenty-nine percent of the total is for pay of personnel. The cost increase from last year's Budget Submission is explained in the program element descriptive summary.

4. (U) FY 1984 Planned Program: No major changes are foreseen in the nature of this element at this time.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

7. (U) Resources: ($ in thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	13,073	13,307	14,525	15,014	Continuing	Not Applicable

8. (U) Comparison With FY 1982 Budget Data:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	13,367	14,483	14,535		Continuing	Not Applicable

*Excludes Reimbursements

Project: N/A
Program Element: #65806F
DOD Mission Area: General Management Support #471

Title: Space Division (SD)
Title: Acquisition and Command Support (ACS)
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: SD plans, programs, and manages systems programs to acquire space and missile systems, Aerospace Ground Equipment, and other subsystems and related hardware; provides for the activation and alteration of ground launch facilities; performs the functions of launch, on-orbit tracking, data acquisition, and command and control of Department of Defense (DoD) satellites; and affects recovery of various space packages. Conducts and manages standardization programs, medical activities, bioenvironmental engineering, system safety engineering, electromagnetic compatibility, personnel subsystems, reliability and maintainability, configuration management, survivability and vulnerability, systems engineering, value engineering, and quality assurance programs related to space and missile systems, equipment and material. Acquires and manages industrial facilities. Prepares, completes, and coordinates program management plans, to include management arrangement with other elements of Air Force Systems Command, United States Air Force, DoD agencies, military departments, Government agencies, and industry. Supports and participates in Research and Development and procurement and production programs established with North Atlantic Treaty Organization, and other friendly international organizations or individual nations. Ensures efficient and effective logistic support of systems and equipment being developed for operational inventory and manages all phases of material, transportation, transportability, supplies, maintenance, Aerospace Ground Equipment, and propellants, in support of all SD programs and projects. Furnishes staff medical support and operates a Class B Dispensary. Provides, in collaboration with the Aerospace Medical Division, medical surveillance of systems development to ensure that medical research and support requirements are determined concurrently with system development. Discharges USAF responsibilities as Manager of the DoD Space Test Program. Provides required functional assistance to the Director of Special Projects, Headquarters USAF. SD has responsibility for System Program offices, including Space Boosters and Space Transportation Program, Defense Dissemination Program, Satellite Data Systems, and has project office responsibility for approximately 40 projects including executive responsibility for the Global Positioning Satellite Joint Program. Two major subelements of SD, the Air Force Satellite Control Facility and the Space and Missile Test Organization are funded as independent program elements: Program Element 35110F, and Program Element 78032F, respectively.

(U) RELATED ACTIVITIES: SD uses the capabilities of the Air Force laboratories, centers, ranges and other AFSC in-house capabilities to the maximum extent feasible in all phases of systems planning, development, acquisition, and test. SD provides assistance to AFSC lead laboratories in the review and evaluation of those industry Independent Research and Development programs related to Air Force space and missile systems, subsystems, and equipment, and acts as lead AFSC organization for contractors assigned by Headquarters AFSC. SD will operate and maintain Ft MacArthur, CA which will be acquired on 1 Oct 1982. Related Program Elements are: 35110F, Satellite Control Facility; 65304F, Acquisition and Command Support (ACS) Telecommunications and General Support; 78032F, Western Test Range; 78022F, Eastern Test Range; 65890F, Audiovisual, and 65898F, Management Headquarters.

Project: N/A
Program Element: #65806F
DOD Mission Area: General Management Support, #471

Title: Space Division (SD)
Title Acquisition and Command Support (ACS)
Budget Activity: Defense-wide Mission Support, #6

(U) WORK PERFORMED BY: Space Division, Los Angeles Air Force Station, CA, and Ft MacArthur, CA. Major contractors include: Trend Western Technical Corp, Los Angeles, CA; SF&F Inc., Anaheim, CA; B&W Services Industries, Los Angeles, CA; Del-Jen, Los Angeles, CA; Burroughs Corp., Paoli, PA; Xerox, Torrance, CA; Ontel Corp., Plainview, NY; Proprietary Computer Systems, Van Nuys, CA; Action Transfer Centers, Gardena, CA; Washington Patrol Services, Inc., Escondido, CA; Quintron Systems, Santa Maria, CA. There are no other major contracts at SD funded by this program element.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable

2. (U) FY 1982 Program: This is an in-house effort by the organization cited above which supports many program elements and projects in the Research, Development, Test and Evaluation community, and procurement programs.

3. (U) FY 1983 Planned Program: This is a continuing program. The main cost of which is for pay of personnel. Fifty-two percent of the total is for pay of personnel. FY 1982/FY 1983 program effort increases due to the Space Transportation System (STS), Space Defense System (SDS), and the operation and maintenance of Ft MacArthur effective 1 Oct 1982.

4. (U) FY 1984 Planned Program: No major changes are foreseen in the nature of this element at this time.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	34,467	36,119	39,942	40,960	Continuing	Not applicable

8 (U) Comparison With FY 1982 Descriptive Summary:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	34,963	38,740	39,970		Continuing	Not Applicable

*Excludes Reimbursements.

Project: N/A
Program Element: #65806F
DOD Mission Area: General Management Support, #471

Title: Armament Division (AD)
Title: Acquisition and Command Support (ACS)
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Deputy for Armament Systems at the Armament Division (AD), Eglin AFB, FL, manages for the Air Force the validation, development and production of air armaments; is responsible for the development test, evaluation, and logistic support of the Sidewinder (AIM-9L/M), Sparrow III (AIM-7F/M), SHRIKE (AGM-45B) and the Anti-Radiation Missile (AGM-88, B/C/D), is responsible for the development, test, evaluation and logistics for dispensers, rockets, flares, fuzes and other nonnuclear munitions and related support equipment, Chemical/Biological defense equipment, improved Air Combat Fighter gun systems, and foreign weapons evaluation; provides armament system program technical direction to contractors; establishes systems program financial objectives and cost control management; manages the acquisition of all subsystems; and incorporates new or advanced technology through modification of system hardware. The Deputy for Advanced Medium Range Air-to-Air Missile Systems (AMRAAM) is responsible for development and production of the AMRAAM. This is a joint service program with the Air Force as the executive service. The Deputy for Range Instrumentation System centrally manages the research, development and acquisition of range instrumentation systems for the SETTA DT&E ranges and the Air Force Wide OT&E/training ranges. The Deputy for Air Base Survivability (ABS) is the designated Air Force central manager responsible for integrating, coordinating and controlling efforts to improve Air Force capability to generate effective sorties in the event of theater air base attack. The Deputy for Development Plans manages all air armament systems conceptual phase programs; is responsible for the Nonnuclear Armament Plans manages all air armament systems conceptual phase programs; Project Vanguard, and prepares and updates the Air Force Nonnuclear Consumable Annual Analysis attrition data base. The Deputy is the International Systems Focal Point and manages the Foreign Weapons Evaluation Program. Development Plans provides technology guidance to the Laboratories, establishes cadre Systems Program Offices as necessary performs engineering and effectiveness studies and acts as Division manager for using command requirements documents.

(U) RELATED ACTIVITIES: AD uses the capabilities of the Air Force Laboratories, test centers, ranges, and other Air Force Systems Command in-house capabilities to the maximum extent feasible in all phases of systems planning, development, acquisition and test. AD/Systems Division functions as AD focal point on all actions cognizant to the Joint Conventional Ammunition Program Group and single manager for conventional munitions activities. Related program elements are PE 27102F - Tactical Air-to-Ground Missiles; PE 35116F - Aerial Target Drones; PE 63232F - Advance Aerial Targets Technology; PE 64602F - Armament/Ordnance Development; PE 64610F - Air Delivered Land Mines; PE 64733F - Surface Defense Suppression; PE 27161F - Tactical Intercept Missiles; PE 63741F Defense Suppression; PE 27315F - Rapier Air Defense Missile System; PE 64601F - C/B Defense Equipment; PE 64603F - Improved ACF Gun Systems; PE 99XXXX - Gun Pod; PE 63609F - Advanced Attack Weapons; PE 64607F - WAAM; PE 64707F - Battlefield Weather Subsystem; PE 64211F - Advanced Aerial Targets Development; and PE 28010F - WRM Munitions. AD/YM, related program elements are PE 63370F and PE 64314F - AMRAAM; AD/YI related program elements are PE 64735F - Improved Capability for Operational Test and Evaluation (OT&E); PE 11897F - Strategic Training Support Equipment (SAC); and PE 27429F - Range Improvement Equipment. AD/XR functions as AD focal point for systems requirements, Division Advisory Group and Scientific Advisory Board (SAB) activities and International Programs Focal Point. Related program elements are PE 63283F - Concept Development; PE 65111F - Foreign Weapons Evaluation, PE 63306F Defense Suppression Weapons Advanced Technology; PE 64302F - Defense Suppression Weapons Engineering Development, PE 63609F - Advanced Attack Weapons, and PE 64604F - Conventional Standoff Weapons.

Project: N/A

Program Element: #65806F

DOD Mission Area: General Management Support, #471

Title: Armament Sytstem Program Offices

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

(U) WORK PERFORMED BY: The Deputy for Armament Systems, Deputy for Development Plans, Deputy for AMRAAM, Deputy for Range Instrumentaton Systems, Deputy for Air Base Survivability, Deputy for Contracting and Manufacturing, Deputy for Comptroller, The Directorate of Communication and Electronics plus the Armament Division Commander and various staff elements. There are no contracts funded in this project.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Discussed in individual program elements managed by AD.

2. (U) FY 1982 Program: Discussed in individual program elements managed by AD. OSD directed a realignment of funding at AD as a result of the redesignation of AD from a Test Center to a Division. This resulted in transferring the AD Commander and various staff elements not directly associated with a Test and Evaluation mission from PE 65807F to PE 65806F, effective in FY 1982. Eight-eight percent is for pay of personnel.

3. (U) FY 1983 Planned Program: Discussed in individual program elements managed by AD. This continues the FY 82 level of effort.

4. (U) FY 1984 Planned Program: This continues the FY 1983 level of effort.

5. (U) Program to Completion: This is a continuing programs.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	12,246	21,099	23,275	23,865	Continuing	Not Applicable

8. (U) Comparison With FY 1982 Descriptive Summary:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	12,129	21,942	22,190		Continuing	Not Applicable

* Excludes Reimbursements.

Project: N/A
Program Element: #65806F
DOD Mission Area: General Management Support #471

Title: Ballistic Missile Office (BMO)
Title: Acquisition and Command Support (ACS)
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: BMO plans, programs, and manages systems programs to acquire ballistic missile systems, Aerospace Ground Equipment, and other subsystems and related hardware; provides for the activation/alteration of missile sites and ground launch facilities. Conducts and manages standardization programs, medical activities, bio-environmental engineering, system safety engineering, electromagnetic compatibility, personnel subsystems, reliability and maintainability, configuration management, survivability and vulnerability, systems engineering, value engineering, and quality assurance programs, related to missile systems, equipment and material. Acquires and manages industrial facilities. Prepares, completes, and coordinates program management plans, to include management arrangements with other elements of Air Force Systems Command, United States Air Force, Department of Defense agencies, military department Government agencies and industry. Supports and participates in Research and Development and procurement and production programs established with North Atlantic Treaty Organization, and other friendly international organizations or individual nations. Ensures efficient and effective logistic support of systems and equipment being developed for the operational inventory and manages all phases of material, transportation, transportability, supplies, maintenance, Aerospace Ground Equipment, and propellants in support of all BMO programs and projects. Discharges USAF responsibility as Manager of the DoD Advanced Missile Reentry Systems program. BMO has responsibility for the Minuteman and Missile-X Program Offices.

(U) RELATED ACTIVITIES: BMO uses the capabilities of the Air Force laboratories, centers, ranges, and other AFSC in-house capabilities to the maximum extent feasible in all phases of systems planning, development, acquisition, and test. Related Program Element is 65304F, Acquisition and Command Support (ACS) Telecommunications.

(U) WORK PERFORMED BY: Ballistic Missile Office, Norton AFB, CA. There are no major contracts at BMO funded by this program element. Minor contractual effort is provided through host base support contract.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable

2. (U) FY 1982 Program: This is an in-house effort by the organization cited above which supports many program elements and projects in the Research, Development, Test and Evaluation community, and procurement programs.

Project: N/A
Program Element: #65806F
DOD Mission Area: General Management Support, #641

Title: Ballistic Missile Office (BMO)
Title: Acquisition and Command Support (ACS)
Budget Activity: Defense-wide Mission Support, #6

3. (U) FY 1983 Planned Program: This is a continuing program, the main cost of which is for pay of personnel. Eight-six percent of the total is for pay of personnel. Increased effort will be on the Missile-X program.

4. (U) FY 1984 Planned Program: No major changes are foreseen in the nature of this element at this time.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

7. (U) Resources: ($ in thousands)

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	7,685	7,722	8,362	8,695	Continuing	Not Applicable

8. (U) Comparison With FY 1982 Descriptive Summary:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	7,278	7,960	8,045		Continuing	Not Applicable

*Excludes Reimbursements

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65807F — Title: Test and Evaluation Support
DOD Mission Area: Major Ranges and Test Facilities, #451 — Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	334,687	360,773	354,273	383,229	Continuing	Not Applicable
2109	Arnold Engineering Development Center	108,929	116,859	125,734	130,246	Continuing	Not Applicable
2110	Western Space and Missile Center	650	2,900	0	0	0	Not Applicable
2111	Armament Division	102,033	101,408	100,739	106,749	Continuing	Not Applicable
2112	Air Force Flight Test Center	77,624	85,924	86,565	100,357	Continuing	Not Applicable
2114	4950th Test Wing	45,451	53,682	41,235	45,877	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides resources for operating the above Air Force Systems Command test activities which are part of the Department of Defense Major Range and Test Facility Base (MRTFB). Operation of the activities includes both technical and base support functions. These activities provide test and evaluation support to the Air Force, other Services, Government agencies, and commercial companies. Many capabilities possessed by the test activities are unique and cannot be found elsewhere.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The program supports the operation and maintenance of the RDT&E activities and includes civilian pay, travel, transportation, rents, communications, utilities, contractual services, supplies and equipment. Past history, projected workload and use of approved inflation indicies form the basis for this cost estimate. The FY 83 Program decrease is due to transfer of major improvement and modernization programs to Program Element (PE) 64755F, Improved Capability for Development Test and Evaluation for improved management visibility. In addition, beginning in FY 83, funds for operation, maintenance, improvement and modernization of the facilities of the 6585th Test Group, Holloman AFB, NM, are transferred to PE 65708F.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	326,237	365,500	TBD		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Military Construction	12,950	0	63,020	21,067	Continuing	Not Applicable

Program Element: #65807F | Title: Test and Evaluation Support
DOD Mission Area: Major Ranges and Test Facilities, #451 | Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This Program Element resulted from consolidation of three Program Elements in FY 1975: 65301F - Space and Missile Test Center (SAMTEC); 65802F - Arnold Engineering Development Center (AEDC); and 65807F - Development and Test Support which included the Armament Development and Test center, now the Armament Division (AD), the Air Force Flight Test Center (AFFTC) and the Air Force Special Weapons Center (AFSWC), now part of the Air Force Weapons Laboratory (AFWL). Also effective in FY 1975, all test activities in this Program Element began to earn direct cost reimbursements from test and evaluation customers under the uniform funding policy established by Department of Defense Directive 3200.11. During FY 1977 an analysis was conducted on the Western Space and Missile Center (WSMC) workload which determined the majority of programs supported were operational. Effective in FY 1979, WSMC operations were funded in the operations and maintenance appropriation.

(U) RELATED ACTIVITIES: The test activities provide test and evaluation support to Air Force programs and those of other Services and Government agencies. Examples include the Air Force Air Launched Cruise Missile, F-15, F-16, MX, Inertial Upper Stage and National Aeronautics and Space Administration Space Shuttle. Additional related activities are covered under each project.

(U) WORK PERFORMED BY: AEDC, Arnold AFS, TN; AD, Eglin AFB, FL, AFFTC, Edwards AFB, CA; and the 4950th Test Wing, Wright Patterson AFB, OH. Major contractors performing work at each center, shown in parenthesis, include: Arnold Research Organization, Inc., PAN AM World Services and Calspan Field Services, Inc. (AEDC); VITRO Services and RCA Missile and Service Division (AD); Dynalectron Corp (6585 Test Group); and Kentron International (AFFTC).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: See attached project descriptions.

Project: #2109 — Title: Arnold Engineering Development Center (AEDC)

Program Element: #65807F — Title: Test and Evaluation Support

DoD Mission Area: Major Ranges and Test Facilities, #451 — Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: AEDC provides ground environment test support for Air Force aeronautical, missile and space programs such as Minuteman, M-X, F-15, F-16, Air Launched Cruise Missile, Advanced Strategic Air Launched Missile and Advanced Ballistic Reentry Systems, as well as for other Service, Government agency and industry programs. The center has three facility complexes encompassing wind tunnels, altitude rocket cells, aeroballistic ranges, altitude engine cells, space chambers and required support and administrative facilities. The test facility complexes are: Von Karman Gas Dynamic Facility which performs aerodynamic testing of scale models of aircraft, missile and space systems from Mach 1.5 to 10, testing of large and full-scale satellites, sensors and space vehicles in a simulated space environment and tests of projectiles (both high performance and conventional gun) at various altitudes and reentry conditions; Engine Test Facility which provides altitude environmental testing for aircraft, missile and spacecraft propulsion systems including turbojets, turbofans and both liquid and solid propellant rockets; and Propulsion Wind Tunnel Facility which provides tests of large-scale models, and in some cases, full scale engine inlet combinations, missiles and space boosters together with their propulsion systems at Mach numbers from 0.5 to 4.5. This national test center is used to evaluate aerospace systems, hardware, concepts and prototypes in simulated operating environments. These test complexes are used to assist in obtaining an optimal design, evaluation and certification of performance and acceptance of hardware by providing accurate data at minimum cost.

(U) RELATED ACTIVITIES: The Center also supports programs of the National Aeronautics and Space Administration such as Space Shuttle, the Army Ballistic Missile Division and the Navy, as well as technology support to the Department of Energy. The Center's facilities are national assets that provide unique test capabilities not available elsewhere.

(U) WORK PERFORMED BY: The AEDC Commander and his staff provide the overall planning, programming, funding and administration of AEDC. The operation of the test facilities and support activities at AEDC is performed by operating contractors. Approximately 80 percent of the AEDC institutional budget is used for the operating contracts. AEDC is operated and maintained by three operating contractors, one for each of three function areas. ARO, Inc (Sverdrup, Inc) is responsible for propulsion testing, including activation and operation of the Aeropropulsion Systems Test Facility. CALSPAN Field Services, Inc, a subsidiary of Calspan Corporation is responsible for Aerospace Flight Dynamics Testing (all other testing). PAN AM is responsible for the mission support functions. Other contractors working on special tasks include: Grumman Data Systems, Bethpage, NY; Westinghouse, Sunnyvale, CA; Daniel, Mann, Johnson & Mendenhall, Los Angeles, CA; Brown Boveri, Switzerland; Sulzer Brothers, Switzerland; Axel Johnson, San Fransisco, CA; Mosser, Bethleham, PA; Clow Corp, Chicago, IL; Rotoflow Corp, Los Angeles, CA; and Carrier, Syracuse, NY.

Project: #2109 Title: Arnold Engineering Development Center (AEDC)
Program Element: #65807 Title: Test and Evaluation Support
DoD Mission Area: Major Ranges and Test Facilities, #451 Budget Activity: Defense-wide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: AEDC has provided vital environmental test support to most of the national aerospace system development programs such as the F-15, F-16, B-1, A-10, F100/F101 Engine Model Derivative Program (EMDP), F-5E, Advanced Ballistic Reentry Systems (ABRES), F-111, Minuteman, Inertial Upper Stage (IUS), Titan, Air Launched Cruise Missile (ALCM), Advanced Strategic Air Launched Missile and the NAVSTAR satellite. Major direct support for environmental testing was provided for advanced surveillance devices, aerospace propulsion and flight dynamics and munitions development. Additional support was provided to Air Force Logistics Command (AFLC) for engine baseline performance and trending. Congressional approval was issued in 1977 for construction of the Aeropropulsion Systems Test Facility, a national test facility capable of simulating altitude flight conditions for integrated aerodynamic and propulsion tests of very large aircraft engines. Construction is progressing towards an Initial Operational Capability (IOC) in FY 1985.

2. (U) FY 1982 Program: Major direct support for environmental testing is being provided for the F-16, ALCM, Advanced Medium Range Air-to-Air Missile (AMRAAM), Wasp, IUS, ABRES, and Missile-Experimental (MX). Support will also be provided to the AFFDL, as well as to the Air Force Aeropropulsion Laboratory, Rocket Propulsion Laboratory and Armament Division. Support to Air Force Logistics Command, Army, Navy, and National Aeronautics and Space Administration (NASA) will continue. F100 Engine Component Improvement Program testing will be conducted as well as tests for F101 Derivative Fighter Engine development. Magnetohydrodynamic technology and test support will be provided to the Department of Energy. In order to provide the best possible test data at minimum cost AEDC will maintain its continuing effort in developing technology and instrumentation to improve and modernize its existing capabilities. AEDC will initiate the true test center concept approach to testing. This concept permits more government involvement in test planning, conduct, data acquisition and analysis.

3. (U) FY 1983 Planned Program: The Center will continue to be a prime contributor to the successful development of Department of Defense and NASA aeronautical, missile and space systems such as ABRES, Advanced Medium Range Air-to-Air Missile, Wide Area Anti-Armor Munition, Space Shuttle, MX, F-16, stores separation testing and ALCM. Aerodynamic testing programs will be conducted for the Foreign Technology Division. Additionally, AEDC will provide support for other Services, such as the Navy and Army, and commercial companies. Magnetohydrodynamic technology support to the Department of Energy will continue.

Project: #2109
Program Element: #65807
DOD Mission Area: Major Ranges and Test Facilities, #451

Title: Arnold Engineering Development Center (AEDC)
Title: Test and Evaluation Support
Budget Activity: Defense-wide Mission Support, #6

4. (U) FY 1984 Planned Program: The statements in paragraph 3 also apply in FY 1984.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E*	108,929	116,859	125,734	130,246	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Budget Data:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate
RDT&E*	105,889	117,559	TBD

*Excludes Reimbursements

Project: #2110 Title: Western Space and Missile Center (WSMC)
Program Element: #65807F Title: Test and Evaluation Support
DoD Mission Area: Major Ranges and Test Facilities, #451 Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The WSMC operates the Western Test Range (WTR) which provides range tracking, data acquisition, and flight safety support for all aeronautical flights, and ballistic missile and space systems launches from Vandenberg AFB, CA. The WSMC operates an integrated system of radars, optical tracking instruments, telemetry receivers, range safety command destruct transmitters, computers, and data transmission and display equipment. Operating sites include: Vandenberg AFB and Pillar Pt, CA and Wheeler AFB, Molokai and Kaena Pt, HI. These funds provide for new range instrumentation research and development at a test range whose funding is predominately operations and maintenance (O&M). The remainder of WSMC/WTR funding is in Program Element 78032F.

(U) RELATED ACTIVITIES: The WSMC provides common range support for: Strategic Air Command (SAC) ballistic missile operational testing; Air Force Space Division polar orbit and Ballistic Missile Office ballistic reentry vehicle launches; other Department of Defense sponsored range users; the National Aeronautics and Space Administration polar orbit launches; on-orbit tracking of satellites launched from the Eastern Test Range; and support to the Navy Pacific Missile Test Center. Funds for WSMC Defense Communications Services and other leased communication services are carried under Program Element 78034F. SAC provides host base services to WSMC at Vandenberg AFB. The majority of funding for WSMC/WTR is in PE 78032F.

(U) WORK PERFORMED BY: Air Force management is under the Air Force Western Space and Missile Center, Vandenberg AFB, CA. Major contractors are: Federal Electric Corporation, Division of International Telephone and Telegraph, Paramus, NJ, provides operation and maintenance of range instrumentation; Aeroneutronic-Ford Corporation, Fort Washington, PA, operates the Vandenberg AFB, Precision Measurements Equipment Laboratory; Computer Sciences Corporation, Los Angeles, CA, provides computer engineering technical services; and Logicon, Inc., Torrance, CA, provides verification and validation of flight safety computer programs. Other contractors include: Bionetics, Hampton, VA; Science Applications Inc., LaJolla, CA; Southern Pacific Transportation Company, San Francisco, CA; and Xerox Corp, Los Angeles, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: WSMC assumed responsibility for intercontinental ballistic missile and space vehicle range support functions from the Navy on 1 February 1965. The FY 1966 program provided for the consolidation and integration of range operations and the establishment of a communications center at Wheeler AFB, HI. The FY 1969 program provided for the installation of new mid-course tracking radar in the Hawaiian Islands and centralization of telemetry and peripheral equipment and data handling, processing, and display. The 1970 through 1974 programs provided for development of a new terminal/reentry support site in the Phoenix Islands for Strategic Air Command operational testing of the Minuteman III, instrumentation improvement modifications to range ships, a tracking accuracy improvement modification of the WSMC radar in Hawaii, major upgrading of the WSMC telemetry capability, acquisition of instrumentation to support the Minuteman III Operational Base Launch program at Vandenberg AFB, CA, initiation of development of an unattached scoring system, new range safety Digital Instrumentation Radar

Project: #2110 Title: Western Space and Missile Center (WSMC)
Program Element: #65807 Title: Test and Evaluation Support
DoD Mission Area: Major Ranges and Test Facilities, #451 Budget Activity: Defense-wide Mission Support, #6

and continued minimum essential improvements to range instrumentation and communications. Support to the Airborne Warning and Control System and B-1 programs began in FY 1976-1977 and added to WSMC's Development Test and Evaluation (DT&E) workload. Minuteman III testing increased significantly in FY 1977 to support Improved Guidance, Missile Precision Measurement System and MK-12A Reentry Vehicles DT&E requirements.

2. (U) FY 1982 Program: The $2.9 million RDT&E for FY 1982 will be used for design and hardware/software development for the MPS-36 Antenna Improved Feed, Command Control Transmitter Secure Coding System, Deployment Mapping Instrument and Global Positioning System - Sonobuoy Missile Impact Location System (GPS-SMILS). Studies of GPS applicability to time, space, position information will also be performed.

3. (U) FY 1983 Planned Program: Funding to complete GPS-SMILS is transferred to PE 64755F All other programs are completed.

4. (U) FY 1983 Planned Program: Not Applicable.

5. (U) Program to Completion: WSMC instrumentation development will be funded in PE 64755F beginning in FY 83.

6. (U) Milestones: GPS-SMILS Initial Operational Capability in FY 86.

7. (U) RESOURCES: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E*	600	2,900	0	0	0	Not Applicable

8. (U) COMPARISON WITH FY 1982 BUDGET DATA:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate
RDT&E*	600	2,900	0

* Excludes Reimbursements

Project: #2111
Program Element: #65807F
DoD Mission Area: Major Ranges and Test Facilities, #451

Title: Armament Division (AD)
Title: Test and Evaluation Support
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: AD is the host organization at Eglin AFB, FL and is the prime Air Force organization charged with nonnuclear armament development. As of 1 October 1979, AD (formerly Armament Development and Test Center) became a full product division. In this role, AD: accomplishes engineering development, test, evaluation and initial acquisition of Air Force nonnuclear munitions; acts as the focal point for munitions integration in aeronautical systems; conducts and supports Air Force weapons effectiveness testing, electromagnetic warfare testing, electronics surveillance and control testing, aeronautical systems testing; operates the 6585th Test Group's Central Inertial Guidance Facility (CIGTF), the 50,000 foot precision rocket sled track, the Radar Target Scatter Facility (RATSCAT) and sponsors all Air Force programs using the Army's White Sands Missile Range; and supports and participate in the United States Air Force, Department of Defense (DoD), and other governmental agency test and evaluation programs, as required. Eglin encompasses 734 square miles of land and a 44,000 square mile Gulf Test Range extending 400 miles south into the Gulf of Mexico. AD conducts more than 400 test projects per year with the emphasis in the field of conventional munitions. To carry out this program, AD utilizes 42 aircraft and over 50 instrumented test areas, sites, and ranges. The ranges are divided into four categories: Armament Systems Test Environment (ASTE), Electromagnetic Test Environment (EMTE), Multipurpose Resources (MPRs) and the Water Test Areas (WTAs). The test and evaluation effort and base operational support requirement are funded under this Program Element. The Acquisition and AD Staffs are funded under Program Element 65806F.

(U) RELATED ACTIVITIES: AD supports the Air Force nonnuclear munitions development programs concerning advanced development, engineering development and initial production of nonnuclear munitions until transition to the Air Force Logistics Command. Test support is also provided to other Services and Government agencies. The Air Force Climatic Laboratory at Eglin AFB provides environmental testing for weapon system programs of DoD. Related and complementary work is accomplished at the Air Force Flight Test Center, Arnold Engineering Development Center, Space and Missile Test Organization, all in Program Element 65807F Test and Evaluation Support; and the Product Divisions of PE 65806F, Aquisition and Command Support.

(U) WORK PERFORMED BY: The AD Commander and his staff provide the overall planning, programming, funding and administration of Armament Division, Eglin AFB, FL. The operation of the range facilities is accomplished by a contract with VITRO Services, Division of Automation Industries, Inc., Ft. Walton Beach, FL. Other contractors include: Dynalectron, Washington, D.C.; Transit Services, Danville, AL; Falls Janitorial Services, Birmingham, AL; TDS Services, Norcross, GA; Kinetic Builders, Fort Walton Beach, FL; Gulf Electric, Crestview, FL; Digital Equipment, Pensacola, FL; and Control Data Corp., Rockville, MD. There are approximately 100 additional contracts divided among over 45 other contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: AD's Eglin activities have primarily included the engineering development, test and evaluation and initial acquisition of nonnuclear munitions and T&E of electromagnetic warfare instrumentation. The 6585th Test Group at Holloman has operated the Central Inertial Guidance Test Facility, the high

Project: #2111 Title: Armament Division (AD)
Program Element: #65807F Title: Test and Evaluation Support
DOD Mission Area: Major Ranges and Test Facilities, #451 Budget Activity: Defense-wide Mission Support, #6

speed test track, target drones and the Radar Target Scatter Facility. In addition, AD supported the collection, reduction, analysis and evaluation of precise test data and the preparation of technical reports. Major weapon systems supported by AD during FY 1981 included the F-111 Seek Eagle, F-15 Tactical Electronic Warfare System (TEWS), F-16 Seek Eagle, PAVE MOVER, Low Level Laser Guided Bomb (LLLGB), WAAM, IR Maverick, AIM-7M, AIM-9M and Advanced Medium Range Air-to-Air Missile (AMRAAM).

2. (U) FY 1982 Program. Fiscal year funds are used for the following purposes on a continuing basis: operate, maintain and upgrade the highly instrumented 734 square mile test complex at Eglin AFB, FL; conduct and support testing in the areas of Air Force nonnuclear munitions, electromagnetic warfare, and missiles and munitions/aeronautical system integration; operate, maintain and upgrade the Central Inertial Guidance Test Facility, High-Speed Test Track and Radar Target Backscatter Facility at Holloman AFB, NM; support United States Air Force, Office of the Secretary of Defense and other Government agencies in test programs, as required; provide administrative, logistical and technical support to approximately 10,000 assigned tenant personnel. Realignment of spaces at AD from 65807F to 65806F reduced the program by $9.1M for FY 82.

3. (U) FY 1983 Planned Program: Many of the FY 1982 efforts will continue. Typical programs requiring support will include Advanced Guidance Technology, F-16 Seek Eagle: F-15(TEWS), Low Level Delivery System (LLDS); Advanced Medium Range Air Missile (AMRAAM) and Wide Area Anti-Armor Munition (WAAM). The operations, maintenance, improvement and modernization funding for the 6585TG at Holloman AFB, NM, will be transferred to PE 65708F in FY 83.

4. (U) FY 1984 Planned Program: Many of the FY 1982 efforts will be continued.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E*	102,035	101,408	100,739	106,749	Continuing	Not Applicable

8. (U) Comparison with FY 1982 Budget Data:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate
RDT&E*	105,889	117,359	TBD

*Excludes Reimbursements

Project: #2112 Title: Air Force Flight Test Center (AFFTC)
Program Element: #65807F Title: Test and Evaluation Support
DOD Mission Area: Major Ranges and Test Facilities, #451 Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The AFFTC conducts and supports tests of aircraft and aircraft systems, aerospace research vehicles, remotely piloted vehicles, cruise missiles and parachute delivery/recovery systems. Major weapon systems undergoing testing at Edwards AFB, CA, include the A-10, F-15, B-1 and Air Launched Cruise Missile. The 6514th Test Squadron at Hill AFB, UT, conducts tests of remotely piloted vehicle systems and the Ground Launched Cruise Missile using the Utah Test and Training Range to evaluate research, tactical and reconnaissance drone systems for military applications. Air Force parachute testing is the responsibility of the 6510th Test Wing. The AFFTC also operates the United States Air Force Test Pilot School which annually trains 50 Department of Defense, allied and contractor test pilots and flight test engineers.

(U) RELATED ACTIVITIES: The AFFTC provides facilities and support to the National Aeronautics and Space Administration (NASA) Hugh L. Dryden Flight Research Center (DFRC) and to the United States Army Aviation Engineering Flight Activity, major tenants at Edwards AFB. The NASA DFRC programs include the Space Shuttle and Transonic Aircraft Technology. The Army programs include helicopter systems testing at Edwards AFB and a high elevation test complex near Bishop, CA. The AFFTC also provides administrative and limited test support to the Air Force Rocket Propulsion Laboratory (AFRPL) located 15 miles east of the main base complex. The AFRPL programs include testing of rocket motors, nozzles and propellants. Other Government agencies receive AFFTC test support as required.

(U) WORK PERFORMED BY: Most of the tests and supporting activities are done by Air Force military and civilian personnel. The AFFTC provides facility and limited administrative support to NASA DFRC, the Army and to tenant contractor organizations. It also provides full administrative support to the Rocket Propulsion Laboratory. However, all tenant organizations provide for their own direct maintenance. Kentron International, Dallas, TX, is the major range contractor for the Edwards Flight Test Range.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The AFFTC has been the center of aircraft and research vehicle flight test for many years because of its unique features: excellent flying weather, large restricted airspace and the availability of natural dry lakebed runways. Programs which have undergone development testing at Edwards AFB include the F-105, XB-70, F-4, YF-12, the F-111 and the C-5A. Jointly, with NASA, the Air Force has tested the high altitude hypersonic X-15 research vehicle and the X-24 A/B lifting bodies. The ALCM flyoff was completed in FY 80. B-52 OAS and and F-1 flight testing were completed in FY 81. GLCM testing was begun as was support of B-52 improvement programs.

Project: #2112 Title: Air Force Flight Test Center (AFFTC)
Program Element: #65807F Title: Test and Evaluation Support
DOD Mission Area: Major Ranges and Test Facilities, #451 Budget Activity: Defense-wide Mission Support, #6

2. (U) FY 1982 Program: Testing is continuing on the A-10, F-15, F-16, B-1 and B-52 programs. The F-16 Delta Wing program starts up in 1982 with flight demonstration scheduled for July. The F-16 Advanced Fighter Technology Integration Program also starts this year and will continue into FY 83. Ground Launched Cruise Missile testing is ongoing. The B-52 improvements and ALCM testing continue. Various technology base programs are being tested including such programs as the F-15 Integrated Flight Fire Control System. Orbital flight tests and landings of the Space Shuttle are being conducted by NASA with Air Force participation. Preparation for the B-1B, F-16 Delta Wing and Low Altitude Navigation and Targeting Infrared System for Night (LATIRN) programs is ongoing.

3. (U) FY 1983 Planned Program: The B-1B will be tested. Various A-10, F-16 and cruise missile programs will continue throughout FY 83. F-16E Delta Wing DT&E continues and the F-16 Multi Stage Improvement Program testing will begin. The ASAT and LANTIRN programs begin testing in FY 83. Various cruise missile test programs will continue throughout FY 83. Edwards will continue to be involved in the Space Shuttle program both as the prime landing site and then as the back up landing site. Preparation for flight testing of the UH-60 and NGT will be ongoing.

4. (U) FY 1984 Planned Program: FY 1984 is the beginning of a surge period in flight testing. All the programs in FY 83 will continue through FY 1984. In addition, flight testing of the UH-60 and Next Generation Trainer will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E*	77,624	85,924	86,565	100,357	Continuing	Not Applicable

8. (U) Comparison With FY 1982 Budget Data:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate
RDT&E*	75,995	86,464	TBD

*Excludes reimbursements

Project: #2114
Program Element: #65807F
DOD Mission Area: Major Ranges and Test Facilities, #451

Title: 4950th Test Wing
Title: Test and Evaluation Support
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The 4950th Test Wing, Aeronautical Systems Division, Wright-Patterson Air Force Base (AFB), OH, performs flight tests of aircraft and airborne systems, supports space vehicle tracking for the Space Division and other DoD and National Aeronautics and Space Administration agencies, and operates the Air Force Systems Command's (AFSC) major Class II aircraft modification facility. Flight tests have varied from evaluations of an airborne side-firing cannon to investigation of state-of-the-art airborne laser systems and night attack sensors. The Wing has the capability to conduct full-scale engineering evaluations, airborne instrumentation and data reduction, Class II aircraft modification and extensive technical photo documentation. Staging out of 25 overseas bases, the Advanced Range Instrumentation Aircraft (ARIA) fleet of seven aircraft provide telemetry support for NASA and DoD missile launches out of Cape Kennedy, FL, and Vandenberberg AFB, CA. The Deputy Commander for Aircraft Modification accomplishes mechanical and electronic modifications to AFSC test aircraft to support flight test programs. Fabrication support is also provided to the Air Force Wright Aeronautical Laboratories. The Wing posseses functional managerial responsibility for Class II Aircraft Modification policy throughout AFSC.

(U) RELATED ACTIVITIES: The 4950th Test Wing supports DoD, NASA and allied programs.

(U) WORK PERFORMED BY: Air Force personnel (55 percent civilian) accomplish 95 percent of the workload of the 4950th. The remaining work is covered by contracts which total $4.0 million. Major contractors include Digital Equipment Corporation of Dayton, OH, which performs computer maintenance; Bendix Corporation of Columbia, MD, which provides ARIA instrumentation maintenance, E-Systems of Greenville, TX, Hayes International Inc., of Birmingham, AL, Technology Inc. of Dayton, OH, and Systems Research Laboratory of Dayton, OH which provides supplementary engineering design and aircraft modification installation. Fifteen percent of the 4950th's 10,000 annual flying hours are in support of ARIA missions. The rest are flown for other tests, support and proficiency training. The fabrication and Class II aircraft modification workload consumes 350 man-years of direct labor effort annually.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The 4950th Test Wing was designated a Major Test Facility in November 1975 and was placed within the purview of DoD Directive 3200.11, the directive which governs the use, management and operation of major DoD ranges and test facilities. Some of the recent accomplishments in the flight test program are the developmen of the Infrared Warning Receiver, Pulse Doppler Map Match Navigation System, Long Range Electro Optical Reciever, Coherent Emitter Location Test, SEEK TALK, B-52 Companion Trainer Aircraft, Airborne Laser Communications System, Airborn Laser Laboratory, Tactical Bistatic Radar and Long Range Passive Location System. Eight F-4Es, three ARIA, and one CH-3 Helicopter were modified in support of the high priority Air Launched Cruise Missile (ALCM) program. The ARIA have supported such programs as Apollo, Venus and Pioneer for NASA; Titan IIIC, Atlas-Agena, and Minuteman for the Air Force; Poseidon and Trident for the Navy; and Pershing for the Army. The Wing converted two EC-135B fan engine aircraft for ARIA support and is preparing to convert the remaining five EC-135N ARIA to the Boeing 707-320C aircraft. Seven KC-135 SAC tankers were modified to incorporate tail floodlights for night aerial refueling operations.

Project: #2114 Title: 4950th Test Wing
Program Element: #65807F Title: Test and Evaluation Support
DOD Mission Area: Major Ranges and Test Facilities, #451 Budget Activity: Defense-wide Mission Support, #6

2. (U) FY 1982 Program: Some of the flight test programs currently being supported are Infrared Properties, Aerospace Radio Propagation, Airborne Laser Laboratory, Aircraft Navigation System Verification, NAVSTAR, Air Launched Cruise Missile, Patriot, ASC-30 SATCOM and Mark XII IFF. In addition the Advanced Range Instrumentation Aircraft (ARIA) are supporting various Air Force, National Aeronautics and Space Administration (NASA), Army and Navy programs. A significant improvement and modernization program is underway to update the ARIA instrumentation systems, to include an upgrade of airborne receivers and a Phased Array Telemetry Antenna System (APATS). The Wing will complete development of a Computer Aided Design (CAD) system for the Deputy Commander for Aircraft Modification. This system will be integrated into a total capability involving Computer Aided Manufacturing (CAM). Extensive design engineering effort will be expended to accomplish the ARIA conversion to Boeing 707-320C aircraft.

3. (U) FY 1983 Planned Program: Continue efforts on existing programs. Support of the Combat Identification Systems, Electro Optical Threat Sensors and UHF Air Operations SATCOM Terminal is also planned. The AIRA will continue to support future DoD and NASA requirements. The CAD/CAM system will be used in conducting Class II aircraft modification projects. Work continues on Boeing 707 to ARIA conversion.

4. (U) FY 1984 Planned Program: The 4950th Test Wing will continue to support flight test programs. The prototype B707 ARIA will be complete and undergo flight testing. The ARIA fleet will eventually consist of six B707 aircraft, four equipped with APATS.

5. (U) Program to Completion: This is continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources: ($ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
RDT&E*	45,451	53,682	41,235	45,877	Continuing	Not Applicable

8. (U) Comparision With FY 1982 Budget Data:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate
RDT&E*	45,513	57,489	TBD

*Excludes Reimbursements

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65808F Title: Advanced Systems Engineering/Planning
DOD Mission Area: Technical Integration/Studies & Analyses, #440 Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4,091	4,981	5,443	5,894	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force conducts development planning (mission area planning, systems architecture, and systems planning) to convert operational requirements into effective weapon systems. This Advanced System Engineering/Planning Program provides technical support for the development planning function at the Electronic Systems Division and the Space Division. This includes the definition of technology needs, the macrosystem planning or architecture required to meet national objectives and the initial system definition necessary to satisfy operational requirements.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This request will provide technical support for the development planning function at the Electronic Systems Division and the Space Division. This effort will include the identification of new technology required for future systems; the future architectural plans for strategic and tactical systems; and initial engineering design for future systems required to satisfy operational requirements. Budget estimates are based on manpower costs for similar, completed projects.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,100	5,100	5,700		Continuing	Not Applicable
Procurement	Not Applicable					

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #65808F Title: Advanced Systems Engineering/Planning
DOD Mission Area: Technical Integration/Studies & Analyses, #440 Budget Activity: Defense-wide Mission Support, #6

2. (U) FY 1982 Program: The program activities at the Electronic Systems Division are emphasizing command, control, communications and intelligence architecture efforts in support of the Tactical Air Forces. This architecture effort is providing a time-phased system acquisition plan. The Technology Planning Guide is being updated. Space Division architecture efforts are being accomplished with emphasis on the ground interfaces with military satellites. This approach to ground control architecture is taking into consideration the development of transportable ground terminals, mobile ground terminals, mission ground stations and relay satellites. The objective is to provide specific recommendations and guidelines to improve space system survivability. Advanced concepts currently being investigated include satellite clustering, atmospheric surveillance and warning, and attempts to better understand how space systems can provide decisive support to military forces.

3. (U) FY 1983 Planned Program: The Electronic Systems Division program will emphasize command, control communications and intelligence architecture for the Tactical Air Forces. Specific areas to be stressed are forward air surveillance and identification concepts, ground target identification and strike capability and electronic warfare concepts. The Technology Planning Guide will be updated to include the current "technology needs" information. The space based satellite data management techniques and military space flight capability investigations are planned to continue.

4. (U) FY 1984 Planned Program: The emphasis on tactical and strategic architectural activities and advanced system engineering efforts will be continued. The Electronic Systems Division will continue the advanced systems planning tasks in the automatic data processing, communications and aerospace defense areas. The Space Division plans to investigate manned space applications such as on-orbit maintenance/servicing and retrieval of satellites as well as an investigation of functions that can best be performed in space.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable.

Program Element: #65808F Title: Advanced Systems Engineering/Planning
DOD Mission Area: Technical Integration/Studies & Analyses, #440 Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: Development planning is the initial step in the systems acquisition process. The overall objective is the conversion of operational requirements into effective military capabilities. The development planning function includes: (1) mission area planning that broadly examines Air Force capabilities and potential deficiencies, and establishes development goals; (2) systems architecture that will provide a time-phased plan for meeting the development goals; (3) systems planning that will define initial system characteristics for a future weapon or support system. This program provides technical support for the development planning function in the strategic and tactical areas of command, control, communications, and intelligence at the Electronic Systems Division and for space systems at the Space Division. In addition to the Air Force personnel assigned to support this functional area, the Aerospace Corporation and the MITRE Corporation are the principal technical support contractors for the program.

(U) RELATED ACTIVITIES: The "technology needs" identified and published in the Technology Planning Guide provide guidance to the basic research and exploratory development planners and the associated 6.1 and 6.2 program elements. The space architecture and the command, control, communications and intelligence architecture activities supported by this program element provide the advanced development planners with the time-phased capabilities needed. The development planning activities are discussed with the other military services to prevent duplication and improve cooperation.

(U) WORK PERFORMED BY: The primary technical support for this program is provided by the Aerospace Corporation, El Segundo, CA, and the MITRE Corporation, Bedford, MA. Other contractors may be selected to provide technical support in specific areas. The Aerospace and MITRE Corporations have been designated Federal Contract Research Centers (FCRCs) and, as such, may have access to contractor proprietary data and to sensitive Air Force procurement information. This capability allows these Federal Contract Research Centers to provide unique and necessary support to the Air Force development planning function.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: System architectural efforts have been emphasized to provide a basis for technology planning and future system acquisition. The Electronic Systems Division managed the Command, Control, Communications and Intelligence Architecture Project in support of the Tactical Air Forces, identified technology needs and published a Technology Planning Guide for use by the basic research and exploratory development planners. The Space Division program focused on space and missile architecture, support to a study on the utility of military crews in space, all aspects of space sensor data management, an in-depth examination of an advanced military launch capability for the 1990s, and initial planning for a stand-off ballistic missile system to improve bomber survivability through increasing stand-off range.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65872F
DOD Mission Area: General Management Support, #471

Title: Productivity Improvement
Budget Activity: Defense-Wide Mission Support #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT			2,201	2,271		4,472
	(U) Computer Aided Design/ Computer Aided Manufacturing System for ADEC			1,319	2,271		3,590
	(U) Aeronautical Systems Division Document System			882			882

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides field units within Air Force Systems Command the equipment to satisfy the following productivity improvement initiatives: Aeronautical Systems Division (ASD) at Wright-Patterson, OH, intends to procure a document control system to further enhance their office automation effort. Arnold Engineering Development Center (AEDC), Tullahoma, TN intends to procure a Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) system to improve their engineering design/drafting productivity by a factor of 2.5 to 1.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds for the acquisition of state-of-the-art equipment to enhance productivity by automating currently non-automated activities. Cost estimates were derived through General Services Administration equipment schedules and independent audits of manpower requirements.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not Applicable. FY 1983 new start.

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #65872F | Title: Productivity Improvement
DOD Mission Area: General Management Support, #471 | Budget Activity: Defense-Wide Mission Support #6

(U) DETAILED BACKGROUND AND DESCRIPTION:

(U) CAD/CAM System for AEDC: The objective of this program is to provide a Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) system at Arnold Engineering Development Center (AEDC). The CAD/CAM system will increase productivity in: Graphical Art, Numerical Control, Finite Element Modeling, and Design/Drafting Activities. Based on years of surveys and on benchmarks in similar industrial applications, Productivity International, Inc., determined, as part of a nineteen man-day audit of AEDC, that the proposed CAD/CAM system would increase productivity. Over a seven year period, the proposed CAD/CAM system would product a new savings of 795,212 manhours and 10,647,900 dollars in salaries. The new system will increase the engineering design/drafting productivity at AEDC by a minimum of 2.5 to 1. This increase in productivity will help solve the problem of locating an adequate number of qualified personnel to to fill current vacancies. The new system will consist of three Central Processing Units, thirty-two graphic work stations, and needed peripherals such as printers/plotters. Also, the CAD/CAM system would have the capability to run three-dimensional software. This capability is not currently available at AEDC. The AEDC workload has caused the Central Processing Unit now in use to be fully configured at maximum potential. Thus, not enough Central Processing Unit memory is available to accommodate three dimensional software.

(U) ASD Document System: The objective of this project is to enhance the basic document generation and control capability within Aeronautical Systems Division (ASD) through the effective implementation of dictation, transcription, and electronic document control systems. The Administrative Systems Program Office of ASD has implemented a word processing system in a major System Program Office as a pilot test and has analyzed both before and after data on the pilot test. The results of this analysis proves that ASD can successfully use current technology to derive a considerable cost savings. The proposed dictation system will provide ASD, over a four year period, with 133,200 additional professional manhours; that represents 2,668,600 dollars in salaries. In addition, dictation machines are available when clerical personnel are absent and are not as prone to error or fatigue. The necessary dictation equipment will consist of 800 desk-top recording and playback units, 200 portable dictation units, and 100 playback units for transcriptionists. Transcriptionists will further need 100 low-cost electronic typewriters which have automatic input features. These electronic typewriters can increase the draft typing speed of dictated material up to 20%. Furthermore, each of the twenty-five word processing centers are tied up at least 20% of the work-day in the performance of program management status tracking activities. This degrades their capability to produce program documentation. The proposed electronic system can reduce this to only five percent of the work, thereby gaining about one hour per day on each of the installed word processors for documentation work. In a pilot test the proposed concept, with a few keystrokes a Cathode Ray Tube displayed the entire current workload (and status) for the System Program Office.

(U) RELATED ACTIVITIES:

(U) CAD/CAM System for AEDC: These systems will be the basis for the future support of the Test Facilities drag requirements for the Aeropropulsion System.

(U) ASD Document System: This project is one of the beginning steps toward an "office of the future" for ASD. The next step is to implement a data processing and management information system interface.

Program Element: #65872F
DOD Mission Area: General Management Support, #471

Title: Productivity Improvement
Budget Activity: Defense-Wide Mission Support #6

(U) WORK PERFORMED BY: The Arnold Engineering Developing Center located at Arnold Air Force Station, Tullahoma, Tennessee is the responsible organization for the CAD/CAM system. The following corporations are expected to bid on this competitive procurement: IBM, Integraph, Applicon, and MacAuto. The Aeronautical Systems Division located at Wright-Patterson Air Force Base, Dayton, Ohio, is the responsible organization for the ASD Document System. IBM, Xerox, Sony, and Wang Corporations are expected to bid on this competitive procurement.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not Applicable

2. (U) FY 1982 Program: Not Applicable

3. (U) FY 1983 Planned Program: Provides funding for acquisition, installation, operation, and training for both Aeronautical Systems Division and Arnold Engineering Development Center projects.

4. (U) FY 1984 Planned Program: Provides funding for continued acquisition of Arnold Engineering Development Center equipment.

5. (U) Program to Completion: The acquisition phase of the program will be completed during FY 1984. After FY 1984 the only costs will be for operation and maintenance.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Budget Data: Not Applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 65890
DOD Mission Area: General Management Support, #471

Title: Installation Audiovisual Support
Budget Activity: Defense-Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) ($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5,064	4,420	5,622	5,756	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This includes base audiovisual (AV) libraries, photo labs, graphic arts, present services and other AV activities located in a Base Audiovisual Service Center (BAVSC).

(U) BASIS FOR FY 1983 RDT&E REQUEST: Continue AV support to the RDT&E Community.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,250	5,900	6,000		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: None

Program Element: # 65890 | Title: Installation Audiovisual Support
DOD Mission Area: General Management Support, #471 | Budget Activity: Defense-Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This includes base AV libraries, photo labs, graphic arts, presentation services and other AV activities located in a Base AV Service Center

(U) RELATED ACTIVITIES: None

(U) WORK PERFORMED BY: Base AV personnel

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Not applicable
2. (U) FY 1982 Program: This is a continuation of AV support
3. (U) FY 1983 Planned Programs: Continuation
4. (U) FY 1984 Planned Programs: Continuation
5. (U) Program to Completion: Not applicable
6. (U) Milestones: Not applicable
7. (U) Resources: Not Applicable
8. (U) Comparison with FY 1982 Descriptive Summary: Not applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65898F
DOD Mission Area: General Management Support, #471
Title: Management Headquarters - Research and Development
Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	32,246*	32,440	35,341	35,766	Continuing	Not Applicable
	HQ AFSC	21,346	20,900	23,671	24,096		
	HQ ASD	3,380	3,440	3,478	3,478		
	HQ ESD	2,237	2,390	2,405	2,405		
	HQ AMD	892	1,044	1,089	1,089		
	HQ AD	1,274	1,353	1,372	1,372		
	HQ SD	3,117	3,313	3,326	3,326		

*The Management Headquarters function at the Product Divisions (ASD, ESD, AD, AMD and SD) were transferred into this Program Element, effective 1 October 82. Prior year amounts adjusted on a comparable basis.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides the resources to support the Commander, his staff, the technical mission and support functions for Headquarters Air Force Systems Command (HQ AFSC), and the Commander and his staff at the following activities: Aeronautical Systems Division (ASD), Wright-Patterson AFB, OH; Electronic Systems Division (ESD), Hanscom AFB, MA; Armament Division (AD), Eglin AFB, FL; Aerospace Medical Division (AMD), Brooks AFB, TX; and Space Division (SD), Los Angeles AFS, CA. Categories of cost include pay and the related costs of civilian personnel, travel, transportation, rents, contractual services, supplies, and equipment.

(U) BASIS FOR FY 1983 RDT&E REQUEST: In order to comply with the revised definition for the Management Headquarters Program Element as contained in Program Change Decision X-1-006, the Management Headquarters functions at the Product Divisions were transferred to this program element. This is a continuing program which provides the resources to support the Commander his staff, the technical mission, and support functions for HQ AFSC and the Commander and his staff at the above listed organizations.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	19,800	23,800	24,400		Continuing	Not Applicable

Program Element: #65898F
DOD Mission Area General Management Support, #471

Title: Management Headquarters - Research and Development
Budget Activity: Defense-wide Mission Support, #6

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) DETAILED BACKGROUND AND DESCRIPTION: The mission of Air Force Systems Command (AFSC) is to advance aerospace science and technology, apply it to aerospace systems development and improvement, and acquire qualitatively superior aerospace systems and equipment needed to accomplish the Air Force mission. Specifically, the Commander and his staff: manage the aerospace systems equipment acquisition programs; act as the primary Air Force agent for technical advocacy of development programs to provide the technology and capability to fulfill known or anticipated Air Force operational requirements; maintain in-house laboratories of superior quality to conduct research in selected scientific areas to provide Air Force competence; plan, develop, and manage - through a central authority - aerospace vehicle launch facilities, range communication-electronics and instrumentation, worldwide satellite control, and recovery facilities for assigned Department of Defense (DOD), National Aeronautics and Space Administration (NASA), and other United States Government agency programs; plan, conduct, and manage systems; systems support; research, exploratory development engineering, and advanced development programs in bioastronautics, research programs in support of the Air Force personnel systems, clinical and aerospace medicine requirements, and specialized aerospace medical education programs; conduct and manage foreign technology program to provide a current foreign aerospace technical threat assessment for use in systems planning and acquisition; perform development testing and evaluation to establish the technical adequacy, safety, environmental consequences, and qualitative characteristics of systems and equipment; conduct such research and development activities as necessary to insure that environmental and ecological considerations are reflected in the course of accomplishing the overall mission; and provide liaison between the Air Force and the scientific community in areas of potential Air Force interest. This program provides the management support resources for the Commander of Headquarters AFSC and the Division Commanders.

(U) RELATED ACTIVITIES: In addition to the above responsibilities, the AFSC provides technical assistance to other major commands in conducting their operational test and evaluation activities; supports the other Services in developing and procuring aerospace items according to current directives; provides-by agreement or on request - foreign aerospace technological data and support to Headquarters United States Air Force (HQ USAF), Major Commands, NASA, and agencies of the national intelligence community; manages the Electromagnetic Compatibility Analysis Center in support of DoD and other Government agencies; established appropriate precedence rating alignment of all units within the precedence categories; informs HQ USAF of areas of conflict owing to changing forces, mission, or emphasis, maintains close liaison with the Federal Aviation Administration to insure the compatibility of Air Force aircraft with other elements of the National Airspace Systems and the ability to operate in airspace under the administration of the International Civil Aviation Organization. Related activities include all Air Force program elements.

(U) WORK PERFORMED BY: Headquarters AFSC, Andrews AFB, MD, performs staff management for work performed by Air Force Systems Command activities. Aeronautical Systems Division is responsible for management of aeronautical systems acquisition. Electronic Systems Division is responsible for command, control and communications systems. Aerospace Medical Division provides biomedical support for aerospace systems. Space Division plans, programs, and manages space systems. Armament Division manages the validation, development, and production of nonnuclear air armament systems.

Program Element: #65898F   Title: Management Headquarters - Research and Development
DOD Mission Area: General Management Support, #471   Budget Activity: Defense-wide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Not Applicable.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This is a continuing program. Funds were used to support the Commander, his staff, the technical mission and support function for Headquarters Air Force Systems Command (HQ AFSC).

2. (U) FY 1981 Program: This is a continuing program supporting the HQ AFSC Commander and staff, and the Management Headquarters functions at the Product Divisions.

3. (U) FY 1982 Planned Program: The planned program will provide resources to coutinue operation of HQ AFSC, and the Commander and his staff at the above listed organizations.

4. (U) FY 1983 Planned Program: The FY 1984 program continues the FY 1983 effort.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison With FY 1982 Budget Data: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 35110F Title: Satellite Control Facility
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ IN THOUSANDS)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		15,387	67,645	60,219	66,350	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is the maintenance of a highly reliable national satellite tracking, telemetry and commanding capability to support the development and operation of DOD satellite systems. The Air Force Satellite Control Facility (AFSCF) consists of a global network which includes instrumentation systems, antennas, communications and data processing equipment required to support a growing inventory of increasingly complex space vehicles.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This program will provide a scientific and engineering capability to develop and maintain a network configuration capable of providing user satellite system support and insure system compatibility. The FY 1983 RDT&E funding represents the amount required to carry on continuing project efforts and provides a program for Data System Modernization to provide required network capacity by upgrading technical systems to meet evolving satellite support requirements.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
RDT&E	14,000	69,500	39,100		Continuing	Not Applicable
Procurement (Aircraft)	1,129	1,428	1,526		Continuing	Not Applicable
Procurement (Other)	19,173	565	17,205		Continuing	Not Applicable
Military Construction		6,900	11,700		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982	FY 1983	FY 1984	Additional to Completion	Estimated Costs
Procurement (Aircraft)	1,129	1,428	1,982	689	Continuing	Not Applicable
Procurement (Other)	19,173	561	11,093	20,127	Continuing	Not Applicable
Military Construction		6,530	11,700	2,828	Continuing	Not Applicable
Operations and Maintenance	44,538	50,534	57,590	66,863	Continuing	Not Applicable

Program Element: #35110F
DOD Mission Area: Space Launch and Orbital Support, #410

Title: Satellite Control Facility
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Satellite Control Facility (SCF) is a world-wide network consisting of a Headquarters at Sunnyvale, CA, seven geographically dispersed tracking stations, a communications satellite calibration site at Camp Parks, CA, a control center (the Satellite Test Center (STC) at Sunnyvale), and a satellite recovery group at Hickam AFB, HI. The mission of the SCF is to provide tracking, real-time telemetry, commanding, (TT&C), and recovery of Department of Defense (DOD) space vehicles operating in a multi-satellite environment. The SCF supports satellites operating with various orbital parameters to accomplish diversified test and operational objectives for the Air Force, the Navy, other DOD agencies, the National Aeronautics and Space Administration, and the North Atlantic Treaty Organization. Support commences prior to launch and in most cases, continues throughout the life of the satellite to include recovery, if required. A complex instrumentation system consisting of antennas, communications, and data processing equipment provides the the ground support capabilities for the many space vehicles. The RDT&E appropriation provides for the development, installation and modification of network components to meet evolving satellite program support requirements. These efforts either correct system deficiencies or allow for increased program support.

(U) RELATED ACTIVITIES: Both Defense Communications System (DCS) and non-DCS telecommunications program activities relating to the SCF are contained in Program Element 35151F (SCF Telecommunications). Real property maintenance activities relating to the SCF are contained in Program Element 35894F (Real Property Maintenance, AFSC). The majority of DOD satellite programs rely to varying degrees on the SCF for TT&C support. The Consolidated Space Operations Center (CSOC), PE 35130F, will provide increased capability and survivability by sharing the control functions of the STC. CSOC will also provide control of DOD Shuttle missions.

(U) WORK PERFORMED BY: Air Force management of this National capability is under the Space Division, Los Angeles, CA. Principal contractors are: Lockheed Missile and Space Company, Sunnyvale, CA, which provides study and development analysis for the STC; Ford Aerospace Communications Corporation, Palo Alto, CA. which provides study and development analysis for the Remote Tracking Stations (RTS); System Development Corporation, Santa Monica, CA, which provides computer system integration; Applied Research, Inc., Santa Clara, CA, which provides systems engineering, integration and test analysis; and IBM Corporation, Gaithersberg, MD which was awarded the development/ acquisition contract for the Data Systems Modernization program for the network.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS: The SCF was initially configured during 1956-1957 to provide on-orbit support for the Discoverer Program. Since then, many new space programs have been added, with older programs being upgraded or deleted. This has resulted in a fluctuating satellite inventory which has varied in recent years from less than 35 to over 55 satellites which required support. In FY 1981, the network supported an average of 45 satellites on-orbit simultaneously. This average is increasing annually as is the overall SCF workload which is expected to increase 18% by 1982. This expanding workload is primarily the result of the lengthened satellite on-orbit lifetime, the increasing complexity of spacecraft and space operations, and support of Space Transportation System launches.

Program Element: #35110F | Title: Satellite Control Facility
DoD Mission Area: Space Launch and Orbit Support, #410 | Budget Activity: Defense-wide Mission Support, #6

Since its inception, the Satellite Control Facility (SCF) has undergone significant evolution in order to provide the required satellite support services. In 1966 a standard integrated tracking, telemetry and commanding system (TT&C) was installed at all remote tracking stations (RTS) to provide a common system. Wideband communications capabilities were achieved through installation of an interim system in 1973. The Defense Communications System/SCF Interface System (DSIS) is now providing wideband communications. Additional satellite communications are provided between the Satellite Test Center (STC) and the RTSs using the Satellite Data System. More capacity has been added to the network with the addition of a second antenna at Guam (1978) and Thule, Greenland (1978) and the SCF use of the British Telemetry and Commanding Station at Oakhanger, England starting in 1977. The standard TT&C system has been augmented by installation of a Time Division Multiplex (TDM) system at the Indian Ocean Station for initial support of the Space Transportation System (STS). For operational use of the STS, all RTSs will be equipped with TDM systems. Three parallel development contracts were let in June 1979 for the first phase of the SCF Data System Modernization (DSM) project. The competitive contracts produced design concepts for a centralized data system that will replace the aging computer systems throughout the SCF. In December 1980 IBM corporation was awarded the follow-on system development, acquisition and installation contract. The modernized system will greatly increase the network capacity as well as significantly reduce operating cost by decreasing the manpower intensity of numerous satellite support functions.

2. (U) FY 1982 PROGRAM: The Satellite Control Facility will continue the planning, development, acquisition, operation and maintenance of systems necessary to support the needs of current and planned space programs. Satellite recovery equipment and mission control center modifications dictated by satellite program requirements will continue. Facilities and equipment for SCF support of the Space Transportation System, including both Orbiter and Inertial Upper Stage, will be developed and provided. The Data System Modernization development/acquisition contract will continue. Facility construction and modification to support operations of a new classified satellite program and installation of equipment associated with DSM will begin.

3. (U) FY 1983 PLANNED PROGRAM: Ongoing efforts to meet evolving satellite program requirements will continue. Wideband communications capability will be provided to the Oakhanger Telemetry and Commanding Station. The most significant portion of the FY 1983 RDT&E program will be the software development work associated with the DSM project. Facility modifications required for new equipment associated with DSM will continue. The increase over the 1982 projection is necessary to provide computer capability required for a new classified satellite program. Procurement funds reflect a decrease in communications equipment requirements because of change in the projected IOC for CSOC.

4. (U) FY 1984 PROGRAM: Ongoing efforts including the initial installation and testing of the equipment for the Data Systems Modernization project will be continued.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35119F
DOD Mission Area: Space Launch and Orbital Support, #410

Title: Space Boosters
Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING)($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	29,394	19,228	15,011	10,623	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The need exists to continue to provide a highly reliable means of placing critical Department of Defense satellites into their required mission orbits until the Space Shuttle becomes operational and all satellite programs have completed transition to the Space Shuttle. This program meets this need by providing for the engineering support and flight performance assessment of the Department of Defense Atlas and Titan III space launch vehicles which are a part of the national launch vehicle family. This program also provides the resources for the Titan III(34)D/Inertial Upper Stage integration, for integration of the Transtage onto the Titan III(34)D, and for Atlas-E launches of Air Force Research and Development satellites.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The basic Atlas and Titan III reliability maintenance, flight assessment, vendor qualification, and component/subsystem replacement efforts will continue. The engineering design and development program to integrate the Inertial Upper Stage and its technology into the Titan III space launch vehicle family will continue. Initial Launch Capability for the Titan III(34)D/Inertial Upper Stage at Cape Canaveral Air Force Station, FL, is now scheduled for September 1982. Integration of the Transtage onto the Titan III(34)D will be completed to support an Initial Launch Capability at Cape Canaveral Air Force Station, FL, in December 1982. Support of one Atlas-E launch of a NAVSTAR Global Positioning System Research and Development satellite is planned in FY 1983. The cost estimate for this program was developed from the extensive historical data which have been collected on this program.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	29,394	19,300	TBD		TBD	TBD
Procurement (Missile)	121,251	113,267	TBD		TBD	TBD

Program Element: #35119F
DOD Mission Area: Space Launch and Orbital Support, #410

Title: Space Boosters
Budget Activity: Defense-wide Mission Support, #6

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Missile)	121,200	68,217	71,100	167,200	Continuing	Not Applicable
(Quantity - Titan III(34)D)		(2)*	(2)*			
(Quantity - Transtage)	(2)					
Operation and Maintenance	58,545	69,214	86,018	87,362	Continuing	Not Applicable

* Advance buy in FY 1982 and FY 1983. Production funding responsibility for the two Titan III(34)D vehicles for which advance buy materials are being bought by this Program Element in FY 1982 will be assumed by PE 34111F. Production funding for the two Titan III(34)D vehicles for which advance buy materials are being bought in FY 1983 will be provided by this Program Element, however, the vehicles will be delivered only if required by major problems in the Space Shuttle affecting its ability to support DOD launches or by a change in policy on maintaining an expendable launch vehicle capability.

Program Element: #35119F
DOD Mission Area: Space Launch and Orbital Support, #410

Title: Space Boosters
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Department of Defense family of space boosters (Atlas, Thor, Titan III) was developed to provide a versatile capability (up to 29,200 pounds in low earth orbit-Titan IIIC) for meeting projected national launch requirements. While the family still includes two surplus ballistic missiles (the Atlas-E and Thor SM-75 vehicles), the primary boosters are considerably improved standardized versions of the original missiles. This Program Element provided for development of the Titan IIIC Space Launch Vehicle and provides continuing support for the Atlas and Titan III launch vehicles. The boosters supported by this program are:

Atlas-E - refurbished Atlas Intercontinental Ballistic Missile (ICBM), radio guided, liquid rocket engine, stage and one-half booster.

Titan IIIB - modified Titan II first and second stages with liquid rocket engines (core vehicle) flown with an Agena upper stage and either radio or inertial guidance.

Titan IIIC - core vehicle with a storable liquid propellant inertially guided upper stage (Transtage) plus two 5 segment 120-inch diameter strap-on solid rocket motors.

Titan IIID - core vehicle with two 5 segment 120-inch diameter strap-on solid rocket motors and radio guidance.

Titan III(34)D/Inertial Upper Stage - Titan IIID modified for use with the Inertial Upper Stage; core vehicle with two 5-1/2 segment 120-inch strap-on solid rocket motors and which is guided by the Inertial Upper Stage guidance system; flown only at Cape Canaveral Air Force Station FL.

Titan III(34)D - radio guided version of the Titan III(34)D which is flown without the Inertial Upper Stage and is flown only at Vandenberg Air Force Base, CA.

Titan III(34)D/Transtage - Titan III(34)D flown with the Transtage replacing the Inertial Upper Stage; guidance provided by the Transtage inertial guidance system; flown only at Cape Canaveral Air Force Station, FL.

The program includes post flight analysis of Research and Development (R&D) components; study, modification, redesign and test of components as a result of deficiencies identified during vehicle systems test and flight; evaluation and improvement (where warranted) of mission reliability; component reliability improvement to prevent launch vehicle failures and analysis support and development planning for new missions. To take advantage of the investment in the Inertial Upper Stage reliability, a program was initiated in FY 1977 to correct current Titan III reliability deficiencies through the integration of the Inertial Upper Stage and its technology into the Titan III Space Launch Vehicle family. The Titan III(34)D/Inertial Upper Stage will improve the current Titan IIID, replace the Titan IIIC Space Launch Vehicles and reduce the number of nonstandard Titan III components. In addition to increasing the Titan III launch reliability, the Titan III(34)D/Inertial Upper Stage will increase Space Shuttle transition flexibility and reduce the Space Shuttle backup launch capability cost. The program also provides for integration of the Transtage onto the Titan III(34)D to

Program Element: #35119F Title: Space Boosters
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

assure the ability to launch critical Department of Defense missions if the development of the Inertial Upper Stage experiences additional delays or if major technical problems are encountered in the initial Inertial Upper Stage flights. The program also provides for Atlas-E launches of certain Air Force Research and Development satellites until they transition to the Shuttle.

(U) RELATED ACTIVITIES: Major Department of Defense and National Aeronautics and Space Administration space systems which employ the Atlas and Titan III boosters include: classified space programs; Defense Satellite Communications System, Program Element 33110F; Satellite Data System, Program Element 35158F; Defense Meteorological Satellite Program, Program Element 35160F; Defense Support Program, Program Element 12431F; NAVSTAR Global Positioning System, Program Element 64778F; Navy Geodetic Satellite; and the National Aeronautics and Space Administration/National Oceanic and Atmospheric Administration meteorological satellite program. This program funds modifications to the Inertial Upper Stage, which is being developed by Program Element 64411F, to allow it to be flown as an upper stage on the Titan III.

(U) WORK PERFORMED BY: Responsible Air Force agency is the Air Force Systems Command Space Division, Los Angeles, CA. Systems Engineering is provided by Aerospace Corporation, El Segundo, CA. Titan III contractors include: Martin Marietta Corporation, Denver, CO (integration, core vehicle, Transtage); Aerojet Liquid Rocket Company, Sacramento, CA (liquid propulsion system); United Technology Corporation-Chemical Systems Division, Sunnyvale, CA (solid rocket motors); Delco Electronics Division, Goleta, CA (inertial guidance); Western Electric Company, Winston Salem, NC (radio guidance) and McDonnell-Douglas Astronautics Company, Huntington Beach, CA (payload fairing). Atlas contractors include: General Dynamics - Convair, San Diego, CA (integration and airframe); Rocketdyne, Canoga Park, CA (liquid propulsion systems); General Electric, Syracuse, NY (guidance). The upper stage contractors include: Boeing Space Division, Seattle, WA (Inertial Upper Stage); McDonnell-Douglas Astronautics Company, Huntington Beach, CA (Improved Stage Vehicle System); and Lockheed Missiles and Space Company, Sunnyvale, CA (Agena). There are several additional contractors supplying Titan III and Atlas components.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Titan III program development go-ahead was received in December 1962. First launch of the Titan IIIA occurred on 1 September 1964. In 1965 the first Titan IIIC successfully placed a 21,000 pound simulated payload in orbit. The last development flight was on 23 May 1973. A reliability improvement program on the Titan III, Atlas, and Atlas-E/F boosters was initiated in FY 1973. A new guidance system for the Titan IIIC was developed and first launched on 13 December 1973. Engineering analyses and reliability improvements have included corrective action for the April 1975 Atlas-E/F failure, development of the Atlas replacement programmer, and initial development of a reliability improvement to the Atlas General Electric Radio Tracker System ground guidance hardware. In June 1977 a Congressional reprogramming authorized a program to correct reliability deficiencies in the current Titan III Space Launch Vehicle family through the use of the Inertial Upper Stage and its technology. This integration effort continued through FY 1981. In FY 1979 the Space Test Program Gamma Ray Spectrometer satellite was successfully launched on an Atlas-F. Through FY 1981, six NAVSTAR Global Positioning System satellites were successfully launched on Atlas-F vehicles. Eight Titan III(34)D launch vehicles were delivered through FY 1981. Integration of the Transtage onto the Titan III(34)D was initiated in FY 1981. The primary reliability maintenance effort performed in FY 1981 was initiation of a program to restore the Atlas-E liquid rocket engine reliability by inspecting and test firing the engines.

Program Element: #35119F Title: Space Boosters
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

2. (U) FY 1982 Program: The Titan III(34)D/Inertial Upper Stage integration effort will be completed to support an Initial Launch Capability at Cape Canaveral Air Force Station, FL, in September 1982. Initial Launch Capability for the Titan III(34)D configuration at Vandenberg Air Force Base, CA, is scheduled for December 1981. Integration of the Transtage onto the Titan III(34)D will continue to support an Initial Launch Capability at Cape Canaveral Air Force Station, FL, in December 1982. The basic Titan III and Atlas reliability maintenance, flight assessment, vendor qualification, and component/subsystem replacement efforts will continue. The primary reliability maintenance effort will continue to be the restoration of the reliability of the Atlas-E liquid rocket engines through testing. The effect of small launch vehicle procurements will continue to increase problems with retaining vendors of critical components of both the Titan III and Atlas-E launch vehicles. This will require increased efforts to qualify new sources of existing materials/components or to redesign vehicle subsystems to incorporate replacement materials/components. Support of two Atlas-E launches for NAVSTAR Global Positioning System Research and Development missions is planned.

3. (U) FY 1983 Planned Program: The basic Titan III and Atlas reliability maintenance, flight assessment, vendor qualification, and component/subsystem replacement efforts will continue. Integration of the Transtage onto the Titan III(34)D will be completed. One Atlas-E launch for a NAVSTAR Global Positioning System Research and Development mission is planned. The FY 1983 Missile Procurement funds provide for the procurement of advance buy materials for two Titan III(34)D backup vehicles, which will allow extension of the maintenance of critical Titan III production capabilities beyond September 1983 if required by further delays in Space Shuttle development or operational availability. The Missile Procurement funds also provide for the procurement of propellants for Titan III(34)D backup vehicles. The RDT&E effort planned in FY 1983 does not differ from that planned at the time the Descriptive Summary was submitted for the FY 1982 Amended President's Budget, although the FY 1983 estimate was marked TBD in that Descriptive Summary. The FY 1983 Missile Procurement effort differs from that described in the FY 1982 Amended President's Budget Descriptive Summary in that advance buy materials for two Titan III(34)D backup vehicles rather than the production of two Titan III(34)D vehicles (using advance buy materials procured in FY 1981) is being funded. Funding for the production of the two Titan III(34)D vehicles, for which advance buy materials were procured in FY 1981, will be provided by PE 34111F. The two sets of advance buy materials for which funding is now being requested in FY 1983 allows further extension of the maintenance of critical Titan III production capability consistent with the ability of the Space Shuttle to support DOD operational requirements.

4. (U) FY 1984 Planned Program: The basic Titan III and Atlas reliability maintenance, flight assessment, vendor qualification, and component/subsystem replacement efforts will continue. Two Atlas-E launches for NAVSTAR Global Positioning System Research and Development missions are planned. The FY 1984 Missile Procurement funds will fully-fund the production of the two Titan III(34)D backup vehicles for which funding for advance buy materials is being requested in FY 1983. Production of these two vehicles would extend the maintenance of critical Titan III production capability until September 1984, however, these vehicles will be produced only if required by major problems in the Space Shuttle affecting its ability to support DOD launches or by a change in policy on maintaining an expendable launch vehicle capability. The FY 1983 Missile Procurement funds also support phaseout of production of certain Titan III configurations.

5. (U) Program to Completion: This is a continuing program. The basic Titan III and Atlas reliability maintenance, flight assessment, vendor qualification, and component/subsystem replacement efforts will continue until phaseout of the Titan III and Atlas vehicles is complete. The program will continue to require funds from other appropriations to support

Program Element: #35119F Title: Space Boosters
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

operational Titan III and Atlas launches, to provide the required expendable launch vehicle backup to the Space Shuttle, to maintain critical Titan III production capability, and to phaseout certain Titan III configurations.

6. (U) Milestones:

A.	Start Titan III(34)D/Inertial Upper Stage Integration		June 1977
B.	Space Shuttle backup launch vehicle procurement		December 1977
C.	Titan III(34)D Initial Launch Capability at Vandenberg AFB, CA		December 1981
D.	Titan III(34)D/Inertial Upper Stage Initial Launch Capability at Cape Canaveral AFS, FL	*(April 1982)	September 1982
E.	Titan III(34)D/Transtage Initial Launch Capability at Cape Canaveral AFS, FL		December 1982
F.	Initiate Titan III production phase down	*(October 1982)	October 1983

*Dates presented in Fiscal Year 1982 Descriptive Summaries.

EXPLANATION OF MILESTONE CHANGES: Delays in completing Inertial Upper Stage development and launch base integrated testing of the Titan III(34)D/Inertial Upper Stage have resulted in a delay in the Titan III(34)D/Inertial Upper Stage Initial Launch Capability at Cape Canaveral Air Force Station, FL until September 1982. No impact to payload programs is expected from this delay based on current launch schedules. Space Shuttle development delays resulted in additional actions being planned for FY 1983 - 1984 to maintain critical Titan III production capability. These actions have enabled the initiation of production phasedown to be delayed until October 1983.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1982 Budget Data: Not Applicable.

Budget Activity: Defense Wide Mission Support, #6
Program Element: #35119F, Space Boosters

Test and Evaluation Data

1. (U) Development Test and Evaluation: In June 1977, the Assistant Secretary of the Air Force for Research, Development and Logistics formally approved the initiation of a program to integrate the Inertial Upper Stage into the Titan III family. This approval was based upon successful completion of a review by the Air Force Systems Acquisition Review Council of the integration program, the concurrence of the Deputy Secretary of Defense, and the prior approval of Congress of an FY 77 reprogramming request to initiate the program. Benefits projected to be derived from the Titan III(34)D/Inertial Upper Stage Integration were: increased reliability, increased payload capability, reduction in launch vehicle configurations, mission model flexibility, and reduced total program cost. The Air Force Systems Command Space Division is responsible for management of the Titan III(34)D/Inertial Upper Stage integration program. Participating contractors are: (1) Martin-Marietta Denver Aerospace Company, Denver, Colorado, Boeing Aerospace Division, Seattle, Washington; Chemical Systems Division of United Technologies, Sunnyvale, California; Aerojet Liquid Rocket Company, Sacramento, California; and McDonnell-Douglas Astronautics, Huntington Beach, California. The Arnold Engineering Development Center, Tullahoma, Tennessee, provides test support to this program.

(U) Testing of Titan III changes required to integrate the Inertial Upper Stage into the Titan III Space Launch Vehicle family consists of structural and electronic ground testing. Structural test provisions include testing of all new and modified hardware. Structural test items for this configuration include a modified Stage II equipment truss, a new design Stage II adapter skirt, an additional solid rocket motor half-segment, a new design Titan III(34)D-to-Inertial Upper Stage support truss, and a modified payload fairing. Additional structural testing will also be required on the existing Stage I long core section. Tests of the Inertial Upper Stage avionics/Titan III(34)D electronics interface will be required to insure system compatibility. Inertial Upper Stage separation and shock testing will be provided to insure Inertial Upper Stage compatibility with the Titan III interface. The Failure Modes and Effects Analysis for the Titan III will be updated to reflect all changes resulting from the Titan III(34)D/Inertial Upper Stage integration.

(U) Inertial Upper Stage separation and shock testing was completed in November 1978 and demonstrated that the actual shock spectrum was less than design specification. The Titan III(34)D/Inertial Upper Stage configuration structural qualification testing was initiated in April 1980 and was completed in September 1980. In October 1979, the second and last full-scale static firing of the 5-1/2 segment, 120 inch diameter Solid Rocket Motor was successfully completed, demonstrating the flight-worthiness of the 5-1/2 segment motor and the new nozzle throat material. In April 1979, the Stage I fuel tank tests were successfully completed, thus verifying that the "stretched" Stage I fuel tank used on the Titan IIIB can withstand the Titan III(34)D/Inertial Upper Stage flight environment. Successful completion of payload fairing separation tests has verified proper separation of the modified payload fairing from the vehicle. Joint Titan III(34)D/Inertial Upper Stage electronics interface testing is scheduled in 1982.

(U) Development of the Inertial Upper Stage under Program Element 64411F continues. The Inertial Upper Stage program entered full scale development in March 1978 with Initial Launch Capability for the Inertial Upper Stage for both the Shuttle and Titan III applications scheduled for July 1980. However, a series of technical problems during the development have resulted in delay in the Initial Launch Capability for the Titan III(34)D/Inertial Upper Stage from July 1980 to September 1982. Critical Design Review of the Inertial Upper Stage was initiated in February 1979 and completed in November 1979.

Budget Activity: Defense Wide Mission Support, #6
Program Element: #35119F, Space Boosters

(U) Inertial Upper Stage propulsion system development testing is proceeding. To date, seven solid rocket motor cases have been burst tested and four cases have been skirt tested. Motor case development and verification have been successfully completed. Motor case efficiency is at the state-of-the-art level, and case burst data show little scatter. Skirt ultimate loads have been demonstrated four times. In addition to the four full scale nozzle firing tests, six large and seven small Inertial Upper Stage motors (including one spin motor) have been successfully fired at the Arnold Engineering and Development Center TN. Two motor firings included the Extendable Exit Cone (deployed prior to the test). The ability to fire Inertial Upper Stage solid rocket motors for the Titan III(34)D application was also demonstrated during these development firings. Two large and two small motors of the total of thirteen fired had propellant offloads (large motor: 50% and 16% offloads; small motor: 50% and 22% offloads). These firings completed the motor development program. In the qualification program, one burst test and twelve additional motor (six small and six large) firings will be conducted. The firings began in November 1981 with the successful firing of the first large motor. The qualification program for the Titan configuration will be complete in July 1982 and continue through September 1982 for the Shuttle configuration. The problem of propellant cracking in the boot area of the solid rocket motor has been solved and confirmed by cold x-rays of four qualification motors (two of each size). Casting of the flight motors has commenced. A phenomenon called "foldback" has been discovered in several Inertial Upper Stage exit cones and identified with nozzle fracture at less than specification stress levels. This problem resulted from manufactuting errors which allowed some exit cones to be built with a "folded" rather than linear carbon ply pattern thus reducing structural integrity. Tooling and process changes have been made to eliminate this problem in the exit cones. The first of the cones built with these process changes should be delivered by March 1982. Flight use of cones with "foldback" is not planned, but they will be used during qualification motor firings to characterize the performance of these exit cones.

(U) Component qualification testing of line replaceable units for the Inertial Upper Stage (Titan III(34)D application) began in August 1979, and all forty components have successfully completed qualification. The last flight component completed qualification in November 1981. Structural qualification of the Titan III(34)D-configured Inertial Upper Stage was completed in September 1980 with the successful accomplishment of separation systems, acoustics and pyrotechnic shock tests. Structural qualification of the Space Transportation System configuration started in September 1981 and was completed in December 1981. Production of the Inertial Upper Stage Qualification Test Vehicle was completed, and the vehicle, using inert solid rocket motors, was stacked. Qualification Test Vehicle testing started in October 1980 and was completed in December 1981. These tests confirmed the system's ability to function in the specified vibration, pyro-shock, and thermal-vacuum environments.

(U) Titan III(34)D/Inertial Upper Stage flight software continues to be a pacing item. The flight software is being developed by TRW and tested at the Boeing Aerospace facility in Kent, WA. The operational flight software verification and validation testing for the first Titan III(34)D flight is in test at Boeing Aerospace, with independent verification and validation of the software now being performed by the Martin Marietta Aerospace Company. Completion of the operational flight software development and validation and generation of the mission data load for the first payload program on the Titan III(34)D/Inertial Upper Stage is now scheduled for July 1982. Completion of the development and validation of flight software for the second payload program on the Titan III(34)D/Inertial Upper Stage is scheduled for the first quarter of calendar year 1983. A decision must be made by 1 April 1982 on which payload program's Inertial Upper Stage software is developed first.

Budget Activity: Defense Wide Mission Support, #6
Program Element: #35119F, Space Boosters

(U) The Pathfinder Test Vehicle, a full-up, non-flight Inertial Upper Stage, to be used with the Titan III(34)D at Cape Canaveral Air Force Station to validate the facility, aerospace ground equipment, and test procedures to be used for checkout and launch of the Titan III(34)D/Inertial Upper Stage was delivered to Cape Canaveral in July 1981. Testing of the Pathfinder Test Vehicle is underway in the Solid Motor Assembly Building at the Titan III Integrate - Transfer - Launch area. Integrated testing of the Pathfinder Test Vehicle with the Titan III(34)D will begin in early 1982 and will be completed to support the September 1982 Initial Launch Capability of the Titan III(34)D/Inertial Upper Stage.

(U) The first flight Inertial upper Stage (Shuttle use) completed acceptance testing in October 1981.

2. (U) Operational Test and Evaluation: Since Titan III is a mature program with no major changes scheduled, there is no requirement for a dedicated Air Force Test and Evaluation Center (AFTEC) OT&E program. Design and operational requirements/ are well understood, and mechanisms exist to handle ongoing assessments and system changes. Specific program Space Booster support will be addressed under other OT&E programs. IUS OT&E is covered under Program Element 64411F.

3. (U) System Characteristics (Titan III(34)D/Inertial Upper Stage Combination):

	OBJECTIVE	CURRENT ESTIMATE	DEMONSTRATED
Low Earth Orbit Missions (No Inertial Upper Stage)			
Payload Capability (pounds)			
100 nautical mile altitude-10 foot Payload Fairing, East launch from Cape Canaveral Air Force Station, Florida	32,900	32 900	
100 nautical mile (polar orbit)-10 foot Payload Fairing, launch from Vandenberg Air Force Base, California	27,600	27,600	
Synchronous equatorial orbit missions			
Payload Capability (pounds)			
10 foot Payload Fairing Cape Canaveral Air Force Station, Florida	4,000	4,040*	
Reliability	97%	97%	

NOTE: (U) Due to the development of the Titan III(34)D from the existing Titan III family and the small number of systems, availability and maintainability objectives have not been specified for the Titan III(34)D.

*(U) With Extendable Exit Cone on second stage

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35130F
DOD Mission Area: Space Launch and Orbital Control, #410

Title: Consolidated Space Operations Center
Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		3,781	19,427	32,116	59,328	293,971	408,623

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Consolidated Space Operations Center (CSOC) consists of two elements: the Satellite Operations Complex (SOC) and the Shuttle Operations and Planning Complex (SOPC). The need for the satellite control capability is based on the vulnerability of the Satellite Test Center (STC) in Sunnyvale, CA, a single node in the satellite control network which provides tracking, telemetry, and command capabilities to satellites supporting various national security missions. The STC is vulnerable to both environmental and manmade threats and has limited growth potential. The need for the Shuttle control capability stems from the planned use of the Space Shuttle for DOD missions. The DOD Shuttle control capability at Johnson Space Center (JSC) does not meet all DOD requirements for planning and conducting DOD missions. The capacity at JSC is limited to 6 to 8 secure DOD flights per year, security is limited to SECRET, and military and civil space operations are intermingled. CSOC overcomes thes limitations by providing a secure environment from which to conduct DOD space missions; the siting criteria minimizes environmental and man made threats; adequate capacity to support the national shuttle traffic model is obtained; and military space operations are conducted from dedicated DOD facilities allowing close coordination of Shuttle and satellite operations.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 request reflects a restructure of the military construction into two segments slipping the satellite control IOC until late 1986 and the Shuttle control IOC until late 1987. FY 83 will continue detailed design and integration efforts for various CSOC segments. Procurement of satellite control and communications systems will commence. Activation planning and formulation of training programs will also be conducted. The RDT&E request is based on estimates provided by HQ AFSC. These estimates are derived from program office analysis, NASA cost projections and existing contract options. Changes from the FY 82 Descriptive Summary include the program restructure revised cost estimates and extension of costs to complete from the 1986 IOC through the 1990 FOC.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	8,700	19,500	23,400		58,600	110,600
Procurement (Other)			112,102		130,068	242,170
Military Construction			117,302		29,000	146,302

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Other)			20,736	83,190	532,544	636,470
Military Construction			67,700	78,000		145,700

Program Element: #35130F
DOD Mission Area: Space Launch and Orbit Control, #410

Title: Consolidated Space Operations Center
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Consolidated Space Operations Center (CSOC) will combine into a single facility a satellite operations capability and the DOD Shuttle control capability, establishing a DOD facility for conducting both DOD satellite and Shuttle support operations. The Satellite Operations Complex (SOC) will share the normal satellite support workload with the Satellite Test Center. If either becomes inoperative for any reason, the remaining Center will assume full responsibility for the satellite programs. The Shuttle Operations and Planning Complex (SOPC) of CSOC will be designed to perform all DOD Shuttle operations with the interim DOD capability at the Johnson Space Center (JSC) remaining as an emergency backup. The extensive coordination required between the CSOC segments will benefit from a common location. In addition, important cost savings will result from the use of such common elements as security, logistics and support, antennas and communication links.

(U) RELATED ACTIVITIES: The Satellite Operations Complex of the CSOC will become an integral part of the Satellite Control Facility (SCF) network, funded under PE 35110F. The Data System Modernization project for the SCF contains contractual options to provide the SOC satellite control complement of equipment. The initial DOD Shuttle control capability is now being established as the JSC Controlled Mode under PE 63411F, 64411F and 12449F. The SOPC complement of equipment will be evolved from NASA systems and the operational experience gained at the Johnson Space Center. PE 35151F, Satellite Control Facility Communications, will include CSOC communications. The DOD Shuttle operations cadre, the Manned Space Flight Support Group, has been established at JSC under PE 35171F.

(U) WORK PERFORMED BY: The CSOC development and acquisition effort is managed by Space Division, Los Angeles AFS, CA. The Architect and Engineering (A&E) contract for CSOC disign was awarded to Holmes and Naver in Feb 81.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS: The FY 1979 CSOC efforts dealt principally with requirements validation and concept development. A joint DOD/NASA study of various satellite operations/Shuttle control configurations was done for Office of Management and Budget in 1979. Mission Element Need Statements for SOC and SOPC were validated by the Secretary of Defense in September 1979. Site surveys were conducted and the [illegible] AFB/Colorado Springs, CO, area was selected as the CSOC site after completion of environmental impact analyses. An [illegible].8M A&E facility design contract was awarded.

2. (U) FY 1982 PROGRAM: CSOC work during FY 1982 will focus on design and definition activities. Start up of the integration support contract will occur; Aerospace Corporation system engineering will continue. NASA will participate in design of the flight planning element to be used first at JSC and eventually transferred to CSCC. The A&E design work will be concluded.

3. (U) FY 1983 PLANNED PROGRAM: During FY 1983 the design, system engineering and acquisition planning efforts of NASA, Aerospace and the integration contractor will continue. Acquisition of the first satellite mission control complex and communication system components will begin. Facilities construction was restructured into two segments. The FY 83 MILCON increment will provide the technical areas that house satellite and Shuttle control operations and utilities support buildings. Increases in RDT&E over last years estimate reflect increased emphasis on front end design and integration planning as well as the slower than anticipated start in FY 81.

Program Element: #35130F Title: Consolidated Space Operations Center
DOD Mission Area: Space Launch and Orbit Control #410 Budget Activity: Defensewide Mission Support #6

4. (U) FY 1984 PLANNED PROGRAM: During FY 84 the major procurements of Shuttle Control System including the first flight control room will begin. Design of the simulator system for use in flight readiness verification will begin. In the satellite control segment, acquisition of the software development test lab (SDTL) and the second MCC will occur and design of the integrated range control center will start. Acquisition of training system and start up of the training program is planned. The FY 84 MILCON provides the engineering and administrative building and other support facilities.

5. (U) PROGRAM TO COMPLETION: Facility occupancy will occur in FY 85 and installation and checkout of satellite control and communications systems will commence. Satellite Control IOC will occur in late 1986; Shuttle Control IOC with one flight control room will be achieved in late 1987. RDT&E cost to complete increases include design, installation and integration of the Shuttle simulator, to be operating in 1988, as well as additional mission control complexes and a second flight control room to be added for the 1990 FOC.

6 (U) Milestones:

A.	Mission Element Need Statements Validated	September	1979
C.	Environmental Impact Analysis Filed	Feburary	1981
B.	Site Selection Announcement	March	1981
D.	Military Construction Program Submission (+35% design complete)	January	1982
E.	Military Construction Program Approval	October	1982
F.	Start Construction	March	1983
G.	Initial Operating Capability - Satellite Control	November	1986
H.	Initial Operating Capability - Shuttle Control	November	1987
I.	Final Operating Capability	June	1990

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35160F
DOD Mission Area: Space Lanuch and Orbital Support, #410

Title: Defense Meteorological Satellite Program
Budget Activity: Defense Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	18,902	47,222	27,751	35,370	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Defense Meteorological Satellite Program provides visual and infrared cloud cover data and other meteorological, oceanographic, and solar-geophysical information. These data are required over the entire surface of the earth in support of strategic and tactical missions. At least, two satellites are required in polar orbit at all times; one providing data in the early morning and early evening, the other during mid-day and mid-night. Program requirements were revalidated by the Joint Chiefs of Staff on 5 October 1981.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Includes funds for modifications to the Block 5D-2 primary sensor to make it compatible with the Shuttle launch environment. Includes funds for modifications to the Block 5D-2 system to reduce system level test time and increase on-orbit effectiveness. It also provides for development of the satellite data handling system which will improve the quality and timelines of primary data available to satisfy mission requirement. Funding amounts are based on 15 years of experience by Air Force Systems Command and contractors in developing, producing, operating and maintaining this system.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
RDT&E	19,000	48,300	38,700		Continuing	Not Applicable
Missile Procurement	43,355	37,956	37,007		Continuing	Not Applicable
Other Procurement	4,145	1,900	6.860		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Missile Procurement	42,800	36,616	167,900	34,800	Continuing	Not Applicable
(Quantity) (Satellite)	(0)	(0)	(2)	(0)		
Other Procurement	4,045	1,833	6,327	11,371	Continuing	Not Applicable
Operation and Maintenance	9,728	13,832	15,517	15,605	Continuing	Not Applicable

Program Element: #35160F Title: Defense Meteorological Satellite Program
DOD Mission Area: Space Launch and Orobtal Support, #410 Budget Activity: Defense Wide Mission Support, #6

DETAILED BACKGROUND AND DESCRIPTION: The Defense Meteorological Satellite Program is a weather satellite system started by the Air Force Its purpose is to provide daily cloud cover data worldwide to support special strategic missions and tactical contingency missions. The first successful launch was in]and the system has been continuously operational since that time. In 1965, weather support to tactical operations was initiated when a mobile van which could receive direct, real-time weather data was deployed to South Vietnam. A requirement exists for at least two satellites in orbit. The orbits are circular, sun-synchronous, near-polar, at 450 nautical miles altitude, with a period of 101.6 minutes. The next launch will be from Vandenberg Air Force Base, CA, using an Atlas launch vehicle. Stored data are recorded on the satellites and later sent to one of the data receiving stations at Fairchild Air Force Base, WA; Loring Air Force Base, ME; or Kaena Point, HI, where it is simultaneously relayed via commercial satellite to the Air Force Global Weather Central at Offutt Air Force Base, NE, and Fleet Numerical Oceanography Center, Monterey, CA, for use in strategic and tactical weather forecasting. Real-time data are also transmitted to tactical receiving terminals located worldwide. Fixed tactical terminals are located in Hawaii, Kwajalein missile range, Guam, the Phillipines, the Azores, and Cape Canaveral, Florida. Mobile tactical receiving terminals are located in Korea, Japan, Alaska, Panama, the Philippines, and Germany. Three Mark IV mobile tactical terminals are now available for instant deployment to any crisis area. Direct links have been installed from Air Force Global Weather Central to Headquarters Tactical Air Command and the Pentagon to provide data on a timely basis to the Commander, Tactical Air Command, and the Joint Chiefs of Staff.

(U) RELATED ACTIVITIES: The Defense Meteorological Satellite Program is a joint-Service program in accordance with the Memorandum of Agreement on Joint Service Management and Operations, dated 15 December 1976. The program provides support to all military services. Based on the successful operation of an experimental receiving terminal aboard the U.S.S. Constellation, the Navy is equipping all large carriers to receive data and is operating two shore based terminals to receive data. The Air Force began procurement of new low cost tactical terminals in FY 1978, and the other services will begin procurement in following years. Navy personnel are integrated into the Program Office to insure compatibility between the Air Force satellites and the receiving and data processing equipment of the Navy. Personnel from the Army's Atmospheric Sciences Lab are coordinating Army matters with the Program Office. Close coordination is also maintained with the civilian weather satellite program, operated by the Department of Commerce. The two systems have different primary missions and different primary sensors. Cloud imagery is the primary Defense need while vertical temperature soundings are the primary Commerce need. Interchange of technology has been continuous, with special emphasis on avoiding duplication of effort. Pursuant to a study directed by the Office of Management and Budget, Commerce decided in January 1974, to adopt the Defense spacecraft, the Block 5D, as a basic spacecraft bus for the civil system. Atlas E launch services for the Defense Meteorological Satellite Program are provided by the Space Boosters Program (Program Element 35119F).

Program Element: #35160F Title: Defense Meteorological Satellite Program
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense Wide Mission Support, #6

(U) WORK PERFORMED BY: Development and procurement are managed by the Space Division, Los Angeles, CA. The Air Force Geophysics Laboratory, Bedford, MA; the Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; Air Force Weapons Laboratory, Kirtland AFB, NM; the Aerospace Corporation, El Segundo, CA; and the Navy's Environmental Prediction Research Facility, Monterey, CA, all contribute to the Defense Meteorological Satellite Program satellite meteorology development program. Contractors include: RCA, Princeton, NJ - spacecraft; Westinghouse Electric Corporation, Baltimore, MD - sensor and ground display equipment; Hughes Aircraft Company, Los Angeles, CA, Barnes Engineering Company, Stamford, CT, and Aerojet Electro Systems, Azusa, CA - special sensors; Harris Corp., Melbourne, FL - Ground Command and Control and Mobile Ground Data Processing Terminals; General Dynamics Convair, San Diego, CA - launch vehicle.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: In addition to continuous support of the special strategic missions, Defense Meteorological Satellite Program provided emergency support during the

Pueblo crisis (1968), all of the Apollo and Skylab recoveries (1969-1974),

the Mayaguez ship recovery operation (1975)

Use of the real-time tactical data in Southeast Asia was highly successful; for example, weather forecasts based on Defense Meteorological Satellite Program data reduced the number of weather ineffective RF-4C sorities in Cambodia by 66% in 1973. The mission of the Defense Meteorological Satellite Program is to provide the United States Armed Forces with visual and infrared weather data of unmatched quality, timeliness, usability, and flexibility. In 1972, the Air Force began the development of a more reliable and producible system, designated the Block 5D integrated spacecraft. This effort continued during FY 1973-1977 and the first Block 5D satellite was launched on 11 September 1976.

Plans for development of an optimized satellite for Shuttle launch were cancelled following Presidential Directive 54 which directed the Departments of Commerce and Defense and the National Aeronautics and Space Administration to retain separate military and civil meteorological satellite programs until a major new development effort was required. A major new satellite system would have to be developed jointly. Both the military and civil programs choose to retain the current satellite configuration and make those modifications required for a successful launch using Space Shuttle. This Shuttle version for the military was designated Block 5D-3.

Program Element: #35160F　　　　Title: Defense Meteorological Satellite Program
DOD Mission Area: Space Launch and Oribtal Support, #410　　　　Budget Activity: Defense Wide Mission Support, #6

2. (U) FY 1982 PROGRAM: Begin efforts to modify the Block 5D-2 system for launch using Shuttle (designated Block 5D-3). Begin modification of the primary sensor for the Block 5D-3. Develop procedures for encryption of command and telemetry links. Develop satellite data handling system. System engineering and systems analysis efforts will be pursued and one satellite is currently scheduled for launch.

3. (U) FY 1983 PROGRAM: Includes funds for modifications to the Block 5D-2 primary sensor to make it compatible with the Shuttle launch environment. Includes funds for modification to the Block 5D-2 system to reduce system level test time and increase on-orbit effectiveness. Also, provides development of the satellite data handling system which will improve the quality and timeliness of primary data available to satisfy mission requirement at Air Force Global Weather Central. Changes from the FY 1982 RDT&E Descriptive Summary in the FY 1983 RDT&E and missile procurement entries are the result of changes in the Shuttle transition RDT&E effort and incorporation of economic order quantity advanced buy to save $43.6 million in missile procurement. In last year's submission, the transition of the satellite from Atlas to Shuttle launch capability was scheduled for FY 1986. This transition depended on National Oceanic and Atmospheric Administration and National Aeronautics and Space Administration transition of their polar orbiting meteorological satellite to Shuttle launch capability which was scheduled to precede the Defense transition. National Oceanic and Atmospheric Administration deferred their transition indefinitely due to funding limitations. This caused an increased and unacceptable funding burden on the Defense Meteorological Satellite Program which resulted in a delay of transition completion from FY 1986 to FY 1990. For the interim, the program will buy four more Block 5D-2 systems in a multiyear (full fund with economic order quantity advanced buy) procurement approach. This approach will produce $43.6 in savings to the Government when compared to the annual procurement of one spacecraft at a time.

4. (U) FY 1984 PROGRAM: Continue efforts leading to transition of Block 5D system to Shuttle launch capability. Continue development of upgraded ground system which will satisfy program data requirements.

5. (U) PROGRAM TO COMPLETION: RDT&E funding will allow evolutionary development of spacecraft and sensors as necessary to support new requirements of the special strategic missions, the Joint-Service mission, and the Joint Chiefs of Staff. This is a continuing program.

Program Element: #35160F   Title: Defense Meteorological Satellite Program
DOD Mission Area: Space Launch and Orbital Support, #410   Budget Activity: Defense Wide Mission Support, #6

6. MILESTONES:

			Date
A.		Program Initiation	
B.	(U)	Contract Award for Block 5D Satellite	Feb 1972
C.	(U)	Deliver First Block 5D with Sensor Complement	3Q FY 1976
D.	(U)	First Launch of Block 5D Satellite	11 Sep 1976
E.	(U)	Contract for Shuttle transition capability modifications	*(Aug 1981) 2Q FY 1982
F.	(U)	First Launch using Shuttle	*(FY 1986) FY 1990

* Date included in FY 1982 RDT&E Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES: These dates changed due to the program changes described in Paragraph 3 on the previous page.

7. (U) RESOURCES: Not Applicable.

Budget Activity: Defensewide Mission Support #6
Program Element: 35160F, Defense Meteorological Satellite Program

Test and Evaluation Data

1. (U) Development Test and Evaluation: RCA Corporation is the prime development contractor for the Defense Meteorological Satellite Program. The following tests have or will be performed on the block 5D-2 system. Detailed Electrical Test (Jun-Jul 80): This special development test of spacecraft verified interface compatibility between spacecraft and the primary and mission sensors. All interface signals and characteristics were monitored during spacecraft level testing to insure the systems were compatible and were within required tolerances. All out of tolerance conditions were annotated and discrepancies were resolved. Initial Systems Performance Test (Nov 80): This standard spacecraft system level test insured operation of all subsystems. Increased Spacecraft Thermal Stress Test (Apr 81): To verify system integrity for the first Block 5D-2 satellite, the thermal stress test was increased to include an additional three thermal cycles above and beyond the normal three thermal cycles. Primary Sensor Reconfiguration during Orbit Simulation Test (Jul 81): This special test on the primary sensor configured it to many of the possible subsystem interconnects to verify operational capability under a simulated orbit environment (thermal vacuum). First Article Spacecraft Acoustic Test (Nov 81): The first Block 5D-2 satellite (S-6) was subjected to an acoustic environment 4 1/2 db above the normal Atlas-induced acoustic environment. The spacecraft was operating in ascent mode during test and all ascent parameters were monitored to insure normal operation. After the acoustic test, a complete spacecraft test was performed to insure no degradation occured. This test included complete mechanical integrity. Pyro Actuated Deployment Test (Nov 81): This special development test at spacecraft level fired each of the pyrotechnic devices and monitors shock induced environment through various accelerometers installed on the spacecraft. In addition, the test verified mechanical deployments under actual pyro-actuated events. Radiation Exposure of Selected Piece Parts (Aug-Oct 81): This special test was performed on selected Block 5D-2 piece parts to insure the devices will meet the required life while subjected to the natural radiation environment of space. Selected devices were sent to radiation laboratories and subjected to an accelerated radiation environment. The devices were monitored to determine maximum dosages they could absorb without degradation. The device's shielding requirements and its life expectancy on orbit were determined from these data. Software Stress Testing (Jan 82): This special software development test insured software compatibility with simulated inputs from spacecraft subsystems such as the earth sensor and sun sensor, and to monitor the software to insure normal response.

2. (U) Operational Test and Evaluation: The Defense Meteorological Satellite Program is continually evolving as meteorological satellite technology advances. The current acquisition efforts for Block 5D-2 satellites and the supporting ground system changes are part of this continuing evolution. The changes and modifications are tested through the development process prior to the launch of new satellites. Hence, as an operational system under continuous upgrade, no identifiable operations test and evaluation requirements currently exist. Based on a review of future plans, no Air Force Test and Evaluation Center managed/monitored Operational Test and Evaluation is required at this time.

Budget Activity: Defensewide Mission Support #6
Program Element: 35160F, Defense Meteorological Satellite Program

3. (U) System Characteristics:

	Objectives	Demonstrated Development Test and Evaluation	Demonstrated Operational Test and Evaluation
Orbit	450± 9 Nautical Miles Circular		450± 5 Nautical Miles
Data Storage Capacity	400 Minutes	400 Minutes	400 Minutes
Imagery Resolution	.3 and 1.5 Nautical Miles, Visual and Infrared	.25 and 1.5 Nautical Miles, Visual and Infrared	.25 and 1.5 Nautical Miles, Visual and Infrared

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35171F Title: Space Launch Support
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	15,000	26,151	16,419	40,346	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides the Space Transportation System resources/capability needed to transport Air Force space payloads into their mission orbits. The main program objective is to provide consolidated management, programming, and execution of the operational phase Air Force Space Shuttle/Inertial Upper Stage/Payload Assist Module-Delta class activities that are common to the Department of the Air Force research and development and operational satellite programs.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Provides first year funds for the procurement of an Inertial Upper Stage (IUS) for a Space Test Program mission. Pays for the continuation of mixed cargo integration activities and the Orbiter Flight Charge to support a Space Test Program sortie mission on the Space Shuttle. Continues efforts in the form of studies and analysis, design, and operational planning to identify and develop beneficial uses of man for on-orbit payload operations. The IUS cost estimate was derived from contractor experience with the initial production build on the full scale development contract. Payload integration costs are estimates based upon prior experience for integrating payloads to expendables.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
RDT&E	26,462	39,700	TBD		Continuing	Not Applicable
Procurement (Missile)	710	33,575	86,648		Continuing	Not Applicable

Program Element: #35171F Title: Space Launch Support
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

(U) OTHER APPROPRIATION FUNDS:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
Procurement (Missile)	700	102,975	155,800	172,400	Continuing	Not Applicable*
(Quantity)						
(Inertial Upper Stages)	(0)	(0)	(4)	(0)	Continuing	
(Payload Assist Modules-Delta class)	(0)	(0)	(10)	(8)	Continuing	
Operation and Maintenance	29,802	72,471	176,782	258,162	Continuing	Not Applicable

*Includes spares.

Program Element: #35171F   Title: Space Launch Support
DOD Mission Area: Space Launch and Orbital Support, #410   Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element provides the Space Shuttle/Inertial Upper Stage/Payload Assist Module-Delta class support that is common to the Department of the Air Force research and development and operational satellite programs. This support includes procurement of Inertial Upper Stages, Payload Assist Modules-Delta class, and their associated launch services; payment of Orbiter Flight Charges to the National Aeronautics and Space Administration; provision of mission control operations and recurring payload integration; and operation of the national Space Shuttle launch site at Vandenberg Air Force Base, CA. The research and development satellite programs supported include the Space Test Program, Program Element 63402F; and the first Space Shuttle mission of each of the following programs: the Defense Meteorological Satellite Program, Program Element 35160F; and the MILSTAR Satellite Communications Program, Program Element 33603F. The operational satellite programs supported are the Defense Meteorological Satellite Program, Program Element 35160F; the Defense Satellite Communications System, Program Element 33110F; the Defense Support Program, Program Element 12431F; the NAVSTAR Global Positioning System, Program Element 35165F; the Satellite Data System, Program Element 35158F; the Space Based Surveillance System, Program Elements 63428F and 12424F; and the MILSTAR Satellite Communications Program, Program Element 33603F.

(U) RELATED ACTIVITIES: The Inertial Upper Stage development, Department of Defense Space Shuttle operations capability development, and the acquisition of the Vandenberg Air Force Base Shuttle launch site are being accomplished in PE 64411F and PE 12449F. The individual Air Force payload programs will provide resources for program unique launch hardware and/or services. The resources for support to other Department of Defense programs are included in the appropriate Special Activity and Department of the Navy Program Elements.

(U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force Systems Command's Space Division, Los Angeles, CA. Systems engineering is provided by the Aerospace Corporation, El Segundo, CA. The Inertial Upper Stage and spacecraft integration contractor is the Boeing Aerospace Company, Seattle, WA. The Payload Assist Module-Delta class contractor is the McDonnell-Douglas Astronautics Company, Huntington Beach, CA. The payload integration contractor is Martin Marietta Corporation, Denver, CO. The Vandenberg Air Force Base Shuttle operations contractor has not been selected. The National Aeronautics and Space Administration is the Space Transportation System manager and operates the national Space Shuttle eastern launch site at Kennedy Space Center, FL, and the mission control center at Johnson Space Center, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Reimbursements were made to the National Aeronautics and Space Administration (NASA) to cover the costs related to terminating the BATSON II communications security capability in the Tracking and Data Relay Satellite System (TDRSS).

2. (U) FY 1982 Program: NASA will be reimbursed for the remainder of the costs associated with terminating BATSON II on TDRSS. Mixed integration activities begin for a Space Test Program sortie mission. Development efforts will begin to define and implement improved man-to-payload interfaces during on-orbit payload operations to further insure the success of military space missions. The reduction in FY 1982 funding resulted from reprogramming actions for higher priority requirements.

Program Element: #35171F Title: Space Launch Support
DOD Mission Area: Space Launch and Orbital Support, #410 Budget Activity: Defense-wide Mission Support, #6

3. (U) FY 1983 Planned Program: An Inertial Upper Stage (IUS) for a Space Test Program synchronous mission will be procured (incrementally funded in FY 83, 84, and 85). Payment of the Orbiter Flight Charge for a Space Test Program sortie mission will be made to NASA. Mixed cargo integration activities for a Space Test Program sortie mission will continue. Efforts will continue to develop and implement a program which enhances mission operations through the use of man during on-orbit payload operations. The increase in FY 1983 Missile Procurement funds from those reflected in the FY 1982 Descriptive Summary is due to a change in procurement plans for the IUS and an increase in the IUS cost. IUS quantities are changed from one fully funded vehicle to advance buy of four vehicles to be procured as part of an eight vehicle block buy.

4. (U) FY 1984 Planned Program: Payment of the Orbiter Flight Charge and mixed and recurring payload integration charges will be made to support a Space Test Program sortie mission in Fiscal 1985. Payment of the second year funding will be made for an IUS procured in Fiscal Year 1983.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #78011F
DOD Mission Area: Production Base Support, #480

Title: Industrial Preparedness Program
Budget Activity: Defense-Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	0	1,977	4,867	Continuing	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program maintains and provides required improvements for Air Force-owned, contractor-operated plants; engineers, validates, and demonstrates new manufacturing technologies; funds technical portion of factory/plant technology modernizations; and provides industrial base strategic and tactical planning. These efforts are necessary to reduce acquisition costs and lead-times, to improve industrial readiness, and to provide surge capability.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Funds a new initiative in Manufacturing Science. This funding will provide the absolutely critical technology base for future efforts and allow development of potentially ultra-high payoff Manufacturing Technologies. It will provide a direct link between the Air Force Manufacturing Technology (MANTECH) Program and academia, will help develop academic centers of manufacturing excellence, and will help stimulate the undergraduate and graduate education of manufacturing engineers.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Not applicable.

(U) OTHER APPROPRIATION FUNDS:

		FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
Procurement:	Aircraft	60,600	93,300	147,400	157,100	Continuing	N/A
	Missile	19,000	24,616	27,200	26,600	Continuing	N/A
	Other	10,083	9,835	10,548	11,188	Continuing	N/A
Operation and Maintenance		8,012	8,845	11,128	12,681	Continuing	N/A

Program Element: #78011F | Title: Industrial Preparedness Program
DOD Mission Area: Production Base Support, #480 | Budget Activity: Defense-Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: Erosion of the Aerospace Forces industrial base and the advancing technology of weapon systems, equipment, and aerospace materiel have resulted in greatly increasing acquisition and maintenance costs. This has been further complicated by the increasing dependence on foreign sources for critical/strategic materials and materiel. Correction of this situation requires maintenance and improvement of existing industrial plants, creation (as appropriate) of new facilities, the influx of new technology (clearly demonstrated as the major factor in productivity improvement), and the capitalization necessary for facilitization and modernization. Further required are analyses and both strategic (for overall guidance and planning) and tactical (for specific implementation) planning to guide investment and the improvement and development of the science foundation critical for technology improvement. The objective of this program element is to fund all appropriate work where private industry can not or will not make such investments. Further, this program element links with major acquisitions to stimulate private investment through government "seed" investment in technology and shared risks and benefits from the mutual investment. Major benefits of the program include reduced acquisition costs or cost avoidances, reduced acquisition lead times, reduced maintenance costs and process time, and improved (acquisition and maintenance) product quality. A further benefit resulting is technology diffusion that enhances the national industrial base as a whole, increasing our international competitiveness.

(U) RELATED ACTIVITIES: Both the Army and the Navy maintain very active Industrial Preparedness programs. Other government agencies such as NASA and the National Bureau of Standards maintain active manufacturing technology efforts. This latter activity is fully coordinated through the DOD Manufacturing Technology Advisory Group (MTAG). Through subcommittees of the MTAG, numerous joint programs are run involving two or more services and, as appropriate, other government agencies. Further, joint activities with the Advanced Research Projects Agency are administered by the appropriate service and coordinated through the MTAG. Internal Air Force participants are the Air Force Systems Command and the Air Force Logistics Command. Projects are jointly planned and prioritized, with execution by the appropriate major command. This PE is potentially fed by nearly all research and exploratory development PEs. Typical efforts feeding this PE include 62102F, Materials; 62201F, Aerospace Flight Dynamics; 62203F, Aerospace Propulsion; 62302F, Rocket Propulsion; and 63211F, Aerospace Structures and Materials. Likewise, this program impacts and feeds numerous Air Force program elements. Examples include 64226F, Long Range Combat Aircraft (B-1B) and 72007F, Depot Maintenance. In FY 1983, several major changes will occur to this PE. These include the initiation of the Manufacturing Sciences Initiative and creation of a new sub-element called Industrial Productivity and Responsiveness Improvement. Exisiting sub-elements include Industrial Facilities, Industrial Preparedness Planning, and Manufacturing Technology. The final change in FY 1983 is the new strategic and tactical planning structure.

(U) WORK PERFORMED BY: The program is executed by the Air Force Systems Command for implementation in private industry and the Air Force Logisitics Command. Agencies participating in the execution include the Wright Aeronautical Laboratories, AFSC's system product divisions, and AFLC's Air Logistics Centers. Many contractors are involved, including McDonnell-Douglas, Rockwell International, Lockheed, Avco, General Dynamics, Martin-Marietta, Boeing, Westinghouse, General Electric, Pratt & Whitney, and numerous additional prime and sub aersopace contractors. Well over 80 contracts are expected to be funded in FY 1983. RDT&E effort is to be performed by industry - academia coalition; the specific participants are unknown at this time.

Program Element: #78011F
DOD Mission Area: Production Base Support, #480

Title: Industrial Preparedness Program
Budget Activity: Defense-Wide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Numerous manufacturing technology efforts were completed and transitioned to industry. A significant example was the engineering and validation of casting technology allowing large primary cast structures. This was transitioned to the Air Launched Cruise Missile with an anticipated cost avoidance of well over $100M (a return-on-investment of over 100:1) projected. The Technology Modernization concept (a contractually linked government investment in technologies and private industry investment in capitalization including shared acquisition savings and contractor risk protection) was initiated with the F-16 prime contractor. Anticipated benefits to the Air Force include a cost avoidance of about $220M with a return-on-investment of nearly 9:1. Critical required facilities maintenance and improvements, including environmental protection actions, were completed.

2. (U) FY 1982 Program: Fifteen major Integrated Computer Aided Manufacturing Projects will be completed. Over 70 additional Manufacturing Technologies will be pursued, of which one-third should be completed. Eleven Technology Modernizations will be started/continued. Facilities projects will be accomplished at Air Force plants 3 (Tulsa, OK), 4 (Fort Worth, TX), 6 (Marietta, GA), 19 (San Diego, CA), 28 (Everett, MA), 42 (Palmdale, CA), 44 (Tuson, AZ), 59 (Binghamton, NY), 63 (Grafton, MA), 78 (Brigham City, UT), and others. Industrial Preparedness Planning will be performed at a modest level.

3. (U) FY 1983 Planned Program: Procurement and Operation and Maintenance funded activities will continue as described above. Technology Modernizations will be incorporated into a new subelement called Industrial Productivity and Responsiveness Improvement providing better management and execution. Industrial Preparedness Planning will receive new emphasis, including planning an overall strategy and developing the tactical planning to guide needed industrial preparedness/productivity/responsiveness actions. An RDT&E initiative will assess and start, as appropriate, to develop manufacturing sciences in the areas of sensor device phenomina and sensor theory, control theory, 3-D material flow technology for computer aided forging die design/manufacture, and end-effector phenomina and manipulator theory. Advanced manufacturing research will be explored in areas such as submicron electronic device processing technology, composite fabrication theory, electronic and avionic packaging technology, metal removal phenomina, and others. The technology portion of the B-1B Tech Mod for the airframe and propulsion prime and sub contractors will also start.

4. (U) FY 1984 Planned Program: Program as outlined above will continue. The Tech Mods underway will mature and industrial capitalization will progress. Manpower for expanded planning and management will be provided; as will be manpower for a logistics contract surge readiness initiative. Overall strategic planning will continue at a lower level of intensity as tactical planning emphasis will grow. Emphasis will be placed on repair technology for the AFLC's Air Logistics Centers, on manufacturing science, and on industrial technology efforts for the space and missile industry. Tech Mods will be identified and initiated as appropriate for AFLC materiel contractors.

5. (U) Program to Completion: This is a continuing program. Areas of emphasis and trends mentioned above will continue. Required maintenance/improvements for Air Force-owned, contractor-operated plants will be performed. Planning will continue, with continued emphasis in tactical planning guided by a structured strategic approach.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #78019F — Title: Utah Test and Training Range
DoD Mission Area: Major Ranges and Test Facilities, #451 — Budget Activity: Defense Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1,776	1,793	2,080	2,338	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides resources for the development of new instrumentation, the procurement of off the shelf equipment and instrumentation, and the operations and maintenance of the Utah Test and Training Range. The range supports development testing of cruise missiles, unmanned vehicles, and airborne parachute recovery systems. It also supports airborne tactical training for active and reserve units, and provides scenarios for large scale operational exercises.

(U) BASIS FOR FY 1983 RDT&E REQUEST: The program includes funds for the equipment and instrumentation necessary to support the RDT&E mission, such as data transmission and communication system modernization. Cost estimates are based on detailed engineering evaluations and, where available, manufacturer's cost quotes for the same or similar equipments.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	1,780	12,000	15,300		Continuing	Not Applicable
Other Procurement	3,277	2,781	1,045		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
Other Procurement	3,277	2,781	987	1,656	Continuing	Not Applicable
Military Construction				1,759	Continuing	Not Applicable
Operation and Maintenance	9,007	11,874	11,643	14,046	Continuing	Not Applicable

Program Element: #78019 | Title: Utah Test and Training Range
DoD Mission Area: Major Ranges and Test Facilities, #451 | Budget Activity: Defense Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Utah Test and Training Range (UTTR) is located in western Utah and consists of 2.9 million acres of controlled airspace. The range supports test and evaluation of Air/Ground Launched Cruise Missiles (ALCM/GLCM), Remotely Piloted Vehicles (RPV), and parachute recovery systems; Tactical Air Command combat crew training; Air Force Logistics Command aircraft and munitions tests; Air Force Test and Evaluation Center (AFTEC) operational test and evaluation; and training for the Air Force Reserves. The RDT&E funds are used to improve and modernize the range instrumentation used for gathering and processing telemetry, optical, and metric data for range users. Other Procurement funds are used for the procurement of off the shelf equipment and instrumentation. Range operation and maintenance is funded from the Operations and Maintenance appropriation.

(U) RELATED ACTIVITIES: The Utah Test and Training Range supports DoD programs and those of other government agencies. The majority of the workload is performed under contract (60 percent). The funding source for this contract is the Operations and Maintenance appropriation.

(U) WORK PERFORMED BY: The Utah Test and Training Range is managed and operated by the Air Force Systems Command's 6501st Range Squadron at Hill AFB, UT. Procurement and contract management support is provided by the Air Force Systems Command's Air Force Flight Test Center at Edwards AFB, CA. The RDT&E appropriation will be used to fund seven technical equipment improvement contracts in FY 1983, the largest of which is anticipated to be less than $750,000. The contracts will be released for bid in FY 1982. Potential contractors for the major range upgrade will not be known until bid responses are received in late FY 1982 or early FY 1983.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: On January 1, 1979 Air Force Systems Command became the single range manager. Effective 1 October 1979, the UTTR was placed within the purview of Department of Defense Directive 3200.11, the directive which governs the use, management and operation of major DoD ranges and test facilities. Funding for range operation was through Operations and Maintenance appropriations. RDT&E funds were used to upgrade capabilities of the mission control center, range instrumentation, data transmission and communications.

2. (U) FY 1982 Program: RDT&E funds will be used to continue the upgrade of the range mission control center and communications system. Additional range capability upgrades using RDT&E funds will include slaving of cinetheodolites to a master radar for automatic pointing.

3. (U) FY 1983 Planned Program: RDT&E funds will be used to continue the range upgrade into FY 1983. FY 1983 upgrades include the modernization of the communication system and the upgrading of data transmission and display systems. Congressional action deleted $10.0 Million of FY 1982 RDT&E funds intended for a major range upgrade to preserve the option to conduct the flight test portion of the Advanced Medium Range Air-to-Air Missile (AMRAAM) operational utility evaluation. Accordingly, the $13.2 million of FY 1983 RDT&E funds to continue this major range upgrade have been deleted.

Program Element: #78019F
DoD Mission Area: Major Ranges and Test Facilities, #451

Title: Utah Test and Training Range
Budget Activity: Defense Wide Mission Support, #6

4. (U) FY 1984 Planned Program: RDT&E funds will be used to continue the upgrade of the mission control center and communication system and for the modernization of range instrumentation.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

7. (U) Resources: Not applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not applicable

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #78026F
DOD Mission Area: Defense System Cost-Effectiveness/ Improvement, 473

Title: Productivity, Reliability, Availability and Maintainability (PRAM)
Budget Activity: Defense Wide Mission Support, #6

RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		8,561	9,165	9,681	10,145	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED. The Air Force has an urgent need to reduce the rising cost of ownership and improve productivity, reliability, availability and maintainability of its operational systems. The Office the Secretary of Defense FY 1981-1985 Consolidated Guidance stated, "We have learned that it is virtually imposs e to anticipate and solve all reliability problems in a complex weapon system before it is fielded. In order to realize the intended performance from a system, one must plan to improve the design with reliability and maintainability modification throughout most of its service life." The Productivity, Reliability, Availability and Maintainability (PRAM) program has continued to respond forcefully to fill this major gap for deployed systems. This has been accomplished, since its inception in 1975 by the Air Force Chief of Staff, through judicious and timely investments in projects leading to lower life cycle costs and improved operational readiness. The need for continuing this vital program has been documented over the years by commanders of both Air Force Systems Command and Logistics Command, and has been underscored by the Assistant Secretary of Air Force for Research, Development and Logistics as well as the Under Secretary of Defense for Research and Engineering.

(U) BASIS FOR FY 1983 RDT&E REQUEST: This program provides investment funds for projects leading to reduced cost of ownership or enhanced force readiness in the areas of airframes, avionics, propulsion (Non-Component Improvement Program applications affecting logistics support, repair technology and test methods that impact more than one engine model), missile, depot maintenance and other support areas. Specific projects to be funded will be formulated by the PRAM Program Office and its affiliated field offices. Selection of projects will be based on such criteria as risk, projected cost, return initiatives (i.e., readiness, mobility, fuel conservation) and return on investment within the scope of its Charter. Projects selected for investment will continue to stand audit during the amortization period. This is a level of effort program.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	8,561	9,200	10,200		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #78026F
DoD Mission Area: Defense System Cost-Effectiveness/ Improvement, 473

Title: Productivity, Reliability, Availability and Maintainability (PRAM)
Budget Activity: Defense Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Department of Defense Consolidated Guidance for FY 1981-1985 highlights the fact that "our tactical Air Forces represent the most expensive investment among our general purpose forces. Procurement and operating costs continue to rise steadily, more rapidly than defense spending as a whole, even after adjusting for inflation." The guidance further expresses "deep concern about the future impact of these trends on the size, age, and readiness of the force." And calls for "major initiatives to reverse these disturbing trends and to provide an effective combat capability commensurate with our increasing commitment of resources." The PRAM program is filling this urgent requirement to reduce the rising cost of ownership while improving the operational readiness of our in-service weapon systems. PRAM's judicious and timely investment in projects lead to lower life cycle costs. These improvement projects drive the very same parameters (e.g., productivity, reliability, availability and maintainability) that lead also to improved operational readiness. This program attacks the high cost of doing business by focusing management attention and funds in a concentrated effort to reduce operational and support costs without sacrificing systems effectiveness. The program objective is pursued through investments in cost reduction projects. These projects are to: (1) improve the reliability and maintainability of weapon systems through modifications and parts substitution, (2) improve the efficiency and productivity of maintenance and logistic support organizations at all levels through more effective equipment, procedures and documentation, (3) exploit lower life cycle cost alternatives in system configurations through component commonality and use of current technology lower cost components, (4) improve specifications, standards, methods and techniques, and (5) enhance the operational readiness of our deployed systems. Implementation of these projects lead to: (1) reduced support manpower requirements, (2) lower spares consumption, stock levels and storage/transportation costs, (3) improved force readiness and (4) fuel conservation through improved equipment and techniques. The need for PRAM projects for operational systems stems from the fact that technology advances through several cycles during the single lifetime of many of our systems. Successful prototypes or studies are not implemented by PRAM, but are implemented by procedural changes and preferred spares, or through the Air Force Modification Program.

(U) To manage this program, an office has been established which is managed by personnel experienced in the research and development, acquisition, and logistic support disciplines. This is a joint Logistic Command and Systems Command Office, equally responsible and responsive to the two commanders. As such, the program office is able to cut across traditional functional and organizational lines to accomplish its goals. This office achieves its objectives primarily through interaction (in an integrating leadership role) with Air Force Laboratories, System Program Offices, Air Logistics Centers, Major Commands and especially industry.

(U) PRAM provides the front-end risk reduction, investigation prototyping evaluation of improvement projects geared toward in-service weapon systems and depot maintenance functions. These projects lead to improved hardware, specification standards, test methods, and adaptation of commercially available items to lower in-service weapon system/subsystem life cycle costs. PRAM funds will not be used to develop new systems or to augment the funding of other development programs. Completed projects are subjected to audit during the amortization period to verify savings.

Program Element: #78026F
DOD Mission Area: Defense System Cost-Effectiveness/ Improvement, 473

Title: Productivity, Reliability, Availability and Maintainability (PRAM)
Budget Activity: Defense Wide Mission Support, #6

(U) RELATED ACTIVITIES: This program is related to Program Element (PE) 64212F, Aircraft Equipment Development (AED), which has as one of its goals the reduction of weapon system ownership costs through development of aircraft equipment with minimun life cycle cost. The PRAM and AED programs are complementary with AED basically funding development of end items of equipment and PRAM primarily funding: (1) application of current high reliability technology to older systems, (2) adaptation of commercial items and procedures to military applications and (3) improvements in development and acquisition techniques, methods and specifications.

(U) PRAM plays a complementary role with the aircraft engine Component Improvement Program (CIP). The CIP is concerned with performance growth in specific current operational engines. PRAM's role deals with efforts applicable to several engines that improve reliability of lower engine life cycle costs. To ensure their complementary operation, PRAM propulsion projects are closely coordinated with the Air Force Propulsion Lab and the Aeronautical Systems Division's Propulsion Program Office. A dialogue has been established with the Army and Navy through which information on program activities and accomplishments is being exchanged.

(U) WORK PERFORMED BY: The PRAM Program Office is located at Wright-Patterson AFB, OH. Satellite PRAM offices have been established at each of the five Air Force Air Logistic Centers and at the Aerospace Guidance and Meteorology Center in Newark, OH. The Air Force Flight Dynamics, Avionics, Materials and Propulsion Laboratories, as well as the Air Force Flight Test Center, Aeronautical System Division, Rome Air Development Center, and Space Division, have been participants in PRAM projects.

(U) The ten largest PRAM contractors were: Boeing Military Airplane Co., Wichita, KS; Bendix Test System Div., Teterboro, NJ; The Garrett Corp., Phoenix AZ; Explosive Technology Div., Fairfield CA; Transequip Inc., Compton CA; Honeywell Inc., Minneapolis MN; The Glass Doctor, St. Petersburg FL, General Electric Co., Burlington VT; Capsulated Systems Inc., Fairborn OH; The Boeing Co., Seattle WA. In FY 1981 there were 72 additional contractors for a total of 91 separate contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The PRAM Program Office was formed in August 1975. As of September 1981, PRAM had initiated 522 projects representing a cumulative PRAM investment of $60.7 million of an estimated Program net savings (gross savings less all government costs), five years after implementation, of $1.499 billion. These projects were in the areas of airframes, avionics, propulsion, missiles and space, depot maintenance and other support areas. A total of 377 projects have been completed with a combined five-year net savings of $437.8 million from a PRAM investment of $22.1 million. An example of a PRAM project that will reduce operations and support costs is an effort to refurbish crazed and scratched windshields on A-10, F-111 and A/T-37 aircraft. These windshields are structurally sound, optically unusable due to crazing of the outer ply. PRAM is testing the application of a combined polymeric-mechanical refurbishment technique that should save 70 percent of the windshields currently condemned. This $270 thousand project should yield 5-year net savings of over $9.8 million. PRAM also prototyped the installation of an improved fire suppressant foam in C-130 aircraft fuel tanks. The new foam has five times the life expectancy of the current

Program Element: #78026F

DoD Mission Area: Defense System Cost-Effectiveness/ Improvement, 473

Title: Productivity, Reliability, Availability and Maintainability (PRAM)

Budget Activity: Defense Wide Mission Support, #6

foam, is lighter, and easier to handle. When fully implemented on the C-130 fleet, a 5-year cost avoidance of over $60 million is expected. The PRAM effort cost $145 thousand. In a fuel conservation effort, PRAM is prototyping a more efficient klystron tube for the Ballistic Missile Early Warning System (BMEWS). The new klystron, which powers the radar, will be over 28 percent more efficient than the old klystron. When implemented, the $644 thousand project will save almost two million gallons of fuel oil and 13,000 tons of coal annually. A productivity enhancing PRAM effort will develop a gauge to accurately measure the turbine nozzle area of jet engines being overhauled to provide more accurate thrust and temperature calibration. This should reduce engine rework after test cell evaluation. The $335 thousand effort should save over $2.6 million over a 5-year period.

2. (U) FY 1982 Program: The $9.2 million program represents a healthy trend to restore this vital program's funding level. In the functional areas addressed by PRAM (i.e., airframes, avionics, missiles and space, propulsion depot and other support), advances in technology accelerate through several generations during the operational life span of most of our older weapon systems. PRAM will continue to harness newer technology and adapt it to our older in-service systems to lower the cost of ownership. In addition, PRAM will continue to place great emphasis on support of urgent Air Force initiatives that are within our Charter. In this regard, PRAM has undertaken projects that will provide significant fuel savings or mobility enhancement. An example of a PRAM productivity enhancing effort is a project to test commercially available equipment for cleaning jet engine fuel nozzles while the engine is still on the aircraft. Currently, the engine must be removed from the aircraft for nozzle cleaning. Dirty nozzles waste fuel and cause hot spots. Numerous airlines are using this preventive maintenance procedure and are experiencing significant cost savings. This project will be jointly managed by the PRAM Program Office and the Military Airlift Command Airlift Center. The $54 thousand effort is expected to yield 5-year net savings of over three million dollars. Another project is developing a method to test installed servo actuators rather than removing them from the aircraft. This portable tester can be adapted to test any type of servo actuator in the Air Force. The project cost is $296 thousand; 5-year net savings in manpower for the F-111 alone should exceed $1.8 million. A project with both great productivity and force readiness impact is a PRAM effort to control corrosion on War Readiness Material general purpose bombs stored in Guam. Almost 30 people are employed full time to combat corrosion of the $72 million inventory. PRAM has two different efforts underway to test methods of preventing corrosion. One involves macroencapsulating the entire bomb and the other specifically addressed the fuse wells. The potential savings from the total PRAM investment of $350 thousand exceeds $4.6 million. PRAM transfers new technologies to the Air Force to reduce operating and support costs. One effort will test a new thermal spray technique on landing gear components currently condemned due to excessive wear of oil and air sealing surfaces. This will allow repair of previously condemned components and save over $230 thousand with a PRAM investment of $40 thousand. Another project will replace vacuum tubes with solid state FETRONS in the C-130 aircraft autopilot. The vacuum tubes rarely reach 500 hours service life whereas the calculated reliability of the FETRONS exceeds 25 years. The project cost of $21 thousand should yield 5-year net savings of $668 thousand.

Program Element: #78026F

DoD Mission Area: Defense System Cost-Effectiveness/ Improvement, 473

Title: Productivity, Reliability, Availability and Maintainability (PRAM)

Budget Activity: Defense Wide Mission Support, #6

3. (U) FY 1983 Planned Program: The FY 1983 $9.7 million request represents a minimum viable level for an effective PRAM Program. This projection of level program funding will barely maintain the interest and participation of the Air Logistics Centers and industry. Senior military and civilian Air Force executives continue to stress the need for this vital program. Accordingly, PRAM will apply maximum management attention to improve the operational readiness and to lower our cost of ownership of our older in-service systems. Candidate PRAM projects exceeding the budget request have been compiled. As in the past, projects actually pursued will be those offering the best potential return on investment.

4. (U) FY 1984 Planned Program: Specific investments will be similar to and in some cases continuation of those initiated in the previous year. The planned $10.1 million request continues the minimum viable funding for a concentrated effort to enhance productivity, reduce life cycle costs and improve operational readiness of in-service systems. Completed projects will continue to stand audit during the amortization period to verify savings.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #01004F
DOD Mission Area: International Activities, #460

Title: International Military Headquarters and Agencies
Budget Activity: Defense-Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING)($ in thousands):

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2,319	2,595	2,788	2,762	Continuing	Not Applicable
2447	SHAPE Technical Centre/ AGARD/Coop R&D		2,295	2,463	2,437		
2446	Von Karman Institute		300	325	325		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program satisfies Department of Defense (DOD) administrative agent responsibilities for the North Atlantic Treaty Organization (NATO) Advisory Group for Aerospace Research and Development (AGARD) in Paris, France and for the Supreme Headquarters Allied Powers Europe (SHAPE) Technical Centre (STC) in The Hague, Netherlands, pays for United States scientists at STC, supports United States Air Force participation in cooperative research and development (R&D) agencies and groups, and pays the United States share of NATO support for the von Karman Institute in Brussels, Belgium.

(U) BASIS FOR FY 1983 RDT&E REQUEST: Support of this program is a continuing international commitment under the auspices of NATO and our mutual weapons development agreements with our allies. Includes funds for improving cooperation among NATO member nations in aerospace R&D under AGARD, for paying civilian salaries at STC, for international cooperative R&D, and for the von Karman Institute. The cost estimates were determined from past experience plus anticipated inflation/exchange rates.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1981	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	1,980	2,600	2,700		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #01004F
DOD Mission Area: International Activities, #460

Title: International Military Headquarters and Agencies
Budget Activity: Defense-Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Supreme Headquarters Allied Powers Europe (SHAPE) Technical Centre (STC) is a multinational organization responsible directly to the Supreme Allied Commander, Europe. The Centre provides scientific and technical advice on military problems with emphasis on Command, Control and Communications. The United States Air Force (USAF), as administrative agent, supports 21 of 114 international scientist and engineer positions at STC. These salary expenses are reimbursed at North Atlantic Treaty Organization (NATO) rates thru credits to our NATO account. (Since the United States (US) pays less than NATO for an equivalent position, the US receives more credit than is actually spent.) The Advisory Group for Aerospace Research and Development (AGARD) provides technical advice and assistance to the NATO Military Committee, promotes advances and cooperation in the aerospace sciences, and provides assistance to requesting NATO member nations to help increase their aerospace scientific and technical potential. The USAF is also administrative agent for AGARD and funds for non-government as well as USAF participation in the AGARD scientific and technical meetings. This includes contracting for special services such as language translation for meetings in the US. In addition to AGARD-sponsored cooperative Research & Development (R&D) efforts, this program pays for USAF participation in data exchange and engineer exchange agreements with free world countries, and participation in those NATO agencies and groups in which USAF membership and participation is directed by treaty or other agreement. Examples of the latter include the NATO Air Force Armaments Group, eight subordinate subgroups and the Tri-Service Groups on Air Defense and on Communications and Electronic Equipment. The remaining international responsibility is for the US share (12.5%) of NATO support to the von Karman Institute for Fluid Dynamics in Brussels, Belgium. This international research facility is instrumental in advancing the state of the art in fluid dynamics and related disciplines. Thru research contracts and publications it is partially self sufficient; remaining budget requirements are contributed by the NATO nations.

(U) RELATED ACTIVITIES: Supports international cooperative R&D agreements, Information Exchange Projects, the US Mutual Weapons Development Data Exchange Program, The Technical Cooperation Program with the United Kingdom, Canada, Australia, and New Zealand, the Defense Research Group, and the US Air Senior National Representative to the Under Secretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: leading US civilian and military scientists, engineers, and administrators.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Completion of Project 2000, a NATO military committee-directed technology forecast of the military capability of NATO in the year 2000. Trials of an information display system for command and control installed at SHAPE for evaluation. Cooperative R&D accomplishments include: signing of a Memorandum of Understanding (MOU) by France (FR), Germany (GE), the United Kingdom (UK) and the United States for the development of a Family of Air-to-Air Missile Systems; signing of an MOU with FR and GE for the shared development and use of an electronic warfare tactics facility in Europe; US participation in very successful chaff trials with the UK, FR and the Netherlands; implementation of a plan for greater cooperation with Korea in R&D and production; and scientist exchange

Program Element: #01004F
DOD Mission Area: International Activities, #460

Title: International Military Headquarters and Agencies
Budget Activity: Defense-Wide Mission Support, #6

programs with Germany and Korea; signing of a bilateral FR/US agreement for the reengining of KC-135 aircraft; the conclusion of the UK/US agreement for the purchase of the Rapier Air Defense system; and signing of initial data exchange agreement between the US and Spain. While some of the data exchange and cooperative R&D initiations do not produce expected results, the relatively small investment and the growing technical capabilities of our allies make this program one of the most highly leveraged in the RDT&E Appropriation.

2. (U) FY 1982 Program: Emphasis on Electronic Warfare and Command and Control systems by the Supreme Headquarters Allied Powers Europe (SHAPE) Technical Centre including information systems for command and control, verification and further development of the Air Command & Control System concept proposed by the Air Defence Planning Group, and support for the NATO Integrated Communications System, which is to be the backbone of survivable, secure communications for NATO. Continued support for the NATO Advisory Group for Aerospace Research and Development and the von Karman Institute. Meeting US treaty obligations through participation in NATO working groups and conferences. Efforts will continue towards reaching agreements on other Family of Weapons concepts, and the conclusion of a US/FR agreement for ducted rocket technology demonstration. The Scientist and Engineer Exchange Program with NATO and non-NATO nations will continue.

3. (U) FY 1983 Planned Program: Participation in NATO working groups will continue as well as cooperative research and development efforts. Funding increases are the result of civilian pay raises, continuing the US support to STC at 21 scientist and engineering positions, small additional support for AGARD and the von Karman Institute, and funding the salary of the AGARD Director, who will be a US citizen. Actual fund requirements will fluctuate with the overseas value of the dollar. The Scientist and Engineer Exchange Program with NATO and non-NATO nations will continue.

4. (U) FY 1984 Planned Program: The efforts described above will continue.

5. (U) Program to Completion: The US AGARD Director will serve for three years. Generally, every other Director is from the US. The other efforts described above are part of a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1982 Descriptive Summary: Not Applicable