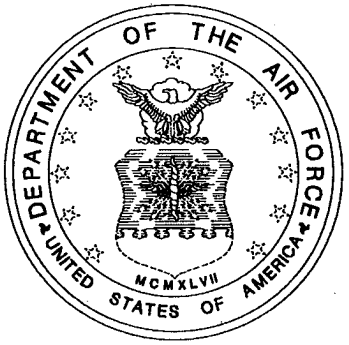
UNCLASSIFIED

DEPARTMENT OF THE AIR FORCE

SUPPORTING DATA FOR FISCAL YEAR 1997

RESEARCH, DEVELOPMENT, TEST AND EVALUATION

DESCRIPTIVE SUMMARIES



MARCH 1996

VOLUME I

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BUDGET JUSTIFICATION FOR PROGRAM ELEMENTS OF THE DEPARTMENT OF THE AIR FORCE RESEARCH AND DEVELOPMENT PROGRAM FY 1997 BUDGET ESTIMATES MARCH 1996

INTRODUCTION AND EXPLANATION OF CONTENTS

1. GENERAL: 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 hearings on the Fiscal Year 1997 Budget Estimates. This information is in addition to the testimony given by DoD witnesses.

a. Exhibits R-2 and R-3 provide narrative information for all RDT&E program elements and projects within the USAF FY97 RDT&E program except those listed in Vol III. The formats and contents of this document are in accordance with the guidelines and requirement of the Congressional committees insofar as possible.

b. The "Other Program Funding Summary" portion of the R-2 includes, in addition to RDT&E funds, Procurement funds and quantities, Military Construction appropriation funds on specific development programs, Operations and Maintenance appropriation funds where they are essential to the development effort described, and where appropriate, Department of Energy (DoE) costs.

c. There are no FY97 "Facilities Exhibits" that contain information on major improvement to and construction of government owned facilities funded by RDT&E.

2: CLASSIFICATION: All R-2 and R-3 exhibits contained in Volumes I and II are UNCLASSIFIED. Classified R-2 and R-3 exhibits are now contained in Volume III. Classified pages bear the appropriate security classification and classified data is identified by use of brackets []. A list of R-2 and R-3 exhibits not included in this submission (due to the level of security classification and necessity of special security clearances) is located in Vol III.

3. COMPARISON OF FISCAL YEARS 1996 AND 1997 DATA. A direct comparison of Fiscal Years 1996 and 1997 data shown in this document with corresponding data in the Descriptive Summaries dated February 1995 will reveal differences. The table below highlights the relationship of the FY97 budget structure to the FY96 Budget approved by Congress:

PE	TITLE	REMARKS
0101113F	B-52 Squadrons	Project 4493 is FY97 New Start.
0102412F	North Warning System (NWS)	Project 2710 completed in FY96.
0207129F	F-111 Squadrons	Project 3079 completed in FY96.
0207136F	Manned Destructive Suppression	Project 2671 is FY96 New Start. Project 4375 terminated in FY96. Project 4516 is FY96 Congressional add.
0207217F	Podded Reconnaissance System	Project 3652 is FY97 New Start.
0207268F	Aircraft Engine Component Improvement Program	New PE. FY96 and prior effort funded in PE 0604268F.
0207320F	Sensor Fused Weapon (SFW)	Project New Start in FY96 for Preplanned Product Improvement. FY 96 reclassification from PE 0604604F, project 1016 is pending.
0207325F	Joint Air-to-Surface Standoff Missile (JASSM)	New Start in FY96
0207431F	Combat Air Intellligence System Activities	New Start in FY97.
0207590F	Seek Eagle	Project 2784 transferred from PE 0604602F in FY96.
0207601F	USAF Wargaming and Simulation	Project 4474 transferred to PE 0605704, project 1010. Project 1011 is FY96 New Start
0303131F	Minimum Essential Emergency Communications	Transfers to project 4521 from PE 0603851, project 1024;

		PE 0604851F, project 13C4; PE 0101213F; and PE 0303131F, project 2832. Project 4521 (DIRECT) funded in project 2832 in FY96 and prior.
0303144F	Electromagnetic Compatibility Analysis Center	FY96 funding transferred from DISA for Joint Spectrum Center. Program returned to Air Force budget in FY97.
0303152F	World-Wide Military Command and Control Systems	Project 4485 was FY95 New Start. FY97 is first budget submission.
0303601F	Milstar Satellite Communications System (SPACE)	Project 2932 transferred from PE 0303606F in FY97 to project 2487.
0303606F	UHF Satellite Communications	Project 2932 effort and resources transferred to PE 0303601F, project 2487 in FY97.
0305145F	Arms Control Implementation	Project 4190 completed in FY96. Project 4520 is FY97 New Start.
0305164F	NAVSTAR Global Positioning System -- User Equip	Project 3028 effort related to Combat Survivor Evader Locator transferred to PE 0305176F.
0305176F	Combat Survivor Evader Locator	New PE in FY96. Project effort moved from PE 35164F, project 3028
0305906F	NCMC-TW/AA Systems	Project 4409 was FY95 New Start. FY97 is first budget submission for the project.
0305910F	SPACETRACK (SPACE)	Project 4239 completed FY96. Project 4241 is FY96 Congressional add.

0308610F	Information Management Automation Program	New Start in FY96 . Congress transferred funds from Operations and Maintenance.
0401119F	C-5 Airlift Squadrons	Project 4523 is FY96 New Start. Projects 4377 and 4495 are FY97 New Starts.
0401130F	C-17 Aircraft	Effort and resources transferred from PE 0604231F to project 2569 in FY97. Included jointly on PE 0604231F descriptive summary.
0401214F	Air Cargo Materiel Handling	New Start in FY97. Projects 5120 and 5150 initiated for effort transferred from PE 0604704F, project 3852.
0401218F	KC-135s	Project 4403 is FY97 New Start.
0601102F	Defense Research Sciences	Starting in FY96, project 06SR funding is eliminated. Infrastructure costs and civilian salaries have been transferred to each technical project.
0602102F	Materials	Starting in FY96, project 06ML funding is eliminated. Infrastructure costs and civilian salaries have been transferred to each technical project.
0602201F	Aerospace Flight Dynamics	Starting in FY96, project 06FS funding is eliminated. Infrastructure costs and civilian salaries have been transferred to each technical project.
0602202F	Armstrong Lab Exploratory Development	In FY96, technical projects/funding from PEs 0602205F and 0602206F were transferred to PE 0602202F, projects 1121, 6302, 7231, 7719, and 7930. Projects in source PEs were eliminated.

		Starting in FY96, project 06MD funding is eliminated. Infrastructure costs and civilian salaries have been transferred to each technical project.
0602203F	Aerospace Propulsion	Starting in FY96, project 06PP funding is eliminated. Infrastructure costs and civilian salaries have been transferred to each technical project.
0602204F	Aerospace Avionics	Starting in FY96, project 06AA funding is eliminated. Infrastructure costs and civilian salaries have been transferred to each technical project.
0602601F	Phillips Lab Exploratory Development	Starting in FY96, project 06WL funding is eliminated. Infrastructure costs and civilian salaries have been transferred to each technical project.
0602602F	Conventional Munitions	Starting in FY96, project 06AL funding is eliminated. Infrastructure costs and civilian salaries have been transferred to each technical project. Project 2567 funding for included in project 2502.
0602702F	Command Control and Communications	Starting in FY96, project 06RA funding is eliminated. Infrastructure costs and civilian salaries have been transferred to each technical project.
0603108F	Integrated Data Systems	FY95 New Start. FY96 Congressional add in PE 0603728F. FY97 is first budget submission.
0603205F	Flight Vehicle Technology	Effort transferred from project 2508 to project 2978.

0603238F	Global Surveillance and Communication Technology	Effort transferred from project 4217 to project 4216.
0603401F	Advanced Spacecraft Technology	Project 0003 is FY96 Congressional add.
0603432F	Polar Adjunct (SPACE)	New Start in FY95. FY97 is first budget submission.
0603771F	Industrial Preparedness Manufacturing Technology	Transferred to PE 0708011F in FY96.
0603790F	NATO Research and Development	New Start in FY97. Transfer to Project NATO from PE 0603790D.
0603851F	Intercontinental Ballistic Missile -- Dem/Val	Effort in project 1024 related to DIRECT transferred to PE 0303131F, project 4521.
0603854F	Global Broadcast Service (GBS)	New Start in FY96
0603855F	Space Architect Office	New Start in FY96
0604201F	Aircraft Avionics Equipment Development	Project 4017 terminated in FY96.
0604231F	C-17 Program	Transferring to PE 0401130F in FY97. Included jointly on descriptive summary with PE 0401130F.
0604249F	Night/Precision Attack	Project 2693 terminated in FY96.
0604268F	Aircraft Engine Component Improvement Program	Transferred to PE 0207268F in FY97.
0604270F	EW Development	Project 3945 is FY97 New Start to combine effort from multiple formerly classified programs.
0604441F	Space Based Infrared Architecture -- EMD (SPACE)	Project 0002 completed in FY96.

0604602F	Armament/Ordnance Development	Project 2784 transferred to PE 0207590F in FY96.
0604604F	Submunitions	Project 1016 will be reclassified to PE 0207320F in FY96.
0604704F	Common Support Equip Dev	Project 2479 completed in FY96. Project 3852 transferred to PE 0401214F, projects 5120 and 5150 in FY97.
0604706F	Life Support Systems	Project 3812 is FY96 New Start.
0604740F	Computer Resource Technology Transition	Project 2524 completed in FY96.
0604851F	Intercontinental Ballistic Missile -- EMD	Project 13C4 created in FY97 to consolidate related efforts. The portion related to DIRECT transferred to PE 0303131F, project 4521. Project 133B completed in FY96.
0605704F	Theater Air Defense BMC4I	New Start in FY96. Funds transferred to project 1010 from PE 0207601F, project 4474.
0605708F	Navigation/Radar/Sled Track Test Support	FY96 Congressional add transferred to PE 0604759, project 2904.
0708011F	Industrial Preparedness	Transferred from PE 603771F in FY96.
1001018F	NATO Joint STARS	Project 0002 initiated for FY95 and FY96 based on Congressional direction.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102F Defense Research Sciences

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	224,978	229,189	234,475	240,220	244,657	249,370	253,891	Continuing	Continuing
2301 Physics	19,514	23,218	20,574	21,070	21,473	21,856	22,282	Continuing	Continuing
2302 Solid Mechanics and Structures	15,165	14,341	15,994	16,381	16,687	17,005	17,316	Continuing	Continuing
2303 Chemistry	32,367	30,608	34,112	34,964	35,616	36,294	36,959	Continuing	Continuing
2304 Mathematical and Computer Sciences	17,837	30,756	34,278	35,187	35,792	36,529	37,155	Continuing	Continuing
2305 Electronics	29,375	27,777	30,982	31,731	32,324	32,939	33,542	Continuing	Continuing
2306 Structural Materials	15,897	15,031	16,767	17,172	17,492	17,826	18,152	Continuing	Continuing
2307 Fluid Mechanics	11,708	11,071	12,349	12,647	12,884	13,129	13,369	Continuing	Continuing
2308 Propulsion	11,266	10,654	11,882	12,169	12,397	12,633	12,864	Continuing	Continuing
2309 Terrestrial Sciences	17,320	14,170	0	0	0	0	0	Continuing	Continuing
2310 Atmospheric Sciences	7,641	7,225	8,058	8,307	8,410	8,640	8,724	Continuing	Continuing
2311 Space Sciences	5,513	5,214	5,814	5,955	6,066	6,182	6,333	Continuing	Continuing
2312 Biological Sciences	16,226	15,344	17,113	17,527	17,854	18,194	18,527	Continuing	Continuing
2313 Human Performance	9,212	8,709	9,715	9,950	10,136	10,329	10,518	Continuing	Continuing
4113 Science and Engineering Education Programs	15,937	15,071	16,837	17,160	17,526	17,814	18,150	Continuing	Continuing

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences

(U) **A. Mission Description and Budget Item Justification:** This Basic Research program, managed by the Air Force Office of Scientific Research (AFOSR), supports Air Force research efforts comprised of in-house investigations in Air Force laboratories and extramural activities in academia and industry. The program element funds broad-based scientific and engineering basic research in technologies critical to the Air Force mission. These technologies include aerospace structures, aerodynamics, materials, propulsion, power, electronics, computer science, directed energy, conventional weapons, life sciences, and terrestrial, atmospheric, and space sciences. All projects are coordinated through the Project Reliance process to harmonize efforts, eliminate duplication, and ensure the most effective use of funds. All technology areas are subject to long-range research planning and technical review by tri-Service scientific planning groups that interface and support the DOD Science and Technology Area Planning Teams.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	239,666	239,893	247,194	Cont
(U) Appropriated Value	247,805	239,978		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-14,817	-4,677		
b. SBIR	-3,693	-3,764		
c. Omnibus/Other Above Threshold Reprogrammings	-2,624	-2,349		
d. Below Threshold Reprogrammings	-1,693			
(U) Current Budget Submit	224,978	229,189	234,475	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY **1 - Basic Research**	PE NUMBER AND TITLE **0601102F Defense Research Sciences**
PROJECT NO. AND NAME **2301 Physics**	

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2301 Physics	19,514	23,218	20,574	21,070	21,473	21,856	22,282	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project provides the fundamental knowledge required to conceptualize and develop new Air Force weapons and also establishes the basis for many technologies critical to the Air Force. Research in physics has an impact on electromagnetic countermeasures, nuclear weapons effects, communications, and non-destructive and non-intrusive testing and analysis, as well as new materials development. Other technologies affected include avionics, laser technology, and propulsion research. The primary areas of research supported by this project are Photonic Physics, Optics, Plasma Physics, and Atomic and Molecular Physics.

(U) FY 1995 ($ in Thousands):

- (U) $19,514 Accomplished laser diode phase coupling and injection locking for generating optical phased arrays. Demonstrated first successful control of higher harmonics of a gyratron oscillator to be used for high-power microwaves (HPM). Accomplished proof of principle and demonstration of first successful table-top neutron generator for soft kill. Demonstrated longevity of states of spin polarized gases and application to non-destructive evaluation.
- (U) $19,514 Total

(U) FY 1996 ($ in Thousands):

- (U) $23,218 Establish novel concepts for boosting performance of HPM systems. Find new approaches to small, laser-based ultra stable clocks for navigation and position finding. Address physics limitations when imaging through the atmosphere for surveillance or airborne laser applications. Extend enhanced imaging techniques to low light levels and high resolution. Explore principles of stretched atoms and their application in energy storage.
- (U) $23,218 Total

(U) FY 1997 ($ in Thousands):

- (U) $20,574 Extend existing imaging techniques to the limits of physical principles for monitoring space debris and space assets. Extend power efficiency and harmonic linearity in microwave and millimeter wave vacuum tubes. Develop novel laser media for the window from ultraviolet to the visible. Continue to support scientific approaches to providing design and performance options in optical countermeasures, HPM, space surveillance, and targeting precision.
- (U) $20,574 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2301 Physics	

(U) B. **Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	19,514	20,562	21,188	Cont
(U) Current Budget Submit	19,514	23,218	20,574	Cont

(U) Change Summary Explanation:
Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. **Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0602601F, Phillips Laboratory.

(U) D. **Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2302 Solid Mechanics and Structures	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2302 Solid Mechanics and Structures	15,165	14,341	15,994	16,381	16,687	17,005	17,316	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Research is conducted in mechanics of materials, particulate mechanics, and structural mechanics. The anisotropy, inhomogeneity, and damage characteristics of advanced aerospace materials dictate the development of new solid mechanics and structural principles which are critical for performance prediction and material synthesis. Research in structures includes nonlinear dynamics, aeroelasticity, intelligent materials and structures, fluid/structure interaction, and failure mechanisms. Extreme service environment (space, blast, thermal, and electromagnetic field) that current and future structural systems must experience has made the development of fundamentals of solid mechanics theory a necessity. Material systems of interest for severe environment applications include high-temperature polymer systems, metallic materials and metal-matrix composites, ceramics and ceramic-matrix composites, and carbon/carbon composites.

(U) FY 1995 ($ in Thousands):

- (U) $15,165 Continued research on the effect of service environment on polymer-matrix composites, including high-temperature composites such as graphite/polyimides. Performed research on adaptive structures which integrate sensors and actuators for detection and mitigation of damage in aerospace structures. Examined the mechanics of functionally graded materials that can be tailored for a particular aerospace application. Studied the behavior of aging aircraft structures, including those having multiple-site cracking and corrosion damage. Modeled chemical fluid flow and transport through soils and explored methods to improve characterization of hazardous waste sites. Studied the localization of damage in structural materials and determined the process by which failure occurs through formation of instabilities. Developed new models of fluid structure interaction that more accurately account for the effect of deformable structures.
- (U) $15,165 Total

(U) FY 1996 ($ in Thousands):

- (U) $14,341 Research the mechanics of metal and composite processing and manufacturing, such as chemical vapor infiltration and deformation forming, including the highly nonlinear and dissipative behavior of material systems undergoing change. Develop models for ceramic-matrix composites subjected to cyclic loading at various frequencies. Develop improved non-destructive evaluation techniques for the detection of corrosion and internal damage in aging aircraft structures.
- (U) $14,341 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2302 Solid Mechanics and Structures	

(U) FY 1997 ($ in Thousands):

- (U) $15,994 Develop models for three-dimensionally reinforced composite materials. Continue research of the scaling issues in structural mechanics and develop necessary computational techniques for handling homogenization. Examine the behavior of materials at very small scales, as necessary for the development of micro-electromechanical systems.
- (U) $15,994 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	15,165	15,979	16,466	Cont
(U) Current Budget Submit	15,165	14,341	15,994	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0603211F, Aerospace Structures.
- (U) PE 0602203F, Aerospace Propulsion.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY **1 - Basic Research**	PE NUMBER AND TITLE **0601102F Defense Research Sciences**
PROJECT NO. AND NAME **2303 Chemistry**	

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2303 Chemistry	32,367	30,608	34,112	34,964	35,616	36,294	36,959	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** In the chemistry research program, knowledge and understanding is sought in chemical synthesis and reactivity, polymer chemistry, surface science, and molecular dynamics. The focus is on building the knowledge base required to develop new materials and to improve the synthesis of existing materials. Research on structural, electronic and photonic materials, electromagnetic and conventional weaponry, propellants, and environmentally safer materials are focus areas. Synthesis and characterization of higher performance and lower cost nonmetallic materials for application as structural composites, lubricants, and sealants is conducted. Unique chemical approaches are utilized to characterize polymeric and organic materials, ceramics, glass, semiconductors, and composite structures. Atomic and molecular level surface interactions that can limit performance of electronic devices and lubricant materials are explored. Molecular energy release mechanisms and energy storage in metastable molecular systems are investigated to foster advances in laser weapons development and new chemical propellants.

(U) FY 1995 ($ in Thousands):

- (U) $32,367 Investigated fuel combustion under supercritical conditions as an enhancement of turbine engine performance. Performed research on explosive materials with focus on molecular designs that retain high energy content, but have reduced shock sensitivity. Continued research on improved environmentally acceptable fire suppressant to replace currently used halons and developed high-performance lubricating coating for solids at high temperatures. Continued research to apply the mathematical theory of optimization to the "up front" design of polymers for optimum properties.
- (U) $32,367 Total

(U) FY 1996 ($ in Thousands):

- (U) $30,608 Initiate research on ceramic precursors covering synthesis, processing fundamentals, and precursor/ceramic structure property relationships. Continue research to develop materials for photonic applications. Explore novel approaches for environmentally benign anti-icing chemistry. Investigate the heterogeneous chemistry occurring on aerosols and particulates in rocket exhausts.
- (U) $30,608 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2303 Chemistry	

(U) FY 1997 ($ in Thousands):

- (U) $34,112 Investigate physical aging effects on properties and performance of polymers. Continue research on low-cost biomimetic approaches to improved materials for electronic and electro-optical applications. Explore novel approaches to inorganic-based polymeric materials. Investigate chemical processing methods for producing nanophase ceramics and laminated metals.
- (U) $34,112 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	32,367	34,106	35,144	Cont
(U) Current Budget Submit	32,367	30,608	34,112	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602601F, Phillips Laboratory.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2304 Mathematical and Computer Sciences	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2304 Mathematical and Computer Sciences	17,837	30,756	34,278	35,187	35,792	36,529	37,155	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This research focuses on mathematical modeling, simulation, and control of complex systems and provides analytical and computational methods. Topics include: effective utilization of high-performance computers; control of aerospace systems; models and computational tools for the design of aircraft, missiles, or other weapons; efficient production of large-scale, well-documented computer programs and software; communication and information theory; signal processing; artificial intelligence in surveillance systems or independent weapons; reliability and maintainability; and the allocation of resources in logistics or operational activities using ideas from optimization and linear programming theories.

(U) FY 1995 ($ in Thousands):

- (U) $17,837 Investigated models of discrete event dynamical systems to facilitate the development of more dynamic and responsive planning systems. Performed research on parallel multiresolution algorithms capable of predicting the long-time dynamics of physical dissipative systems over a broad range of physical scales. Developed massively parallel algorithms for efficient and reliable solutions to computational electromagnetics problems by using improved artificial boundary conditions that permit the truncation of the computational domain.
- (U) $17,837 Total

(U) FY 1996 ($ in Thousands):

- (U) $30,756 Investigate the capacity for image enhancement and data compression schemes to facilitate the transmission of information over limited bandwidths. Transition the theory of invariants in vision to efficient automatic object recognition technology. Develop optimal control methods that allow for effective pulse-shaping for high-power microwave. Research combinations of Artificial Intelligence and Operations Research methods to provide real-time reactive planning strategies.
- (U) $30,756 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2304 Mathematical and Computer Sciences	

(U) FY 1997 ($ in Thousands):

- (U) $34,278 Transition theories of student models to efficient computer mediated training. Study methods for managing large amounts of dissimilar information for use on distributed heterogeneous processors to enable real-time battlefield collaboration. Develop evaluation methods that permit the simulation of combustion processes for conventional warhead design problems. Develop efficient mathematical codes to study the dynamic behavior of the earth's surface and the atmosphere.
- (U) $34,278 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	32,525	34,272	35,315	Cont
(U) Current Budget Submit	17,837	30,756	34,278	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0602702F, Command, Control, and Communications.
- (U) PE 0603728F, Advanced Computer Technology.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2305 Electronics	

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2305 Electronics	29,375	27,777	30,982	31,731	32,324	32,939	33,542	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Research emphasizes electronic devices and systems that enable new Air Force capabilities such as battle information management systems, countermeasures, sensors, and the more electric aircraft concept. The goals are to increase the data and information processing speed of electronic systems, to firmly control their complexity and reliability, and to improve the security and reliability of information and data transmission. Research is conducted in electronic processes which will enable the engineer to model and predict performance of electronic materials, devices, and systems for high-speed digital and analog signal processing, microwave and millimeter wave signal and power generation, microwave tubes, superconducting optical signal processing, and radiation hardening.

(U) FY 1995 ($ in Thousands):

- (U) $29,375 Devised new electronic/optic holographic concept to increase compact disc storage capability by a factor of one thousand. Established record speed detection for ultra-short optical pulses to be used in radar and communication. Determined origin of unknown defects in indium phosphide, the dominant substrate for photonics. Devised and developed first high-frequency field effect transistor using gallium nitride, a novel high-temperature electronic material. Obtained significant improvement in electron materials quality by observing back-scattered ions in mass spectrometer during growth.
- (U) $29,375 Total

(U) FY 1996 ($ in Thousands):

- (U) $27,777 Find materials and device configurations which tolerate electronic operation beyond current military specifications, up to 300°C. Determine quantum effects limiting further down-scaling of silicon devices. Take a critical look at the feasibility of active silicon-based opto-electronic devices. Search for high density optical information storage memories. Explore novel concepts for digital superconductive circuits. Search for reliable sensors for hidden corrosion detection.
- (U) $27,777 Total

(U) FY 1997 ($ in Thousands):

- (U) $30,982 Continue support for strategically important electronics technologies, with special attention being given to innovative approaches to ultrafast, real-time avionics concepts, to advancing the state-of-the-art in optical computing storage, and to improving the precision of space surveillance and targeting.
- (U) $30,982 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2305 Electronics	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	29,375	30,953	31,895	Cont
(U) Current Budget Submit	29,375	27,777	30,982	Cont

(U) Change Summary Explanation:
Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0602702F, Command, Control, and Communications.
- (U) PE 0603728F, Advanced Computer Technology.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2306 Structural Materials	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2306 Structural Materials	15,897	15,031	16,767	17,172	17,492	17,826	18,152	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Research focuses on metallic polymers, and ceramic and nonmetallic structural materials. Materials research provides the knowledge for improving the performance, cost, and reliability of structural materials. Structural materials research studies a broad range of material properties such as strength, toughness, fatigue resistance, and corrosion resistance of airframe, turbine engine, and spacecraft materials. Emphasis is on refractory alloys, intermetallics, polymer composites metal and ceramic matrix composites, and advanced ceramics, such as alumina, silicon carbide, silicon nitride, and carbon/carbon. Research in new processing methods complements research on materials properties. Direct goals of this program are to increase the operating temperature of engine materials which will further increase thrust-to-weight ratio of engines, develop improved aerospace vehicle structural materials, and control or eliminate advance material reliability issues related to high temperature strength, toughness, fatigue, and environmental conditions.

(U) FY 1995 ($ in Thousands):

- (U) $15,897 Studied polymer composite degradation from service environment. Explored new concepts to provide increased damage tolerance to a third generation of intermetallic materials which show potential for operations at elevated temperatures. Performed fundamental studies of interfaces between metals and ceramics. Performed research on processing of ceramic material through oxidation of metallic precursors. Studied nanocrystalline metallic and ceramic structural materials focusing on processing, property mechanisms, characterization, and material stability. Studied the relationship between the compositional and microstructural features of metals and ceramics and their physical, chemical, and mechanical properties.
- (U) $15,897 Total

(U) FY 1996 ($ in Thousands):

- (U) $15,031 Research polymer composites bonding integrity and strength enhancement. Investigate processing approaches to the synthesis of functionally graded materials with emphasis on achieving balanced mechanical properties. Research microstructural mechanisms controlling mechanical performance of nanocrystalline materials. Investigate high temperature fracture mechanics, static and dynamic fatigue, and mechanisms of surface strengthening of monolithic and composite ceramic materials. Continue fundamental studies, both theoretical and experimental, on structure and properties of ceramic/metal and ceramic/ceramic interfaces at high temperatures. Research oxidation-resistant interfaces for composites and coatings for carbon/carbon materials and investigate the environmental effects of processing/property relationships of carbon/carbon composites.
- (U) $15,031 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2306 Structural Materials	

(U) FY 1997 ($ in Thousands):

- (U) $16,767 Investigate processing approaches to the synthesis of nanolaminated thin oxide films with emphasis on achieving balanced mechanical and thermal properties. Continue to research microstructural mechanisms controlling mechanical performance of nanocrystalline materials. Elucidate microstructural aspects of high temperature fracture mechanics, static and dynamic fatigue, and mechanisms of surface strengthening of monolithic and composite ceramic materials. Continue studies on polymer composites chemical and physical behavior for improving aerospace structural strength. Continue fundamental studies, both theoretical and experimental, on structure and properties of ceramic/metal and ceramic/ceramic interfaces at high temperatures. Continue studies of new oxidation-resistant interfaces for composites and coatings for carbon/carbon materials. Study doping of carbon to improve oxidation resistance.
- (U) $16,767 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2306 Structural Materials	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	15,897	16,751	17,261	Cont
(U) Current Budget Submit	15,897	15,031	16,767	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0603211F, Aerospace Structures.
- (U) PE 0708011F, Manufacturing Technology.
- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0602201F, Aerospace Flight Dynamics.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102F Defense Research Sciences

PROJECT NO. AND NAME: 2307 Fluid Mechanics

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2307 Fluid Mechanics	11,708	11,071	12,349	12,647	12,884	13,129	13,369	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Research involves turbulence prediction and control, unsteady and separated flows, hypersonics, and internal fluid dynamics. This research provides fundamental knowledge, tools, data, concepts, and methods for improving the efficiency, effectiveness, and reliability of aerospace vehicles. Research provides an understanding of key fluid flow phenomena, improves theoretical models for aerodynamic prediction and design, and originates flow control concepts and predictive methods to expand current flight performance boundaries. Research includes the development of computational methods for complex flows, prediction of real gas effects in high-speed flight, control and prediction of turbulence in flight vehicles, propulsion systems, aero-optic applications, the dynamics of unsteady and separated flows, thrust vectoring and high lift concepts associated with enhanced performance and maneuverability, heat transfer and compressor instabilities in gas turbine engines, flow-structure interactions in both external and internal flows, and transport phenomena in structural materials processing.

(U) FY 1995 ($ in Thousands):

- (U) $11,708 Performed research on boundary layer transition on supersonic and hypersonic flight vehicles. Studied nonlinear buffet and limit cycle oscillations in the transonic nonlinear regime. Explored methods for controlling vortex breakdown with leading and trailing edge boundary manipulation concepts. Developed turbulence models which include the effects of compressibility for application to complex high-speed aerodynamics and heat transfer. Explored micro-electromechanical systems approaches for advanced flow sensors and actuators and developed predictive methods for three-dimensional flows about multiple flight vehicles/stores undergoing dynamic maneuver. Investigated pressure-temperature sensitive paint systems for full coverage unsteady measurements in high-speed turbomachinery flows.
- (U) $11,708 Total

(U) FY 1996 ($ in Thousands):

- (U) $11,071 Investigate active heat transfer reduction concepts in wall jet flows. Develop theory of trailing edge receptivity and explore active control concepts for supersonic jet screech suppression. Investigate dynamic aerothermoelastic effects associated with supersonic and hypersonic maneuvering flight vehicle configurations. Study materials processing fluid dynamics research within thermofluids area. Research unsteady aeroelasticity in gas turbine compressors emphasizing inlet-compressor interactions.
- (U) $11,071 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2307 Fluid Mechanics	

(U) FY 1997 ($ in Thousands):

– (U) $12,349	Develop a full computational technique for airbreathing propulsion systems, including new turbulence models to predict unsteady, compressible, internal flow phenomena. Integrate micro-actuators, sensors, and nonlinear control algorithms to optimize materials processing systems and also to enable high-lift airfoil design concepts. Investigate actively bladed high-speed compressors to simultaneously suppress noise, flutter, and surge in gas turbine engines. Incorporate new Large Eddy Simulation computational techniques to predict unsteady three-dimensional flows around high-speed flight vehicle configurations.
– (U) $12,349	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2307 Fluid Mechanics	

(U) B. **Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	11,708	12,337	12,712	Cont
(U) Current Budget Submit	11,708	11,071	12,349	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. **Other Program Funding Summary;**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0603211F, Aerospace Structures.

(U) D. **Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2308 Propulsion	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2308 Propulsion	11,266	10,654	11,882	12,169	12,397	12,633	12,864	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Efforts include space power and propulsion, airbreathing propulsion, and propulsion diagnostics. Research is focused on the efficient utilization of energy in airbreathing engines and chemical and non-chemical rockets. Research is organized into the areas of chemically reacting flow, non-chemical energetics, and diagnostics. Chemically reacting flows involve complex coupling between energy release through chemical reaction and the flow processes which transport chemical reactants, products, and energy. Non-chemical energetic systems include plasma and beamed energy propulsion for orbit raising space missions and efficient ultra-high energy techniques for space-based energy utilization. Thermal management of space-based power and propulsion systems will be addressed. Research in diagnostics supports the first two areas by providing critically needed measurement capabilities for processes such as spray and solid propellant combustion, and plasma propulsion.

(U) FY 1995 ($ in Thousands):

- (U) $11,266 Studied degenerate four-wave mixing and laser-induced fluorescence for plasma measurements. Performed droplet and spray behavior research to include the coupling between sprays and the appearance of instabilities in liquid-fueled rockets, and the dispersion of non-dilute sprays in gaseous turbulent shear layers. Investigated fuel droplet behavior at resolutions smaller than the droplet size to explore the phenomenon of turbulence modulation by droplets and extended quantitative multi-dimensional imaging techniques to time-resolved measurements in three dimensions and the characterization of plasmas. Developed direct simulation Monte Carlo and Navier Stokes hybrid computational model to predict plume fields in the continuum and transition regimes.
- (U) $11,266 Total

(U) FY 1996 ($ in Thousands):

- (U) $10,654 Study combustion product formation in combustors and plumes. Investigate supercritical fuel behavior, and conduct computational and experimental studies of droplet dispersion, vaporization, and combustion in turbulent jets. Research gas mixing in preburner chambers to study combustion instability in liquid-fueled rockets and platelet injector dynamics, and continue experimental and numerical investigation of plasma thrusters for orbit maneuvering and station keeping.
- (U) $10,654 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2308 Propulsion	

(U) FY 1997 ($ in Thousands):

- (U) $11,882 Continue combustion product formation studies and the investigation of supercritical fuel behavior. Conduct additional computational and experimental studies of turbulent combustion and droplet dispersion, vaporization, and combustion. Study combustion instability in liquid-fueled rockets and continue experimental and numerical investigation of plasma thrusters for orbit maneuvering and station keeping.
- (U) $11,882 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	11,266	11,871	12,232	Cont
(U) Current Budget Submit	11,266	10,654	11,882	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603211F, Aerospace Structures.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2309 Terrestrial Sciences	

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2309 Terrestrial Sciences	17,320	14,170	0	0	0	0	0	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Provide fundamental research in seismology. Basic research in seismology is required to understand the propagation through the earth of seismic waves caused by underground explosions and to locate the source of such events. Research is required to identify seismic signatures which can be used to discriminate between natural events (for example, earthquakes), and explosions and other man-caused events. This research will provide an improved seismic monitoring capability required to effectively monitor compliance with nuclear test ban treaty agreements and will also help detect nuclear proliferation by improving the detection and identification of small nuclear tests.

(U) FY 1995 ($ in Thousands):

- (U) $17,320 Investigated seismic signatures of all natural and man-made events which require discriminants in order to identify underground nuclear tests with high reliability and investigated near source phenomena coupled with host rock rheology and cavity characteristics to establish non-ideal effects on magnitude estimation. Continued research relating to determination of location and depth of natural and man-caused seismic events. Continued support of the Global Seismic Network/Joint Seismic Program (GSN/JSP).
- (U) $17,320 Total

(U) FY 1996 ($ in Thousands):

- (U) $14,170 Continue research relating to discriminating between nuclear underground tests and other types of underground and surface non-nuclear explosions. Continue location and depth of seismic events research. Continue support of the GSN/JSP.
- (U) $14,170 Total

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2309 Terrestrial Sciences	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	17,320	5,606	5,776	Cont
(U) Current Budget Submit	17,320	14,170	0	Cont

(U) Change Summary Explanation:

Funding: In FY 1997 and out, funding for Air Force seismic research efforts has been transferred to PE 0305145F, Arms Control Implementation.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602601F, Phillips Laboratory.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY **1 - Basic Research**	PE NUMBER AND TITLE **0601102F Defense Research Sciences**
PROJECT NO. AND NAME **2310 Atmospheric Sciences**	

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2310 Atmospheric Sciences	7,641	7,225	8,058	8,307	8,410	8,640	8,724	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Areas of emphasis include ionospheric research and meteorology. This research includes the physics, dynamics, and chemistry of processes that determine the structure and variability of the earth's atmosphere. Atmospheric properties such as wind, density, clouds and precipitation, ionization, and optical/infrared (IR) transmission/emissivity all affect the performance of Air Force systems. Research includes new measurement techniques and the development of models for specifying and predicting weather and other atmospheric conditions. Emphasis is placed on understanding fundamental atmospheric processes and their impacts on optical and IR weapon systems, and on understanding the dynamics and structure of the ionosphere that affect communications and surveillance systems. Major research efforts focus on ionospheric dynamics, mesoscale meteorology, triggered and natural lightning, cloud prediction, and models which define the optical structure of the atmosphere.

(U) FY 1995 ($ in Thousands):
- (U) $7,641 Performed mesoscale meteorology research for improving numerical models of battlefield-scale forecasts and conducted research on the coupling of the atmosphere's fluid behavior with its chemistry, especially in the middle/upper atmosphere. Studied artificially-disturbed ionosphere. The results of this study are vital to the development of improved optical and infrared technology.
- (U) $7,641 Total

(U) FY 1996 ($ in Thousands):
- (U) $7,225 Research satellite data retrieval algorithms with emphasis on improved utilization of multispectral data. Study atmospheric electrification with emphasis on tropospheric discharges which may extend into the stratosphere and the ionosphere. Improve our understanding of atmospheric structure within the mesosphere and thermosphere with emphasis on relationships to optical transmissivity of atmosphere.
- (U) $7,225 Total

(U) FY 1997 ($ in Thousands):
- (U) $8,058 Investigate improved atmospheric simulation capabilities with emphasis on initial development of four-dimensional, spatially correlated fields of wind, clouds, relative humidity, visibility, etc. Conduct studies related to WSR-88D doppler radar to develop methodologies for improved identification of aliased signals, turbulence, and severe weather. Continue research on atmospheric electrification with emphasis on tropospheric discharges which may extend into the stratosphere and the ionosphere.
- (U) $8,058 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2310 Atmospheric Sciences	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	7,641	8,051	8,296	Cont
(U) Current Budget Submit	7,641	7,225	8,058	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0305160F, Defense Meteorological Satellite Program.
- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603220C, Surveillance, Acquisition, Tracking, and Kill.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102F Defense Research Sciences

PROJECT NO. AND NAME: 2311 Space Sciences

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2311 Space Sciences	5,513	5,214	5,814	5,955	6,066	6,182	6,333	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** The objective of this project is to provide basic knowledge of the space environment and solar activity for the design and calibration of advanced Air Force systems relevant to operations in and through near-earth space. The project also supports the Air Weather Service (AWS) by improving observing and forecasting techniques that support operational military systems in space environments. Theoretical and empirical descriptions and models of the physics of the sun and the earth's magnetosphere, which are critical elements of future AWS prediction models and radiation belt codes, are being investigated.

(U) FY 1995 ($ in Thousands):

- (U) $5,513 Designed an instrument for solar magnetic field studies, which will be transitioned to the Air Force Space Forecast Center in FY 1996-1997. Combined kinematic models of solar convection and three-dimensional magnetohydrodynamic simulations for solar activity forecasting. Validated time-dependent models of magnetic storm effects with Air Force and NASA satellite data and ground-based sensors. Determined the effects that limit propagation efficiency and the performance of satellite charge control systems and ballistic missile defense systems.
- (U) $5,513 Total

(U) FY 1996 ($ in Thousands):

- (U) $5,214 Transition solar activity models to 6.2 for solar forecasting applications. Define processes throughout the solar-terrestrial system using simultaneously measured solar, solar wind, and magnetosphere satellite data. These results will be used for the prediction of geomagnetic storms which affect ground and space assets. Complete models of radiation in plasmas, which are required to assess communications using electron beams or space borne antennas. Obtain data from a space shuttle experiment to validate electron beam propagation models, examine plasma effects on large space structures, and assess tethers in space as power generators.
- (U) $5,214 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2311 Space Sciences	

(U) FY 1997 ($ in Thousands):

- (U) $5,814 Integrate solar activity and coronal mass ejection models with interplanetary, magnetosphere, ionosphere, and thermosphere models to generate a unified global space weather mode scheduled to be transitioned to the Air Force Space Forecast Center in FY 1998. Use space- and ground-based data to test the models and to examine the characteristics of space environment particles and fields during the minimum of solar cycle 22 and the rise of cycle 23. Evaluate secular variations of the geomagnetic field and their effect on radiation dosage over the past three solar cycles. Assess the utility of these variations as a tool for long-term planning of the lifetimes of Air Force and DoD spacecraft. Use high latitude satellite data to establish solar wind signatures for geomagnetic storm alerts. Study satellite degradation by the radiation belts to provide the basis for developing more survivable, robust, Air Force satellite systems.
- (U) $5,814 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,513	5,809	5,986	Cont
(U) Current Budget Submit	5,513	5,214	5,814	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0302101F, Geophysics.
- (U) PE 0602702F, Command, Control and Communications.
- (U) PE 0603410F, Space System Environmental Interactions.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2312 Biological Sciences	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2312 Biological Sciences	16,226	15,344	17,113	17,527	17,854	18,194	18,527	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project consists of three research areas: environmental and general toxicology and effects of biohazards; neuroscience; and chronobiology. Environmental toxicology or environmental quality research has been expanded in order to provide the basic understanding of the fate and effects of Air Force chemicals and materials on the environment. This understanding is required in order to develop efficient and cost-effective strategies to clean up contaminated sections of air bases and to mitigate future environmental contamination due to Air Force operations. Knowledge of the mechanisms by which Air Force chemical and physical agents can cause toxic responses in organisms will allow the development of procedures to prevent and predict toxicity and provide strategies for the development of new materials that will not be harmful to man or the environment. Basic research in neuroscience and chronobiology will result in new strategies to prevent G-induced loss of consciousness in pilots, impaired performance due to jet-lag and shift-work, night operations, and the loss of life and aircraft due to stress, inattention, or lack of vigilance.

(U) FY 1995 ($ in Thousands):
- (U) $16,226 Studied the neurochemistry and molecular biology of the brain during changes in state along a continuum from sleep to arousal to attentiveness. Studied the mechanisms regulating circadian rhythms in performance in humans. Determined the mechanisms involved in retinal damage induced by ultrashort laser pulses. Performed research on biochemical/molecular markers of toxicity.
- (U) $16,226 Total

(U) FY 1996 ($ in Thousands):
- (U) $15,344 Research on biochemical concepts for site remediation and hazardous waste minimization will continue. Toxic mechanisms studies related to health and environmental hazard assessment of new Air Force compounds will receive emphasis. Continue research on the neurochemistry and molecular biology of the brain to identify biochemical mechanisms that control circadian clock, attention, arousal, learning, and stress.
- (U) $15,344 Total

(U) FY 1997 ($ in Thousands):
- (U) $17,113 Research on adaptive neural control systems will begin to investigate mechanisms involved in regulating goal-oriented behavior and novel defensive strategies employed by organisms for individual and collective protection of resources. Research to determine the mechanisms of toxic effects to man and the environment of new Air Force compounds, such as organic matrix composites and propellants, will continue. Emphasis will be placed on new approaches to predictive toxicology including physiologically-based toxicokinetic modeling.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2312 Biological Sciences	

– (U) $17,113 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	16,226	17,097	17,618	Cont
(U) Current Budget Submit	16,226	15,344	17,113	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

– (U) PE 0602202F, Human Systems Technology.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601102F Defense Research Sciences

PROJECT NO. AND NAME: 2313 Human Performance

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2313 Human Performance	9,212	8,709	9,715	9,950	10,136	10,329	10,518	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification**: This project provides fundamental knowledge of information processing in humans and other complex organisms needed to advance technologies of autonomous systems, command and control, human systems integration, and personnel selection and training. Research on sensory and perceptual processing impacts technologies of computer image and speech processing, human interface, and personnel selection. Research on cognitive and team processes impacts technologies of selection, education and training, command and control, and adaptive autonomous systems. Supported areas of research include Vision, Hearing, Cognition, Spatial Orientation, Intelligent Tutors, and Team Situational Awareness.

(U) FY 1995 ($ in Thousands):

- (U) $9,212 Investigated team member fatigue and stress to determine optimum performance environments for command, control, and communications. Modeled human performance using computer algorithms for application to virtual environments/workstation design. Conducted cognition research to address complex decision-making. Determined the sensory threshold changes associated with off variable axis rotation-induced spatial disorientation. Performed Air Force relevent research in Vision, Hearing, Cognition, Spatial Orientation, Intelligent Tutors, and Team Situational Awareness.
- (U) $9,212 Total

(U) FY 1996 ($ in Thousands):

- (U) $8,709 Continue research in Vision, Hearing, Cognition, Spatial Orientation, Intelligent Tutors, and Team Situational Awareness. Determine optimal image compression for human viewing. Determine mechanisms of human auditory localization. Evaluate models of advising in the context of intelligent tutoring. Determine the performance dimensions of human psychomotor abilities.
- (U) $8,709 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 2313 Human Performance	

(U) FY 1997 ($ in Thousands):

- (U) $9,715 Continue human performance research, including computational modeling of human sensory processing and pattern recognition. Model human decision-making in selected dynamic tasks of information processing. Experimentally test models of motor performance in virtual environments. Extend models of spatial orientation to performance in naturalistic versions of laboratory tasks. Explore mechanisms of biosensors to improve sensors for infrared detection and unmanned tactical aircraft.
- (U) $9,715 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	9,212	9,706	10,002	Cont
(U) Current Budget Submit	9,212	8,709	9,715	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0602702F, Command, Control and Communication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 4113 Science and Engineering Education Programs	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4113 Science and Engineering Education Programs	15,937	15,071	16,837	17,160	17,526	17,814	18,150	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project stimulates scientific and engineering education and increases the interaction between the broader research community and the Air Force laboratories. Emphasis is placed on increasing the number of U.S. citizens, especially women and minorities, with advanced degrees in science and engineering. These programs include: the Summer Faculty Research Program under which selected university faculty members conduct research at Air Force labs; the Graduate Student Research Program where graduate students in areas of interest to the Air Force perform research at Air Force labs; the University Resident Research Program where faculty members spend one year at an Air Force lab contributing to Air Force research needs and operations; the U.S. Air Force National Research Council (NRC) Resident Research Associateship Program which provides outstanding post-doctoral and senior scientists and engineers opportunities to research problems of their own choice that are compatible with the research interests of selected Air Force labs; the Laboratory Graduate Fellowship Program which is designed to stimulate doctoral candidate interest in Air Force labs and the research programs of those labs; and the National Defense Science and Engineering Graduate Fellowship Program which is jointly sponsored by the Army, Navy, Air Force, and the Advanced Research Projects Agency for the purpose of increasing the number of U.S. citizens trained in science and engineering.

(U) FY 1995 ($ in Thousands):

- (U) $15,937 The Summer Faculty Research Program supported 190 university faculty for up to 12 weeks at Air Force labs. The Graduate Student Research Program supported 115 students for up to 12 weeks at Air Force labs. Five percent of these Summer Research Program participants are members of a historically black or minority college. The University Resident Research Program supported 22 university researchers. The National Research Council Resident Research Associateship Program supported 61 fellows, two-thirds are post-doctoral researchers with the remaining one-third seniors. The Laboratory Graduate Fellowship Program supported 25 fellows. The National Defense Science and Engineering Graduate Fellowship Program supported approximately 97 fellowships with ten percent set aside for members of ethnic minority groups underrepresented in science and engineering.
- (U) $15,937 Total

(U) FY 1996 ($ in Thousands):

- (U) $15,071 This program will continue to support scientific and engineering education.
- (U) $15,071 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Sciences
PROJECT NO. AND NAME 4113 Science and Engineering Education Programs	

(U) FY 1997 ($ in Thousands):
- (U) $16,837 This program will continue to support scientific and engineering education.
- (U) $16,837 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	15,937	16,793	17,303	Cont
(U) Current Budget Submit	15,937	15,071	16,837	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:
- (U) PE 0601103D, University Research Initiative.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	65,336	71,683	72,360	73,421	78,149	80,858	87,103	Continuing	Continuing
06ML Laboratory Operations	29,526	0	0	0	0	0	0	Continuing	Continuing
4347 Materials for Structures, Propulsion, and Subsystems	19,724	44,161	44,077	44,264	47,532	49,271	53,156	Continuing	Continuing
4348 Materials for Electronics, Optics, and Survivability	6,435	13,322	13,473	13,888	14,580	15,044	16,177	Continuing	Continuing
4349 Materials Technology for Sustainment	9,651	14,200	14,810	15,269	16,037	16,543	17,770	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Applied Research program develops materials technologies and non-destructive inspection/evaluation technology. It is the primary source of advanced materials to reduce life cycle costs and improve performance, supportability, reliability, survivability, and affordability of current and future Air Force systems and support equipment. In FY 1995, the technical projects were realigned from a materials orientation to an application orientation to reflect the Air Force Technology Master Process. Starting in FY 1996, separate infrastructure projects have been eliminated. All efforts in this program element contain the resources necessary, including civilian salaries, to manage, conduct, and document the technical activities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials

(U) B. **Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	68,779	74,534	73,321	Cont
(U) Appropriated Value	70,049	74,534		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-3,257	-1,444		
b. SBIR	-713	-972		
c. Omnibus/Other Above Treshold Reprogrammings	-743	-435		
(U) Current Budget Submit	65,336	71,683	72,360	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increases due to additional emphasis on improved materials, space systems, and aging aircraft. Starting in FY 1996, Project 06ML has been eliminated and infrastructure costs, including civilian salaries, have been put in the technical projects.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. **Other Program Funding Summary:** Not Applicable.

(U) D. **Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials

PROJECT NO. AND NAME
06ML Laboratory Operations

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
06ML Laboratory Operations	29,526	0	0	0	0	0	0	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Provides management and operational support for the Materials Directorate, Wright-Patterson AFB, OH. Includes: pay and benefits for civilian scientists, engineers, and support personnel; travel; transportation; rents; communications; utilities; supplies and equipment; and salaries. This project will be terminated in FY 1995 and its content distributed to the technical projects.

(U) B. **Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	29,844	0	0	Cont
(U) Current Budget Submit	29,526	0	0	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Project funding incorporated under technical projects after FY 1995.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. **Other Program Funding Summary:** Not Applicable.

(U) D. **Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE March 1996

2 - Applied Research | **0602102F Materials**

PROJECT NO. AND NAME

4347 Materials for Structures, Propulsion, and Subsystems

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4347 Materials for Structures, Propulsion, and Subsystems	19,724	44,161	44,077	44,264	47,532	49,271	53,156	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: Develops materials technologies for aircraft, spacecraft, and missiles with improved affordability, maintainability, and enhanced performance of current and future Air Force systems. Advanced thermal protection and carbon-carbon (C-C) composites materials are developed that are affordable, lightweight, dimensionally stable, thermally conductive and/or ablation and erosion resistant to meet the requirements of aircraft, spacecraft, missiles, and ballistic reentry systems. A family of affordable lightweight materials are developed, including metals, metallic and nonmetallic composites, and ceramics which can provide upgraded capability for existing aircraft, spacecraft, missile, and propulsion systems to meet the requirements for new systems beyond the year 2000. Included are turbine engine materials with operating capabilities from 1700°F to 2800°F that will enable engine designs to double the thrust to weight of 1986 engine performance capabilities. Spacecraft material technologies are developed that are lightweight, dimensionally stable, noncontaminating, and resistant to the space environment. Alternative or replacement materials are developed to maintain the performance of aging operational reentry systems. Fluids, lubricants, seals, and other nonstructural material technologies are developed for the subsystems on aircraft, spacecraft, and missile systems as well as their propulsion systems.

(U) FY 1995 ($ in Thousands):

- (U) $4,367 Develop carbon-carbon and thermal protection material technologies to improve operational capability of strategic and tactical systems. These materials offer significant benefits in weight savings, dimensional stability, and thermal conductivity properties which will lead to higher performance structures, smaller radiators on aerospace systems, lighter and cooler space and aircraft electronics packages as well as the historical benefit of high temperature, extreme environmental shape retention.
  - (U) Demonstrated an advanced shape stable carbon-carbon composite material for reentry applications.
  - (U) Demonstrated advanced composite woven cylinders (one foot length) for spacecraft and reentry applications.
  - (U) Evaluated polymeric precursor coatings for spacecraft thermal control and structural applications under simulated space environments.
- (U) $2,184 Develop nonstructural materials (such as fluids, lubricants, seals, greases, and coatings) for improved system performance, reduced toxicity, and reduced life cycle costs.
  - (U) Identified advanced turbine engine seal materials to be transitioned to the Integrated High Performance Turbine Engine Technology (IHPTET) Phase II engine demonstrators.
  - (U) Tested and qualified potassium silicate thermal coatings for satellite thermal control and structural application
  - (U) Low infrared coatings provided as interim and long-term solutions to Air Mobility Command (AMC) aircraft.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials

PROJECT NO. AND NAME
4347 Materials for Structures, Propulsion, and Subsystems

– (U) $4,186	Develop advanced nonmetallic composite structural materials for aircraft applications including lightweight airframes, control surfaces, aircraft canopies, smart skins, and engine compressor frames and ducts, and for spacecraft applications including lightweight trusses, struts, solar arrays, antenna supports, and bus structures. These materials technologies will offer significant benefits in weight savings compared with the use of traditional metallic counterparts. – (U) Characterized the electroluminescent behavior in ordered polymers to establish their feasibility as a new class of materials suitable for displays in aircraft crew stations. – (U) Completed and transitioned the knowledge base for the intelligent processing of a high temperature polymeric matrix composite material (AFR700B) to industry. – (U) Developed materials specification for high modulus, thin gage organic matrix composite materials for use in satellite thermal control and structural applications.
– (U) $5,139	Develop affordable lightweight metallic materials that are considerably lighter than conventional aluminum and can withstand higher temperatures than currently available materials. Applications are in lighter aircraft and spacecraft structural components, and in high temperature, high performance engine components. – (U) Completed preliminary characterization of the mechanical properties of titanium matrix composite for use as actuator rods for advanced turbine engine exhaust components. – (U) Determined the ranges for two intermetallic precipitates and their effects on the fracture behavior of an advanced titanium alloy for use in aircraft structural applications.
– (U) $3,848	Develop ceramic matrix composites and very high temperature metallics to enable revolutionary performance improvements in advanced propulsion systems and high temperature airframe structures. – (U) Developed new materials and processes for the repair of ceramic matrix composites (CMC) for in aircraft and propulsion applications. Included development of CMC for repair technology and for space launch thermal protection applications. – (U) Developed and demonstrated a new class of thermal barrier coatings for turbine engine applications with the potential for improved stability, increased temperature capability, and reduced weight.
– (U) $19,724	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials

PROJECT NO. AND NAME
4347 Materials for Structures, Propulsion, and Subsystems

(U) FY 1996 ($ in Thousands):

- (U) $9,771 — Develop carbon-carbon and thermal protection material technologies to improve operational capability of strategic and tactical systems. These materials offer significant benefits in weight savings, dimensional stability, thermal conductivity properties which will lead to higher performance structures, and smaller radiators on aerospace systems and lighter and cooler space and aircraft electronics packages as well as the historical benefit of high temperature, extreme environmental shape retention.
  - (U) Develop and evaluate new nosetip, heatshield, and antenna window materials for fielded aging reentry vehicles.
  - (U) Validate advanced structural and thermal control composites and polymer-based protective coatings in space environments for carbon-carbon satellite and electronic thermal management.
- (U) $5,499 — Develop nonstructural materials (such as fluids, lubricants, seals, greases, and coatings) for improved system performance, reduced toxicity, and reduced life cycle costs.
  - (U) Complete laboratory demonstration of fire resistant, low temperature hydraulic fluid for all Air Force aircraft.
  - (U) Evaluate and demonstrate low solvent content low-observable coatings for aircraft.
- (U) $10,334 — Develop advanced nonmetallic composite structural materials for aircraft applications including lightweight airframes, control surfaces, aircraft canopies, smart skins, and engine compressor frames and ducts, and for spacecraft applications including lightweight trusses, struts, solar arrays, antenna supports, and bus structures. These materials technologies will offer significant benefits in weight savings compared with the use of traditional metallic counterparts.
  - (U) Demonstrate a low-cost (30% part cost savings) organic matrix composite process for aircraft and turbine engine applications.
  - (U) Complete laboratory demonstration of damage tolerant thermoplastic composite technology to secondary structural applications in advanced fighter aircraft.
  - (U) Investigate in-flight material fatigue life modeling and prediction for composite aircraft structures.
- (U) $8,805 — Develop affordable lightweight metallic materials that are considerably lighter than conventional aluminum and can withstand higher temperatures than currently available materials. Applications are in lighter aircraft and spacecraft structural components, more efficient space launch systems, and in high temperature, high performance engine components.
  - (U) Complete laboratory demonstration of gamma titanium aluminides for Integrated High Performance Turbine Engine Technology (IHPTET) demonstrator engines for 30% weight savings over superalloys.
  - (U) Complete mechanical testing of conventional titanium-matrix metal matrix composites (MMC) for establishing a data base and developing an analytical model to be used in design of MMCs.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials
PROJECT NO. AND NAME 4347 Materials for Structures, Propulsion, and Subsystems	

- (U) $9,752 Develop ceramic matrix composites and very high temperature metallics to enable revolutionary performance improvements in advanced propulsion systems and high temperature airframe structures.
  - (U) Evaluate the performance of a ceramic matrix composite for space launch applications.
  - (U) Demonstrate microlaminate thermal barrier coatings for superalloys with added 200°F thermal resistance with minimal (less than two percent) weight for turbine engine blades.
  - (U) Demonstrate in situ control of ceramic fiber matrix interface coatings for improved composite strength, toughness, and durability for turbine engine applications.
- (U) $44,161 Total

(U) FY 1997 ($ in Thousands):

- (U) $9,647 Develop carbon-carbon and thermal protection material technologies to improve operational capability of strategic and tactical systems. These materials offer significant benefits in weight savings, dimensional stability, thermal conductivity properties which will lead to higher performance structures, and smaller radiators on aerospace systems and lighter and cooler space and aircraft electronics packages as well as the historical benefit of high temperature, extreme environmental shape retention.
  - (U) Conduct ground test validation of alternate/replacement nosetip, heatshield, and antenna window materials and deliver models for flight test demonstration for ballistic missile upgrades.
  - (U) Develop one step carbon-carbon process for electronic packaging applications in aircraft and spacecraft.
- (U) $6,458 Develop nonstructural materials (such as fluids, lubricants, seals, greases, and coatings) for improved system performance, reduced toxicity, and reduced life cycle costs.
  - (U) Complete laboratory demonstration of polyalphaolefin (PAO)-based coolant with improved temperature stability and dielectric performance for Air Force airborne radar systems.
  - (U) Identify advanced lubricants and coating system technologies for application in spacecraft moving mechanical assemblies.
- (U) $10,221 Develop advanced nonmetallic composite structural materials for aircraft applications including lightweight airframes, control surfaces, aircraft canopies, smart skins, and engine compressor frames and ducts, and for spacecraft applications including lightweight trusses, struts, solar arrays, antenna supports, and bus structures. These materials and processing technologies will offer significant benefits in weight savings compared with the use of traditional metallic counterparts.
  - (U) Publish a composite patch design guide based on spline variation elastic theory for the repair and life extension of aging aircraft.
  - (U) Demonstrate the viability of high modulus polymeric composites for lightweight spacecraft structural applications.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials

PROJECT NO. AND NAME
4347 Materials for Structures, Propulsion, and Subsystems

- (U) $8,932 Develop affordable lightweight metallic materials that are considerably lighter than conventional aluminum and can withstand higher temperatures than currently available materials. Applications are in lighter aircraft and spacecraft structural components, more efficient space launch systems, and in high temperature, high performance engine components.
  - (U) Complete material validation of titanium metal matrix composite (Ti MMC) actuator rods for use on thrust vectoring nozzles of advanced turbine engines.
  - (U) Demonstrate the application potential of an advanced Ti MMC for use in next-generation gas turbine engines.
  - (U) Demonstrate proper processing routes for producing isotropic aluminum lithium thick plate products from 15,000 pound ingots for weight reduction and replacement of aluminum in aircraft and spacecraft structures.
  - (U) Perform initial high cycle fatigue (HCF) evaluations of titanium alloy to provide guidance on resolving HCF issues with existing and future Air Force turbine engines.
- (U) $8,819 Develop ceramic matrix composites and very high temperature metallics to enable revolutionary performance improvements in advanced propulsion systems and high temperature airframe structures.
  - (U) Develop low-cost ceramic matrix processes that can reduce the cost of these composites by 40% of today's cost.
  - (U) Develop repair materials for low-observable and other ceramic composite structures.
- (U) $44,077 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials

PROJECT NO. AND NAME
4347 Materials for Structures, Propulsion, and Subsystems

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	21,337	45,918	45,171	Cont
(U) Current Budget Submit	19,724	44,161	44,077	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increases are due to additional emphasis on improved materials, space systems, and aging aircraft. Part of Project 06ML, Laboratory Operations, funding incorporated in this project after FY 1995.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0603112F, Advanced Materials for Weapon Systems.
- (U) PE 0603211F, Aerospace Systems.
- (U) PE 0603202F, Aeropropulsion Subsystem Integration.
- (U) PE 0603216F, Aeropropulsion and Power Technology.
- (U) DOD Metal Matrix Composite Steering Group.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials

PROJECT NO. AND NAME
4348 Materials for Electronics, Optics, and Survivability

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4348 Materials for Electronics, Optics, and Survivability	6,435	13,322	13,473	13,888	14,580	15,044	16,177	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops materials technologies for optical and electro-optical devices and subsystems for aircraft, missile, and space systems. This project also develops new materials for protection of aircrews, sensors, aircraft, and space systems from laser threats. Radar modules, microwave devices, infrared (IR) detectors, photonics, and optical processors are used in target detection, data processing, electronic warfare, and communications. The performance of these systems is constrained by the quality and physical characteristics of these materials. New materials are developed that improve the production quality and rates to develop advanced electronic and optical materials that offer higher operating speeds, greater bandwidth density, improved thermal management, greater sensitivity, and expanded dynamic range. Protection from lasers is dependent upon the wavelength, whether the wavelength is pulsed or continuous, the ability of the enemy to vary the wavelength, as well as the susceptibility of the system. Materials are developed that can withstand the high laser temperature gradients, reject damaging wavelengths, or lower response thresholds, and/or response times.

(U) FY 1995 ($ in Thousands):

- (U) $4,212 Develop new electronic and electromagnetic materials for improved microwave and microelectronic technology for radar, communications, and optical signal processing systems. Developments will offer lower cost and higher performance systems capable of operating in more demanding thermal, atmospheric, and electromagnetic environments.
  - (U) Demonstrated epitaxial growth processing of silicon carbide semiconductors, making its processing comparable to conventional semiconductor materials.
  - (U) Demonstrated diamond and optical anti-reflective on IR windows which maximize sand erosion resistance for high-speed aircraft and missile applications.
- (U) $2,223 Develop materials to enhance the survivability of aircrews and sensor systems against laser threats. These materials will prevent costly systems losses or damage from laser irradiation.
  - (U) Identified candidates mid-wave nonlinear absorption in organic material complexes for protection of night vision systems.
  - (U) Assessed material performance limits of spatial light modulators for variable reflectance mirrors in sensor and personnel protection applications.
  - (U) Demonstrated switchable reflection-based filter using polymer-dispersed, liquid crystal-based switchable holographic filters in visors for personal protection from lasers.
- (U) $6,435 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials

PROJECT NO. AND NAME
4348 Materials for Electronics, Optics, and Survivability

(U) FY 1996 ($ in Thousands):

- (U) $10,050 Develop new electronic and electromagnetic materials for improved microwave and microelectronics technology for radar, communications, and optical signal processing systems. Developments will offer lower cost and higher performance systems capable of operating in more demanding thermal, atmospheric, and electromagnetic environments.
  - (U) Demonstrate a semiorganic frequency conversion crystal source for blue laser applications (double transfer rates or storage capabilities of red laser).
  - (U) Complete durable long wave infrared (LWIR) window materials effort.
  - (U) Demonstrate high temperature microwave electronic materials for uncooled radar and avionics applications.
- (U) $3,272 Develop materials to enhance the survivability of aircrews and sensor systems against laser threats. These materials will prevent costly systems losses or damage from laser irradiation.
  - (U) Demonstrate a low-energy threshold midwave infrared semiconductor nonlinear absorber for sensor protection.
  - (U) Complete laboratory demonstration of first generation switchable hologram materials for application into switchable filters used in visible and near-infrared sensor protection.
- (U) $13,322 Total

(U) FY 1997 ($ in Thousands):

- (U) $9,855 Develop new electronic and electromagnetic materials for improved microwave and microelectronics technology for radar, communications, and optical signal processing systems. Developments will offer lower cost and higher performance systems capable of operating in more demanding thermal, atmospheric, and electromagnetic environments.
  - (U) Demonstrate a high temperature superconducting infrared detector material that would not require cryogenic cooling for specialized space applications.
  - (U) Demonstrate enhanced operability and resolution of long wavelength focal plane arrays for space imagery for space imagery and tracking through the development of very low defect detector materials.
  - (U) Develop electronic materials that couple digital and optical data transfer on a single chip.
- (U) $3,618 Develop materials to enhance the survivability of aircrews and sensor systems against laser threats. These materials will prevent costly systems losses or damage from laser irradiation.
  - (U) Develop candidate mid-infrared, nonlinear materials and evaluate for use in tunable filter technology for laser protection devices.
  - (U) Complete laboratory demonstration of first generation, nonlinear organic materials for application into optical power limiters used in visible and near-infrared personnel and sensor protection.
- (U) $13,473 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials

PROJECT NO. AND NAME
4348 Materials for Electronics, Optics, and Survivability

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	6,933	13,852	13,626	Cont
(U) Current Budget Submit	6,435	13,322	13,473	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this PE since the previous President's Budget are due to budget restraints and priorities within the Science and Technology (S&T) Program. Horizontal increases are due to additional emphasis on improved materials and aging aircraft. Part of Project 06ML, Laboratory Operations, funding incorporated in this project after FY 1995.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. **Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603112F, Advanced Materials for Weapon Systems.
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603211F, Aerospace Systems.
- (U) Tri-Service Laser Hardening Materials and Structures Group.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. **Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials

PROJECT NO. AND NAME
4349 Materials Technology for Sustainment

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4349 Materials Technology for Sustainment	9,651	14,200	14,810	15,269	16,037	16,543	17,770	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops materials to provide operational support to Air Force mission areas by providing technologies to inspect the quality of delivered systems, transitioning more reliable and maintainable materials, establishing capability to detect and characterize performance threatening defects, eliminating the dependency on hazardous and toxic materials in repair and maintenance, and providing quick reaction support to the operational commands and repair centers. Non-destructive inspection/evaluation (NDI/E) methods are essential to ensure optimum quality in the design and production of aircraft, spacecraft, propulsion, and missile systems. NDI/E methods are essential to monitor and detect the onset of any service-initiated damage and/or deterioration. This project develops techniques that increase the capability and reliability of currently used methods to detect and characterize performance threatening defects in metallic and nonmetallic composite structures.

(U) FY 1995 ($ in Thousands):

- (U) $2,366 Develop NDI/E technologies to evaluate and characterize damage in complex, low-observable materials and structures. Develop NDI/E technologies to inspect and maintain integrity of aging aircraft and missile structures and aeropropulsion systems. NDI/E capability improvements are essential to ensure optimum quality in design, production, and maintenance of Air Force aircraft and missile weapon systems.
  - (U) Identify potential NDI/E technologies for the characteristics of low-observable structures.
  - (U) Developed a microfocus x-ray source for high energy tomoscope.
  - (U) Identified corrosion and crack detection characterization technologies for the inspection of airframe structures.
  - (U) Demonstrated NDI/E technologies for the characterization of fiber-reinforced composite materials and structures.
- (U) $7,285 Develop support capabilities, information, and processes to resolve problems in the use of materials or in conducting failure analysis of components. Develop a materials database for transition of materials to aerospace systems. Maintain a handbook and develop guidelines for materials repair of aircraft structures.
  - (U) Identified heat damage assessment NDI needs for composite structures.
  - (U) Developed outline for composite repair guide.
  - (U) Investigated and defined current state-of-the-art for field level composite repairs.
  - (U) Developed non-destructive technologies to determine adhesive bondline thickness on repair patches.
  - (U) Evaluated scratch resistant coating technologies for Air Force pilot visors.
  - (U) Determined behavior of primers on aluminum substrates for guiding metal to metal structural adhesive bonding development.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials
PROJECT NO. AND NAME 4349 Materials Technology for Sustainment	

– (U) $9,651 Total

(U) FY 1996 ($ in Thousands):

– (U) $4,969 Develop non-destructive inspection/evaluation (NDI/E) technologies to evaluate and characterize damage in complex, low-observable materials and structures. Develop NDI/E technologies to inspect and maintain integrity of aging aircraft and missile structures and aeropropulsion systems. NDI/E capability improvements are essential to ensure optimum quality in design, production, and maintenance of Air Force aircraft and missile weapon systems.
  – (U) Demonstrate corrosion characterization technologies for the inspection of transport and refueling aircraft.

– (U) $9,231 Develop support capabilities, information, and processes to resolve problems in the use of materials or in conducting failure analysis of components. Develop a materials database for transition of materials to aerospace systems. Maintain a handbook and develop guidelines for materials repair of aircraft structures.
  – (U) Develop advanced surface cleaning and surface preparation for removal of aircraft paints.
  – (U) Develop advanced heat blanket repair concept for large area (greater than ten square feet) composite patches.

– (U) $14,200 Total

(U) FY 1997 ($ in Thousands):

– (U) $5,232 Develop NDI/E technologies to evaluate and characterize damage in complex, low-observable materials and structures. Develop NDI/E technologies to inspect and maintain integrity of aging aircraft and missile structures and aeropropulsion systems. NDI/E capability improvements are essential to ensure optimum quality in design, production, and maintenance of Air Force aircraft and missile weapon systems.
  – (U) Develop corrosion and crack detection characterization technologies for the inspection of airframe structures.
  – (U) Demonstrate NDI/E technologies for the characterization of fiber-reinforced composite materials and structures.
  – (U) Develop NDI/E technologies for the characterization of low-observable materials and structures.

– (U) $9,578 Develop support capabilities, information, and processes to resolve problems in the use of materials or in conducting failure analysis of components. Develop a materials database for transition of materials to aerospace systems. Maintain a handbook and develop guidelines for materials repair of aircraft structures.
  – (U) Demonstrate an advanced non-chromate treatment for corrosion resistance and surface hardening in aircraft structural materials.
  – (U) Demonstrate technology for improved composite repairs and composite repairs on metals.
  – (U) Demonstrate improved non-hazardous cleaning techniques for liquid oxygen lines and solid state electronics.
  – (U) Evaluate technologies and material candidates for a biodegradable chaff.
  – (U) Develop alternative alternative paint/depaint technologies to reduce or eliminate volatile organic compounds

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602102F Materials
PROJECT NO. AND NAME 4349 Materials Technology for Sustainment	

– (U) $14,810 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	10,665	14,764	14,524	Cont
(U) Current Budget Submit	9,651	14,200	14,810	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increases are due to additional emphasis on improved materials, space systems, and aging aircraft. Part of Project 06ML, Laboratory Operations, funding incorporated in this project after FY 1995.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0603112F, Advanced Materials for Weapons Systems.
- (U) PE 0603211F, Aerospace Structures.
- (U) PE 0603211F, Aerospace Systems.
- (U) Office of Science and Technology Committee Materials Working Group on Non-Destructive Materials.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	56,755	60,947	65,080	67,212	70,085	71,964	75,442	Continuing	Continuing
06FF Directorate Operations	32,998	0	0	0	0	0	0	Continuing	Continuing
2401 Structures	6,129	15,836	16,074	16,601	17,312	17,775	18,634	Continuing	Continuing
2402 Vehicle Equipment	4,371	11,296	11,458	11,827	12,332	12,663	13,274	Continuing	Continuing
2403 Flight Controls and Advanced Cockpits	7,603	19,642	19,979	20,635	21,517	22,095	23,163	Continuing	Continuing
2404 Aeromechanics and Integration	5,654	12,034	15,356	15,863	16,540	16,983	17,804	Continuing	Continuing
4397 Air Base Technology	0	2,139	2,213	2,286	2,384	2,448	2,567	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Applied Research program develops the air vehicle technology base in aeromechanics, structures, flight control, cockpits, vehicle subsystems, and air base operability to reduce life cycle costs and improve performance of existing and future air vehicles and air bases. These air vehicle technology programs offer: increased reliability, maintainability, and supportability for air vehicles, subsystems, and air base operability; all-weather, day/night operations. FY 1996 program funding increase is due to programs in support of the Air Force Aging Aircraft initiative and the shift of Air Base Technology, now Project 4397 from PE 0602206F, Project 2673. Starting in FY 1996, separate infrastructure projects have been eliminated. All efforts in this program element contain the resources necessary, including civilian salaries, to manage, conduct, and document the technical activities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	59,715	66,268	64,254	Cont
(U) Appropriated Value	60,946	63,100		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-2,754	-1,222		
b. SBIR	-621	-649		
c. Omnibus/Other Above Threshold Reprogrammings	-645	-282		
d. Below Threshold Reprogramming	-171			
(U) Current Budget Submit	56,755	60,947	65,080	Cont

(U) Change Summary Explanation:

Funding: Vertical decreases in FY 1995 and FY 1996 from the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. The horizontal increase from FY 1995 to FY 1996 is due to assumption of responsibility for air base technology efforts previously conducted under PE 0602206F, Project 2673. The horizontal and vertical increases in FY 1997 are due to added emphasis of aerospace flight dynamics technologies which support the Air Force's aging aircraft and affordability initiatives.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

2 - Applied Research | **0602201F Aerospace Flight Dynamics**

PROJECT NO. AND NAME
06FF Directorate Operations

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
06FF Directorate Operations	32,998	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project provides for the management, support, and operation of the Flight Dynamics Directorate of Wright Laboratory, Wright-Patterson AFB, OH. It provides for: the pay and related costs for civilian scientists, engineers, and support personnel; transportation of equipment; communications and utilities costs; travel; and procurement of supplies, equipment, and support services.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	32.958	0	0	Cont
(U) Current Budget Submit	32,998	0	0	Cont

(U) Change Summary Explanation:

Funding: Changes due to redistribution of this project into the technical projects beginning in FY 1996.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

PROJECT NO. AND NAME
2401 Structures

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2401 Structures	6,129	15,836	16,074	16,601	17,312	17,775	18,634	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project develops more supportable and survivable aircraft structures technologies; investigates new structural concepts and design techniques which exploit new materials and fabrication processes to strengthen air vehicle structures while reducing weight and cost; and develops "smart" structures that will have embedded sensors to report stress, fatigue, and/or battle damage, leading to improved maintainability.

(U) FY 1995 ($ in Thousands):

- (U) $3,840 Develop advanced metallic and composite structural concepts and design techniques for air vehicles.
  - (U) Developed analytical designs for active vibration control, using piezoelectric damping layers, increasing aircraft lifetime.
  - (U) Released to the Navy and industry the Automated Structural Optimization System for aircraft design optimization.
  - (U) Developed aircraft health monitoring sensor capability to reduce maintenance and aid reconfiguration in the event of battle damage.
- (U) $2,289 Develop structural life enhancement methods to ensure the structural integrity of both metallic and composite repairs.
  - (U) Fatigue tested a micro-channel heat exchanger for exhaust-washed structures to more efficiently cool high-temperature structures.
  - (U) Developed a personal-computer-based risk analysis model for aging aircraft life extension.
- (U) $6,129 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

PROJECT NO. AND NAME
2401 Structures

(U) FY 1996 ($ in Thousands):

- (U) $3,325 Develop advanced structural concepts and design techniques for performance enhancement through distributed vibration suppression, wing warping and camber shaping and for enhanced affordability and survivability of upgraded and derivative aircraft.
  - (U) Develop "smart stiffness" approaches and systems to maneuver flight vehicles by means of wing warping, without conventional separate control surfaces, to reduce aircraft weight, drag, and radar signature, and to alleviate fighter aircraft vertical tail buffet and fatigue damage.
  - (U) Develop multidisciplinary structural design methodology to reduce fighter aircraft gross weight.
- (U) $12,511 Improve durability of existing stealth vehicles structures operating in extreme environments and extend usable structural lives of aging aircraft through proven techniques that account for life, risk repairs, and dynamic loads.
  - (U) Develop concepts for low-observable exhaust washed structures that significantly increase aircraft life and develop active/passive heat transfer techniques which increase durability and reduced infrared signature.
  - (U) Develop preliminary corrosion analysis metrics to assess corrosion fatigue effects on inspection and maintenance intervals.
  - (U) Develop analysis techniques for predicting structural component life accounting for widespread fatigue damage and develop methodologies for calculating stress intensities of cracked structural components.
  - (U) Develop advanced predictive methods to control flutter and avoid structural damage and to enable active aeroelastic wing for improved maneuverability.
- (U) $15,836 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics
PROJECT NO. AND NAME 2401 Structures	

(U) FY 1997 ($ in Thousands):

- (U) $550 Develop structures incorporating distributed vibration suppression and wing warping or camber shaping.
  - (U) Continue testing of embedded, distributed vibration suppression techniques for aircraft structures.
  - (U) Continue testing "smart stiffness" wing warping concepts.
- (U) $2,327 Develop advanced structural concepts and design methods that will enhance affordability and survivability of upgraded/derivative aircraft..
  - (U) Fabricate composite structures to demonstrate potential for 50% manufacturing cost savings and improved battle damage tolerance over existing structures.
  - (U) Develop analytical techniques to provide structural flutter clearance for new store configurations on existing aircraft in lieu of expensive flight testing.
- (U) $11,798 Extend usable structural lives of aging aircraft through proven techniques that account for life, risk, repairs, and dynamic loads.
  - (U) Develop corrosion analysis metrics to assess corrosion fatigue effects on inspection and maintenance intervals.
  - (U) Develop crack growth analysis techniques that include widespread fatigue damage to predict structural component service life.
  - (U) Develop techniques for analyzing bonded composite repairs of metallic structures, eliminating riveted/bolted metal repair patches.
  - (U) Develop and demonstrate weapon bay acoustic suppression system to increase the performance envelope of current and future air vehicles.
- (U) $1,399 Improve durability for existing stealth vehicles structures operating in extreme environments such as temperature, noise, and vibration caused by engine exhaust.
  - (U) Develop concepts for low -observable ceramic composite exhaust structures of stealth vehicles that significantly increase life and decrease costs.
  - (U) Develop structural temperature control concepts to reduce infrared signature of current fleet.
- (U) $16,074 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics
PROJECT NO. AND NAME 2401 Structures	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	6,129	16,397	15,927	Cont
(U) Current Budget Submit	6,129	15,836	16,074	Cont

(U) Change Summary Explanation:

Funding: Vertical decrease in FY 1996 from the previous President's Budget is due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase from FY 1995 to FY 1996 reflects the incorporation of infrastructure costs within the project and the added emphasis on structures technologies to support Air Force initiatives. The horizontal and vertical increases in FY 1997 are due to added emphasis of structures technologies which support the Air Force's aging aircraft and affordability initiatives.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602269F, Hypersonic Technology Development.
- (U) PE 0603211F, Aerospace Structures.
- (U) PE 0603112F, Advanced Materials for Weapon Systems.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

PROJECT NO. AND NAME
2402 Vehicle Equipment

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2402 Vehicle Equipment	4,371	11,296	11,458	11,827	12,332	12,663	13,274	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops technologies to reduce subsystem and component life cycle costs, improve vehicle/crew member survival in operational environments, and improve subsystem performance for current and future flight vehicles.

(U) FY 1995 ($ in Thousands):

- (U) $3,365 Demonstrate technologies that increase performance, supportability, and affordability of air vehicle subsystems.
  - (U) Tested a microencapsulated phase changing material which controls heat reduction paths and simplifies aircraft cooling subsystems.
  - (U) Completed analysis and development of aircraft windshield testing methods to measure increased maintainability and survivability.
  - (U) Characterized a relationship between plastic windshield aging, mechanical loading, and heat exposure.
  - (U) Identified aircraft release separation improvements for placement of cargo from high altitude air drops.
- (U) $1,006 Develop and demonstrate technologies that increase air vehicle survivability and crew member safety.
  - (U) Developed two-body separation computational techniques to provide an analytical assessment of the aerodynamic stability improvements achieved through careful integration of advanced aircraft escape subsystems with airframe designs.
- (U) $4,371 Total

(U) FY 1996 ($ in Thousands):

- (U) $8,140 Demonstrate technologies that increase performance, supportability, and affordability of air vehicle subsystems.
  - (U) Design, fabricate, and test micro-scale heat transfer devices to reduce weight and improve performance of internal aircraft temperature control systems
  - (U) Conduct studies on improving windshield resistance to electrostatic charge damage.
  - (U) Develop design criteria for next generation aircraft transparencies which yield improved protection and increased service life.
  - (U) Develop and demonstrate conceptual design methods to compute the optimum air release point for delivery of cargo from high altitude air drops.
- (U) $3,156 Develop technologies that increase air vehicle survivability and safety.
  - (U) Develop innovative concepts and design tools to evaluate the aerodynamics performance during high-speed separation of integrated escape subsystems and vehicle airframes.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics
PROJECT NO. AND NAME 2402 Vehicle Equipment	

- (U) $11,296 Total

(U) FY 1997 ($ in Thousands):

- (U) $3,094 Develop and demonstrate component damage repair technologies that increase air vehicle survivability
  - (U) Continue development of experimental techniques and analytical tools to define effects of various ballistic threats against various structural components.
- (U) $2,979 Develop subsystem technologies to enhance air vehicle protection and survivability.
  - (U) Develop abrasion-resistant coating for next generation injection molded transparencies to fabricate single-piece canopies for increased affordability and a factor of five reduction in life cycle costs.
  - (U) Develop capability to conduct transparency tests that determine degradation of performance and supportability.
  - (U) Develop methodology to alleviate transparency electrostatic discharge to reduce degradation and life cycle costs.
  - (U) Demonstrate two-body separation computational techniques to model high-speed aircraft escape subsystem performance.
- (U) $2,750 Develop and demonstrate technologies for aircraft internal thermal energy management systems.
  - (U) Complete initial concept demonstrator for subsystems integrated design assessment technology.
  - (U) Fabricate and test thermal system composite materials components to achieve 50% reduction in weight and size.
  - (U) Design and test enhanced heat exchanger model to improve aircraft temperature control system performance.
- (U) $2,635 Develop and demonstrate landing gear systems for improving performance and supportability of air vehicle subsystems.
  - (U) Develop and demonstrate scientific methods for predicting and measuring landing gear stability.
  - (U) Develop lightweight landing gear technology to gain overall aircraft performance and efficiency.
- (U) $11,458 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics
PROJECT NO. AND NAME 2402 Vehicle Equipment	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,371	11,694	11,359	Cont
(U) Current Budget Submit	4,371	11,296	11,458	Cont

(U) Change Summary Explanation:

Funding: Vertical decrease in FY 1996 from the previous President's Budget is due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase from FY 1995 to FY 1996 reflects the incorporation of infrastructure costs within the project and the added emphasis on vehicle equipment technologies to support Air Force initiatives. The horizontal and vertical increases in FY 1997 are due to added emphasis of vehicle equipment technologies which support the Air Force's aging aircraft and affordability initiatives.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0603106F, Logistics System Technology.
- (U) PE 0603205F, Flight Vehicle Component and Subsystem Technologies.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0603245F, Flight Vehicle Technology Integration.
- (U) PE 0604212F, Aircraft Equipment Development.
- (U) PE 0604609F, Reliability and Maintainability Technology Insertion Program.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

PROJECT NO. AND NAME
2403 Flight Controls and Advanced Cockpits

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2403 Flight Controls and Advanced Cockpits	7,603	19,642	19,979	20,635	21,517	22,095	23,163	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops technology to enable the pilot to obtain maximum performance from the aircraft under all conditions, provide the pilot with the display of information from on-board subsystems and off-board intelligence sources for increased situational awareness leading to enhanced mission performance and flight safety, provide robust capability to control aircraft after damage and failures, and network synthetic environments for simulation evaluation of advanced concepts.

(U) FY 1995 ($ in Thousands):

- (U) $6,006 Develop advanced flight control concepts to provide a combat advantage for 21st century aircraft by increasing performance and survivability while decreasing cost and supportability requirements.
  - (U) Developed and verified the Standard Evaluation Maneuver Set (STEMS) for flying qualities on military aircraft.
  - (U) Demonstrated applicability of alternative aerodynamic control effectors for reduced/no vertical rudder configurations.
  - (U) Conducted flight simulations to support flying quality analysis techniques development.
  - (U) Developed an advanced rotary actuator for primary control surfaces on aircraft with very thin wings.
- (U) $1,597 Develop technologies for improved situational awareness and supportability of current and future aircraft cockpits.
  - (U) Developed and tested two-dimensional audio cueing and helmet-mounted symbology to reduce the amount of time required to visually detect and identify airborne threats.
- (U) $7,603 Total

(U) FY 1996 ($ in Thousands):

- (U) $14,981 Develop advanced flight control concepts to provide a combat advantage for advanced aircraft by increasing performance and survivability while decreasing cost and supportability requirements.
  - (U) Conduct wind tunnel tests of innovative combinations of control effectors (e.g., pop-up controls, wing flexing controls, pneumatic controls) providing safe and effective control for air vehicles to realize signature, affordability, and controllability benefits.
  - (U) Develop aircraft evaluation techniques to support development of criteria for the design of flight control systems that prevent pilot-induced control problems.
  - (U) Continue to develop and demonstrate promising actuator technology for flight critical control surfaces of advanced aircraft.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

PROJECT NO. AND NAME
2403 Flight Controls and Advanced Cockpits

- (U) $4,998 Develop pilot-vehicle interface technologies for enhanced situational awareness and supportability of current and future aircraft cockpits.
  - (U) Develop and conduct pilot-in-the-loop tests of state-of-the-art information display formats and controls to enhance situational awareness and optimize workload.
  - (U) Develop initial concepts for cockpit information fusion of multiple data sources for increased mission effectiveness in future air battles.
  - (U) Develop and evaluate preliminary design of two-person large aircraft cockpit concepts to reduce crew size and life-cycle costs.
- (U) $19,979 Total

(U) FY 1997 ($ in Thousands):

- (U) $5,100 Develop and demonstrate advanced flight control techniques to provide air combat advantage by increasing performance and survivability while decreasing cost and supportability requirements.
  - (U) Continue developing advanced control concepts such as advanced actuators and wing flexing.
  - (U) Develop central control system to support groups of manned and unmanned aircraft to increase mission effectiveness and attack options.
- (U) $4,825 Develop new flight control design methods and criteria that provide air combat advantage by increasing performance and survivability while decreasing cost.
  - (U) Select and evaluate reconfigurable flight control techniques which allow battle damaged, reduced signature aircraft to fly safely.
  - (U) Develop criteria and design standards for flight control systems that prevent pilot-induced control problems and improve handling qualities.
- (U) $3,344 Develop advanced cockpit decision aids to improve aircrew productivity and enhance mission effectiveness.
  - (U) Develop and evaluate state-of-the-art information display formats and controls to enhance situational awareness and increase aircrew effectiveness.
  - (U) Conduct testing of cockpit information fusion with multiple data sources for increased mission effectiveness in future air battles.
- (U) $3,861 Develop capabilities to evaluate ways to increase performance and survivability while decreasing cost and supportability requirements.
  - (U) Develop techniques incorporating long distance networking to support modeling of close-in and high angle-of-attack air combat.
- (U) $2,849 Demonstrate enhanced cockpits to improve weapon system performance through the integration of new pilot-vehicle interface technologies.
  - (U) Develop cockpit display capabilities allowing two-person, large aircraft cockpits to access threat intelligence information in-flight.
  - (U) Develop cockpit display technologies for single-seat fighter-bombers operating in high threat environments.
- (U) $19,979 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

PROJECT NO. AND NAME
2403 Flight Controls and Advanced Cockpits

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	7,603	20,336	19,755	Cont
(U) Current Budget Submit	7,603	19,642	19,979	Cont

(U) Change Summary Explanation:

Funding: Vertical decrease in FY 1996 from the previous President's Budget is due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase from FY 1995 to FY 1996 reflects the incorporation of infrastructure costs within the project and the added emphasis on flight controls and advanced cockpits technologies to support Air Force initiatives. The horizontal and vertical increases in FY 1997 are due to added emphasis of flight controls and advanced cockpits technologies which support the Air Force's aging aircraft and affordability initiatives.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603205F, Flight Vehicle Component and Subsystems Technology.
- (U) PE 0603245F, Flight Vehicle Technology Integration.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

PROJECT NO. AND NAME
2404 Aeromechanics and Integration

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2404 Aeromechanics and Integration	5,654	12,034	15,356	15,863	16,540	16,983	17,804	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops aerodynamic design integration technologies for current and future flight vehicles, focusing on speed regimes ranging from low to high Mach. These technologies have potential to reduce cost, improve range to yield enhanced global force projection, improve maneuverability, and reduce observability. This project integrates technologies into air vehicle concepts and develops design assessment and analysis tools.

(U) FY 1995 ($ in Thousands):

- (U) $3,505 Develop affordable technologies to increase aerodynamic performance and survivability through reduced drag, improved fuel fraction, enhanced maneuverability and control, and reduced signature.
  - (U) Completed a preliminary study of advanced, low-cost, compact inlets to increase mission range of combat aircraft.
  - (U) Evaluated high-payoff aerodynamic concepts for affordable, survivable transport aircraft.
  - (U) Investigated concepts for increasing aerodynamic efficiency of air vehicles to increase combat aircraft mission range.
  - (U) Prepared designs for advanced fluidic thrust vectoring nozzles which lower costs and reduce signatures.
- (U) $2,149 Develop and demonstrate numerical methods and technologies for a more efficient approach to aircraft design.
  - (U) Completed conceptual development for aerodynamic design optimization code for aircraft performance and survivability.
  - (U) Developed numerical database of front-line Air Force air vehicles to permit rapid evaluations of and solutions for aerodynamic deficiencies of operational and developmental aircraft.
  - (U) Developed mathematical methods to numerically characterize aerodynamic and structural interactions in aging aircraft and advanced flight vehicles.
- (U) $5,654 Total

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2 - Applied Research	0602201F Aerospace Flight Dynamics

PROJECT NO. AND NAME
2404 Aeromechanics and Integration

(U) FY 1996 ($ in Thousands):

- (U) $9,977 Develop and demonstrate affordable technologies to increase aerodynamic performance and survivability through reduced drag, improved fuel fraction, enhanced maneuverability and control, and reduced signature.
  - (U) Develop advanced, low-cost, compact engine inlets to increase mission range of combat aircraft.
  - (U) Develop low-drag/low-observable weapons pod concepts for increasing weapons payload and air vehicle range.
  - (U) Develop conceptual designs for advanced, fluidic, low-cost, reduced signature thrust-vectoring nozzles.
  - (U) Develop high-payoff aerodynamic concepts that significantly extend combat aircraft mission range.
  - (U) Investigate concepts and design criteria for intermediate-range, fast reaction strike flight vehicles which minimize thermal protection system weight and total system cost.
  - (U) Develop high-lift devices to reduce landing/take-off distances of affordable, survivable transport aircraft.
- (U) $2,057 Develop and demonstrate numerical technologies to reduce the time required to field aircraft designs and modifications while increasing performance and reducing signature.
  - (U) Develop and demonstrate rapid, accurate algorithms to predict aerodynamic performance in order to evaluate advanced, affordable air vehicle designs.
  - (U) Develop mathematical models of aerodynamic and structural interactions in aging aircraft and advanced flight vehicles.
  - (U) Develop and demonstrate new methods of aerodynamic design optimization for aircraft performance and survivability.
- (U) $12,034 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics
PROJECT NO. AND NAME 2404 Aeromechanics and Integration	

(U) FY 1997 ($ in Thousands):

- (U) $9,081 Develop and demonstrate affordable technologies to increase aerodynamic performance and survivability through reduced drag, improved fuel fraction, enhanced maneuverability and control, and reduced signature.
  - (U) Complete advanced, low-cost, compact engine inlet designs to increase mission range of combat aircraft.
  - (U) Complete advanced concept development for fluidic, low-cost, reduced signature, thrust-vectoring nozzles.
  - (U) Complete study of high-lift aerodynamic concepts to reduce landing /take-off distances for affordable, survivable transport aircraft.
  - (U) Complete conceptual development of low-drag/low-observable weapons pod and carriage concepts to increase weapons payload and air vehicle range.
  - (U) Develop concepts and design criteria for advanced, affordable, intermediate-range, manned and unmanned aircraft to provide fast reaction strike capability.
  - (U) Investigate methods for reducing aeroacoustic damage in aircraft twin nozzle installations to increase nozzle service life.
- (U) $3,027 Develop and demonstrate numerical technologies to reduce the time required to field aircraft designs and modifications while increasing performance and reducing signature.
  - (U) Complete aerodynamic design optimization code for analysis of aircraft performance and survivability.
  - (U) Continue development of mathematical models of aerodynamic and structural interactions in aging aircraft and advanced flight vehicles.
  - (U) Develop numerically-based design capability to support weapons certification, crew escape, and safe paratrooper operation.
  - (U) Develop and demonstrate rapid, accurate methods to predict aerodynamic performance to evaluate advanced, affordable air vehicle designs.
- (U) $3,248 Develop integrated concepts, design, and analysis tools for fixed wing air vehicles.
  - (U) Develop architecture for integrating air vehicle design methods for Air Force, Navy, NASA, and industry.
  - (U) Develop designs for baseline aircraft concepts and identify relevant technologies.
  - (U) Evaluate benefits of fixed wing technology goals to warfighter payoffs.
- (U) $15,356 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

PROJECT NO. AND NAME
2404 Aeromechanics and Integration

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,654	15,626	15,192	Cont
(U) Current Budget Submit	5,654	12,034	15,356	Cont

(U) Change Summary Explanation:

Funding: Vertical decrease in FY 1996 from the previous President's Budget is due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase from FY 1995 to FY 1996 reflects the incorporation of infrastructure costs within the project and the added emphasis on aeromechanics and integration technologies to support Air Force initiatives. The horizontal and vertical increases in FY 1997 are due to added emphasis of aeromechanics and integration technologies which support the Air Force's aging aircraft and affordability initiatives.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0603205F, Flight Vehicle Component and Subsystem Technologies.
- (U) PE 0603260F, Hypersonic Technology Development.
- (U) PE 0603245F, Flight Vehicle Technology Integration.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

PROJECT NO. AND NAME
4397 Air Base Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4397 Air Base Technology	0	2,139	2,213	2,286	2,384	2,448	2,567	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops technologies for fixed and bare base operations, including airfield pavements, energy systems, automation, air base survivability, air base recovery, protective systems, fire protection, and crash rescue. This project assumes the efforts started under PE 0602206F, Project 2673. This project supports the DOD Energy Program Memorandum (DEPPM) 91-2 to reduce energy usage and will reduce operations and maintenance (O&M) costs.

(U) FY 1995: Not Applicable.

(U) FY 1996 ($ in Thousands):

- (U) $1,291 Develop design criteria for improved bare base and fixed site applications (e.g., power and environmental utilities, survivable air base structures, and durable or repairable airfield surfaces).
  - (U) Develop new concepts for ground power generation such as solar, solid oxide, and commercial conversions for reduced size, weight, and cost and increased transportability.
  - (U) Develop deployable pavement evaluation methods and equipment for rapid evaluation of bare base and fixed site runway conditions.
  - (U) Develop lightweight composite deployable shelters to increase readiness and reduce airlift requirements.
- (U) $848 Develop aircraft and air base fire fighting technologies (e.g., clean, environmentally-safe, fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment techniques, and fire fighter training systems).
  - (U) Complete development of an environmentally acceptable (biodegradable and non-toxic) Aqueous Film Forming Foam for fire protection.
  - (U) Study the impact of JP-8 fuel on aircraft hangar fire protection requirements.
- (U) $2,139 Total

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2 - Applied Research	0602201F Aerospace Flight Dynamics
PROJECT NO. AND NAME 4397 Air Base Technology	

(U) FY 1997 ($ in Thousands):

- (U) $1394 Develop design criteria for improved bare base and fixed site applications (e.g., power and environmental utilities, survivable air base structures, and durable or repairable airfield surfaces).
  - (U) Continue development of concepts for lightweight composite material for deployable structures to increase readiness and reduce airlift requirements.
  - (U) Continue to develop new hardware concepts for advanced real-time pavement quality control and quality assurance tools.
  - (U) Develop new materials and manufacturing concepts for the construction of lightweight mats to be used in the creation of aircraft operating surfaces at deployment locations.
  - (U) Continue development of new concepts for ground power generation such as solar, solid oxide, and commercial conversions for reduced size, weight and cost and increased transportability.
- (U) $819 Develop aircraft and airbase fire fighting technologies (e.g., clean, environmentally-safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment techniques, and fire fighter training systems).
  - (U) Complete study of the impact of JP-8 fuel on aircraft hangar fire protection requirements
- (U) $2,213 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602201F Aerospace Flight Dynamics

PROJECT NO. AND NAME
4397 Air Base Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	2,215	2,021	Cont
(U) Current Budget Submit	0	2,139	2,213	Cont

(U) Change Summary Explanation:

Funding: Air base technology efforts previously performed in PE 0602206F, Project 2673, were transferred to this project in FY 1996. This project also includes infrastructure costs. The horizontal and vertical increases in FY 1997 are due to added emphasis of air base technologies.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0602206F, Civil Engineering and Environmental Quality.
- (U) PE 0603205F, Flight Vehicle Subsystem and Component Technologies.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0603307F, Air Base Operability Advanced Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

	COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	82,423	82,420	87,103	87,276	90,423	93,471	98,191	Continuing	Continuing
06ED	Laboratory Operations	2,191	0	0	0	0	0	0	Continuing	Continuing
06HT	Laboratory Operations	10,939	0	0	0	0	0	0	Continuing	Continuing
06MD	Laboratory Operations	27,592	0	0	0	0	0	0	Continuing	Continuing
1121	Training Development and Assessment Technology	3,257	0	0	0	0	0	0	Continuing	Continuing
1123	Manpower, Personnel, and Training Technology	11,807	21,301	20,830	21,061	22,380	23,275	24,304	Continuing	Continuing
1710	Logistics Technology	2,969	6,061	6,058	6,102	6,671	7,011	7,346	Continuing	Continuing
1900	Environmental Quality Technology	2,041	9,866	9,960	10,280	10,619	10,899	11,680	Continuing	Continuing
2673	Air Base Operability Technology	1,872	0	0	0	0	0	0	Continuing	Continuing
6302	Occupational and Environmental Toxic Hazards in Air Force Operations	1,963	0	0	0	0	0	0	Continuing	Continuing
6893	Manned Weapon System Effectiveness	609	0	0	0	0	0	0	Continuing	Continuing
7184	Crew Technology	4,831	24,362	29,221	28,681	29,219	30,113	32,164	Continuing	Continuing
7231	Safety and Aircrew Effectiveness in Mechanical Force Environments	2,446	0	0	0	0	0	0	Continuing	Continuing
7719	Force Acquisition and Distribution Technology	2,515	0	0	0	0	0	0	Continuing	Continuing

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
7755 Aircrew Physiology Technology	1,043	7,231	6,682	6,788	6,798	6,880	7,095	Continuing	Continuing
7757 Toxicology/Radiation/Noise Hazards	4,353	13,599	14,352	14,364	14,736	15,293	15,602	Continuing	Continuing
7930 Advanced Crew Technology	1,995	0	0	0	0	0	0	Continuing	Continuing

Note 1: Beginning in FY 1996, the three Applied Research PEs at Armstrong Laboratory (PE 0602202F, Human Systems Technology (Projects 06MD, 6302, 6893, 7184, 7231, 7755, 7757, and 7930); PE 0602205F, Personnel, Training, and Simulation (Projects 06HT, 1121, 1123, 1710, and 7719); and PE 0602206F, Civil Engineering and Environmental Quality (Projects 06ED, 1900, and 2673) have been combined into PE 0602202F. The total PE costs shown for FY 1995 reflect this consolidation. In addition, beginning in FY 1996, the three 06 accounts for laboratory operations (Projects 06ED, 06HT, and 06MD) have been redistributed into the technical projects. Also, beginning in FY 1996, Project 2673, Air Base Operability Technology, transfers from PE 0602206F to the Wright Laboratory PE 0602201F, Aerospace Flight Dynamics. All efforts in this program element contain the resources necessary, including civilian salaries, to manage, conduct, and document the technical activities.

Note 2: There are no new starts in this Program Element. Starting in FY 1996, Projects 1123, 7184, and 7757 reflect title changes and incorporation of work previously reported as follows: Project 1123: Title Change to: Manpower, Personnel, and Training Technology. Starting in FY 1996, this project incorporates work from Projects 1121 and 7719. Project 7184: Title Change to: Crew Technology. Starting in FY 1996, this project incorporates work from Projects 6893, a portion of 7231, and 7930. Project 7755: Title Change to: Aircrew Physiology Technology. Project 7757: Starting in FY 1996, this project incorporates work from Project 6302 and a portion of Project 7231.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development

(U) **A. Mission Description and Budget Item Justification:** This Applied Research program establishes technology feasibility and develops the technology base for Air Force human interface needs required for weapon systems, operational readiness, and environmental quality. The program addresses crew systems; manpower, personnel, training, and logistics; aerospace biodynamic investigation; occupational and environmental safety; and environmental compliance and site remediation.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	86,665	90,311	87,841	Cont
(U) Appropriated Value	88,550	86,911		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reduction	-4,292	-1,683		
b. SBIR	-899	-747		
c. Omnibus/Other Above Treshhold Reprogrammings	-938	-261		
d. Below Threshold Reprogrammings	+2	-1,800		
(U) Current Budget Submit	82,423	82,420	87,103	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this Program Element since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizonal increase in FY 1997 is due to increased emphasis on aircrew training technologies, technologies to support aging aircraft, and crew escape technologies.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 06ED Laboratory Operations

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
06ED Laboratory Operations	2,191	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project complements all other projects in this program element by providing for the management, support, and operations of the Armstrong and Wright Laboratories located at Tyndall AFB, FL. It provides for: the pay and related costs of civilian scientists, engineers, and support personnel; travel; transportation of equipment; rents; communications; utilities; laboratory supplies; unique equipment; and related costs.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,920	0	0	Cont
(U) Current Budget Submit	2,191	0	0	Cont

(U) Change Summary Explanation:

Funding: Changes due to redistribution of the three 06 accounts for laboratory operations (Projects 06ED, 06HT, and 06MD) into the technical projects beginning in FY 1996.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 06HT Laboratory Operations

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
06HT Laboratory Operations	10,939	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project provides for the management, support, and operations of the Human Resources Directorate of the Armstrong Laboratory. This Directorate has elements at: Brooks AFB, TX; Wright-Patterson AFB, OH; and Mesa, AZ. It provides for: the pay and related costs of civilian scientists, engineers, and support personnel; travel; transportation of equipment; rents; communications; utilities; laboratory supplies; unique equipment; and contractor support services.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	11,638	0	0	Cont
(U) Current Budget Submit	10,939	0	0	Cont

(U) Change Summary Explanation:

Funding: Changes due to redistribution of the three 06 accounts for laboratory operations (Projects 06ED, 06HT, and 06MD) into the technical projects beginning in FY 1996.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 06MD Laboratory Operations

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
06MD Laboratory Operations	27,592	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project provides for the management, support, and operations of the Aerospace Medicine, Crew Systems, and Occupational and Environmental Health Directorates of the Armstrong Laboratory It provides for: the pay and related costs of civilian scientists, engineers, and support personnel; travel; transportation of equipment; rents; communications; utilities; laboratory supplies; unique equipment; and related costs.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	28,162	0	0	Cont
(U) Current Budget Submit	27,592	0	0	Cont

(U) Change Summary Explanation:

Funding: Changes due to redistribution of the three 06 accounts for laboratory operations (Projects 06ED, 06HT, and 06MD) into the technical projects beginning in FY 1996.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 1121 Training Development and Assessment Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1121 Training Development and Assessment Technology	3,257	0	0	0	0	0	0	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project develops technology to accelerate learning, increase skill/knowledge retention, and enhance job performance. This effort also develops cost-effective methods for designing, delivering, and evaluating training. Increased Air Force use of advanced technology and changes in the overall qualifications of the recruit pool add challenge to the already demanding task of effectively training Air Force recruits.

(U) FY 1995 ($ in Thousands):

- (U) $1,029 Develop intelligent/adaptive training technologies.
  - (U) Demonstrated the effectiveness of instructional strategies for automated, intelligent instruction in operational tasks and settings.
  - (U) Completed evaluation of reading/writing tutor for fundamental literacy skills and assess scientific skills tutor.
  - (U) Conducted field evaluation of virtual environment application to training technology.
- (U) $1,407 Develop intelligent, instructional design technologies.
  - (U) Developed guidelines for developing adaptive, interactive courseware for Air Force education needs.
  - (U) Demonstrated interactive courseware for selected logistics environments.
  - (U) Continued to develop interactive, multi-media distance learning technologies to increase the quality of distance training.
- (U) $821 Develop intelligent training assessment technologies.
  - (U) Delivered technology to support career field management planning.
  - (U) Developed and tested components of a comprehensive framework for education and training assessment.
- (U) $3,257 Total

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 1121 Training Development and Assessment Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,230	0	0	Cont
(U) Current Budget Submit	3,257	0	0	Cont

(U) Change Summary Explanation:

Funding: Changes due to consolidation into Project 1123.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602233N, Mission Support Technology: Personnel, Training, and Simulation Technology Area.
- (U) PE 0602785A, Manpower, Personnel, and Training Technology.
- (U) PE 0603227F, Personnel, Training, and Simulation Technology.
- (U) PE 0604243F, Manpower, Personnel, and Training Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 1123 Manpower, Personnel, and Training Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1123 Manpower, Personnel, and Training Technology	11,807	21,301	20,830	21,061	22,380	23,275	24,304	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project develops and evaluates new methods and techniques for aircrew training. It investigates the spectrum of aircrew training for the best ways to design, deliver, and assess training on the ground and in the air. It develops and evaluates flight training technologies to achieve maximum fidelity at minimum cost. This project will reduce the cost of future aircrew training technologies and increase the capability for realistic combat training. Beginning in FY 1996 and beyond, the following Mission Description will reflect work previously reported under Projects 1121 and 7719. This Applied Research program develops technologies to increase operational readiness by providing more effective methods to classify, assign, train, and retain personnel. This program focuses on reducing the manpower required to operate and support weapon systems and on improving the effectiveness of the operators and maintainers.

(U) FY 1995 ($ in Thousands):

- (U) $10,391 Develop concepts, trainers/simulators, and associated technologies to improve Air Force aircrew training.
  - (U) Developed guidelines for situational awareness in fighter operations.
  - (U) Developed tri-Service training guidelines for distributed mission training.
  - (U) Determined terrain and object density specifications for low altitude flight.
  - (U) Demonstrated intercept debrief using low-cost virtual reality technology.
- (U) $1,416 Develop guidelines for fidelity specifications for visual technologies to increase effectiveness of aircrew training simulators.
  - (U) Developed and demonstrated color matching for independent visual displays used in distributed combat training exercises.
  - (U) Designed user friendly eye position monitor for use in aircrew training.
- (U) $11,807 Total

(U) FY 1996 ($ in Thousands):

- (U) $3,043 Develop intelligent/adaptive training technologies for improved automated training.
  - (U) Demonstrate the effectiveness of instructional strategies for automated, intelligent instruction in operational tasks and settings.
  - (U) Continue large-scale evaluation of an intelligent tutor for fundamental science literacy skills, and of a licensed reading/writing tutor for commercial sale.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 1123 Manpower, Personnel, and Training Technology	

- (U) $3,236 Develop intelligent, instructional design technologies to reduce cost and time of automated training system design.
  - (U) Develop and evaluate desktop training technology to improve decision-making skills in military applications such as logistics planning and resource allocation.
  - (U) Complete formative evaluation of an experimental tool for providing intelligent performance support to novice instructional designers.
  - (U) Develop interactive, multi-media distance learning technologies.
- (U) $1,881 Develop assessment and evaluation technologies for adaptive training.
  - (U) Complete development and evaluation of an experimental, intelligent training decision support technology for assessing the impacts of changes in personnel, budgets, and training resources.
  - (U) Develop preliminary education and training assessment guidelines.
- (U) $1,290 Develop concepts, trainers/simulators, and associated technologies to improve Air Force aircrew training.
  - (U) Develop electronic classroom technology for aircrew training.
  - (U) Continue development of training guidelines for situational awareness training.
  - (U) Continue development of part-task trainers for combat mission training.
  - (U) Complete Training Effectiveness Evaluation of Initial Joint Service Combat Training Network.
- (U) $2,470 Develop guidelines for fidelity specifications for visual technologies used to improve aircrew training simulators.
  - (U) Determine terrain and target correlation specifications for dissimilar visual technologies used in distributed combat training exercises.
  - (U) Develop and evaluate eye position monitor for use in training aircrews.
  - (U) Determine effects of display viewing distance on perception of target size.
- (U) $2,064 Develop technologies to help identify, classify, assign, train, and retain personnel and structure Air Force and DoD jobs to obtain maximum performance and mission accomplishment.
  - (U) Deliver neural network-based officer retention estimation technology.
  - (U) Deliver benchmarked occupational learning difficulty ratings to help determine the most efficient entry-level and career job assignment aptitude criteria.
  - (U) Deliver a benchmarked job structuring computer-based decision aid to help design the most efficient force to achieve directed Air Force missions.
  - (U) Complete Integrated Definition (IDEF) analysis of Army job structuring process and provide analytical comparison of each Services' process to support effective joint job structuring design, modeling, and enhancement.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 1123 Manpower, Personnel, and Training Technology	

- (U) $7,317 Develop technologies to improve assessment of individual qualities/abilities (e.g., cognitive, physical, spatial, etc.) of Air Force personnel.
  - (U) Develop data base of specific mental capabilities required for complex, high-technology jobs for on-the-job performance assessment.
  - (U) Collect technical school performance data and continue criterion database development.
  - (U) Develop noncognitive measures of effectiveness.
  - (U) Continue development of performance assessment methodologies to determine mission readiness of personnel.
  - (U) Collect test data to evaluate minority performance on pilot ability measurements.
  - (U) Determine gains in re-testing for pilot ability measures.
  - (U) Identify ability demands of new training systems syllabus.
  - (U) Conduct aircrew personnel selection test utility analyses.
  - (U) Continue development of psychomotor and cognitive aptitude batteries.
  - (U) Develop scoring routines and conduct data analyses for validity, equity practice effects and feedback effects studies.
  - (U) Develop crew resource management (CRM) test technology for selecting Air National Guard and Air Force Reserve pilots.
  - (U) Collect data to evaluate new measures for officer selection.
- (U) $21,301 Total

(U) FY 1997 ($ in Thousands):

- (U) $3,656 Develop intelligent/adaptive training and instructional design technologies.
  - (U) Continue demonstration of the effectiveness of instructional strategies for automated, intelligent instruction in operational tasks and settings.
  - (U) Complete evaluation of a tool for providing intelligent performance support to novice instructional designers.
  - (U) Continue to develop and evaluate interactive, multi-media distance learning technologies.
- (U) $778 Develop intelligent training assessment technologies.
  - (U) Develop and validate criteria to assess the effectiveness and efficiency of intelligent training technologies in operational settings.
  - (U) Conduct preliminary validation of an integrated education and training assessment framework.
- (U) $9,222 Develop concepts, trainers/simulators, and associated technologies to improve Air Force aircrew training.
  - (U) Continue to develop electronic classroom technology for aircrew training.
  - (U) Continue development of training guidelines for situational awareness training.
  - (U) Continue development of part-task trainers for combat mission training.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 1123 Manpower, Personnel, and Training Technology	

- (U) $1,614 Develop guidelines for fidelity specifications for visual technologies used to improve aircrew training simulators.
  - (U) Determine impact of enhanced visual replay as feedback tool for distributed training debrief.
  - (U) Determine networking requirements for multi-ship displays.
- (U) $2,264 Develop technologies to help identify, classify, assign, train, and retain various categories of Air Force personnel.
  - (U) Develop and verify the relationship between training time, equipment repair time, and individual aptitude and experience.
  - (U) Deliver technology to support analysis of enlisted and officer force retention and compensation policy issues.
  - (U) Develop the design for an automated technology for field-based collection of individual and organizational productivity measures.
  - (U) Complete initial version of software aiding tool to assess personnel productivity and readiness.
  - (U) Complete analysis, quantification, and verification of key Manpower, Personnel and Training (MPT) functional relationships to support the linkage between training, job performance, aptitude, and experience.
- (U) $3,296 Develop technologies to assess individual qualities/abilities (e.g., cognitive, physical, spatial, etc.) of Air Force personnel.
  - (U) Develop adaptive and generative tests of abilities to improve precision while decreasing administration time.
  - (U) Continue development of database of specific mental capabilities required for complex, high-technology jobs for on-the-job performance assessment.
  - (U) Complete development of noncognitive measures of effectiveness.
  - (U) Continue development of performance assessment methodologies to determine mission readiness of personnel.
  - (U) Continue collection of technical school performance data.
  - (U) Continue data analysis for validity and equity studies.
  - (U) Continue to determine gains in re-testing for aircrew selection tests.
  - (U) Continue to collect test data to evaluate minority group performance on aircrew selection tests.
  - (U) Continue to develop crew resource management test technology for selecting Air National Guard and Air Force Reserve pilots.
  - (U) Validate crew resource management skills test for selection of C-130 pilots.
  - (U) Analyze data for new officer selection test.
- (U) $20,830 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 1123 Manpower, Personnel, and Training Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	11,403	23,105	20,751	Cont
(U) Current Budget Submit	11,807	21,301	20,830	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizonal increase in FY 1996 is due to incorporation of 06 account laboratory operations funds plus incorporation of Projects 1121 and 7719 into this project. Horizonal decrease in FY 1997 is due to budget constraints within the S&T Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602233N, Mission Support Technology: Personnel, Training, and Simulation Technology Area.
- (U) PE 0602716A, Human Factors Engineering Technology Development.
- (U) PE 0602727A, Non-System Training Devices Technology.
- (U) PE 0602785A, Manpower, Personnel, and Training Technology.
- (U) PE 0603106F, Logistics Systems Technology.
- (U) PE 0603227F, Personnel, Training, and Simulation Technology.
- (U) PE 0604227F, Flight Simulator Development.
- (U) PE 0604243F, Manpower, Personnel, and Training Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 1710 Logistics Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1710 Logistics Technology	2,969	6,061	6,058	6,102	6,671	7,011	7,346	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops technologies to: improve logistics support for both combat and peacetime operations; enhance logistics planning and assessment models for realistic wartime and contingency operations; improve logistics support requirements' trade off and design methods to reduce manpower and equipment needed to support logistics operations in dispersed locations; and develop software tools for use in designing improved reliability, maintainability, supportability, and man-machine interfaces to reduce life cycle costs and increase system affordability of aging aircraft and new weapon systems.

(U) FY 1995 ($ in Thousands):
- (U) $2,969 Develop requirement assessment tools to improve wing-level contingency logistics planning and support equipment operational concepts.
  - (U) Developed and assessed requirement tracking and design trade off tools.
  - (U) Developed needs assessment methods and technologies to improve wing-level logistical planning and support.
- (U) $2,969 Total

(U) FY 1996 ($ in Thousands):
- (U) $6,061 Develop technology for improved logistics planning, for support equipment upgrades, and for more effective software maintenance.
  - (U) Continue to develop needs assessment methods and technology to improve wing-level contingency logistical planning and support.
  - (U) Continue to develop improved software maintenance technology for on-board aircraft systems.
- (U) $6,061 Total

(U) FY 1997 ($ in Thousands):
- (U) $6,058 Develop technology for improved contingency logistics planning, support equipment functional upgrades, and more effective software maintenance of on-board systems.
  - (U) Complete preliminary software tools to support wing-level contingency logistics planning, replanning, and support.
  - (U) Develop computer-based design tools to minimize weapon systems deployment footprint, and increase support equipment reliability and maintainability.
- (U) $6,058 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 1710 Logistics Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,124	6,570	5,808	Cont
(U) Current Budget Submit	2,969	6,061	6,058	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizonal increase in FY 1996 is due to incorporation of 06 account laboratory operations funds into this project and increased emphasis on improved reliability, maintainability, and supportability of aging aircraft.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602233N, Mission Support Technology: Personnel, Training, and Simulation Technology Area.
- (U) PE 0602716A, Human Factors Engineering Technology Development.
- (U) PE 0603106F, Logistics Systems Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 1900 Environmental Quality Technology	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1900 Environmental Quality Technology	2,041	9,866	9,960	10,280	10,619	10,899	11,680	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops technologies to characterize the chemistry of Air Force-generated pollutants and toxic materials, assesses their interaction with the environment, and develops control and clean-up techniques. Efforts are conducted to reduce the cost and increase the effectiveness of technologies that protect the environment. New Air Force fuels and chemicals are analyzed to identify and prevent possible environmental problems. Materials are investigated and new processes explored to minimize hazardous waste generation. Novel site remediation, monitoring, and modeling technologies are also explored.

(U) FY 1995 ($ in Thousands):

- (U) $921 Develop technologies and design criteria for improved monitoring, characterization, and treatment of contaminated Air Force sites.
  - (U) Developed in situ biological and physical/chemical technologies to contain and treat dense nonaqueous phase liquids (DNAPLs), including methods to treat DNAPLs in aquifers, as faster, lower-cost alternatives to current pump-and-treat technologies.
  - (U) Developed in-place sensors and techniques for characterization and monitoring, including a micromachined fiber optic sensor and continued development of technology for integration of seismic and electromagnetic sensing for use in a cone penetrometer for DNAPLs.
  - (U) Identified and characterized the conditions, processes, products, and key indicators associated with the natural attenuation of hydrocarbon fuels to provide a scientific foundation for regulatory acceptance as a cleanup alternative.
- (U) $1,120 Develop technologies to predict and reduce contamination by Air Force materials and operations.
  - (U) Developed innovative technologies to treat hazardous wastes from Air Force industrial operations to reduce disposal costs and comply with regulatory limits, including technologies to remove metals from waste water and completed bench scale testing of a bioreactor to degrade ammonium perchlorate, an oxidizer of rocket fuel.
  - (U) Developed technically feasible methods to control air pollutant emissions from Air Force industrial processes, including cleaning, painting/depainting, and combustion operations to comply with Clean Air Act Amendments (CAAA).
  - (U) Developed evaluation criteria and procedures to determine the atmospheric chemistry of new Air Force fire fighting agents and solvents for input into the selection process and compliance determination of new and replacement materials.
- (U) $2,041 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 1900 Environmental Quality Technology	

(U) FY 1996 ($ in Thousands):

- (U) $3,565 Develop technologies and design criteria for improved monitoring, characterization, and remediation of contaminated Air Force sites.
  - (U) Complete analysis of soil surfactant interactions toward development of an in situ surfactant curtain; continue in-place physical/chemical technology development to contain and treat dense nonaqueous phase liquids (DNAPLs).
  - (U) Finish refinement of pulsed pumping technique as an economical replacement for the current continous pump-and-treat technology to remove contaminants from groundwater and develop horizontal monitoring to improve sensor placement; continue to develop in-place sensors and geophysical technologies to locate, identify, and monitor dense nonaqueous phase liquid (DNAPL) sources, plumes, and remediation activities.
  - (U) Continue to develop methods for stimulating the in situ anaerobic destruction of contaminants cheaper and simpler than current aerobic technologies and continue to develop in-place bioremediation technologies to clean up Air Force sites contaminated with fuels and solvents.
- (U) $6,301 Develop technologies to predict and reduce contamination by Air Force materials and operations.
  - (U) Develop process monitoring technologies to treat/recover/control oils/emulsifying agents from aqueous waste streams; continue to develop innovative technologies to treat hazardous wastes from Air Force industrial operations to reduce disposal costs and comply with regulatory limits.
  - (U) Continue to develop affordable technologies to control air pollutant emissions from Air Force industrial processes to comply with Clean Air Acts Amendments.
  - (U) Determine the atmospheric chemistry of candidate and new Air Force fuels and chemicals, including determining the atmospheric chemistry of halon replacements, and depainting solvents, and conduct atmospheric research to enhance risk assessment and model verification for Air Force space launch operations.
- (U) $9,866 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 1900 Environmental Quality Technology	

(U) FY 1997 ($ in Thousands):

- (U) $3,984 Develop technologies and design criteria for improved monitoring, characterization, and treatment of contaminated Air Force sites.
  - (U) Complete development of use of zero-valent metals to treat water contaminated with solvents; and for removing dense nonaqueous phase liquids (DNAPLs) from groundwater; continue to develop physical/chemical technologies (such as alcohol flushing and resistive heating) to contain and treat in-place DNAPL sources.
  - (U) Continue to characterize the fate and transport characteristics of DNAPLs in soils and groundwater using physical model studies to validate and develop models for optimization of remediation technologies and plans, including addressing the combined effects of physical/chemical and biological processes on contaminants.
  - (U) Identify the aerobic and anaerobic conditions and ecology leading to potential intrinsic bioremediation of nonpetroleum compounds and identify the toxic potential of residual compounds following bioremediation of petroleum compounds.
- (U) $5,976 Develop technologies to predict and reduce contamination in the environment by Air Force materials and operations.
  - (U) Continue to develop technologies to treat/recover/control oils/emulsifying agents for aqueous waste streams generated by activities such as aqueous degreasing operations and corrosion control facility opertions.
  - (U) Develop innovative technologies to treat/recycle hazardous wastes from Air Force industrial and space operations (such as hydrothermal oxidation of energetic materials) to reduce disposal/recycel costs and comply with regulatory limits.
  - (U) Develop a low back pressure Nitrogen Oxide control technology (pulsed corona reactor technology) for jet engine test cells based on a low temperature chemical reaction process.
  - (U) Continue development of chemical tank waste treatment technologies for etching/pickling/plating baths; continue to develop cost effective alternate processes and materials that reduce or eliminate the production of hazardous wastes and the use of hazardous materials including the Ion Vapor Deposition of Heavy Metals process.
  - (U) Determine the atmospheric chemistry of candidate and new Air Force fuels and chemicals; develop a database of the rates of photochemical and dark reactions of Air Force organic solvent vapors, new fire extinguishants, and new fuels in the presence of specific air pollutants.
- (U) $9,960 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 1900 Environmental Quality Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,354	10,691	10,504	Cont
(U) Current Budget Submit	2,041	9,866	9,960	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizonal increase in FY 1996 is due to incorporation of 06 account laboratory operations funds into this project and increased emphasis on environmental technologies.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0601102F, Defense Research Sciences.
- (U) PE 0602102F, Materials.
- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0603211F, Aerospace Structures.
- (U) PE 0603723F, Civil and Environmental Engineering Technology.
- (U) PE 0603716D, Strategic Environmental Research and Development Program.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 2673 Air Base Operability Technology	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2673 Air Base Operability Technology	1,872	0	0	0	0	0	0	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project provides the technology base for current and future Air Force systems in these areas: survivable air base structures, utilities, and operating surfaces against more accurate and powerful conventional and chemical/biological weapons; battle damage assessment and repair; air mobile structures; and cost-effective fire protection, maintenance, and repair of air base facilities, utilities, and operating surfaces.

(U) FY 1995 ($ in Thousands):

- (U) $1,403 Developed technologies and design criteria for improved bare-base/fixed-site applications (e.g., power and environmental utilities, survivable air base structures, and durable/repairable airfield surfaces).
- (U) $469 Developed advanced aircraft/air base fire fighting technologies (e.g., clean, environmentally-safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment techniques, and fire fighter training systems).
- (U) $1,872 Total

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 2673 Air Base Operability Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,138	0	0	Cont
(U) Current Budget Submit	1,872	0	0	Cont

(U) Change Summary Explanation:

Funding: Beginning in FY 1996, Project 2673 transfers to Wright Laboratory's PE 0602201F, Aerospace Flight Dynamics.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0601102F, Defense Research Sciences.
- (U) PE 0602102F, Materials.
- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0603211F, Aerospace Structures.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0603307F, Air Base Operability Advanced Technology Development.
- (U) PE 0603723F, Civil and Environmental Engineering Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 6302 Occupational and Environmental Toxic Hazards in Air Force Operations	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
6302 Occupational and Environmental Toxic Hazards in Air Force Operations	1,963	0	0	0	0	0	0	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project provides for toxicological technology development and assessment of Air Force materials and processes. It assesses human tolerance levels for chemicals, fuels, and materials to establish exposure criteria for designing new technologies and performs trade off analyses between weapon systems performance and occupational health and environmental support specifications.

(U) FY 1995 ($ in Thousands):

- (U) $1,963 Continue toxicological technology development and assessment of Air Force materials and processes.
  - (U) Provided systems managers with critical information for risk versus benefit decisions on alternative solvents, new materials such as Halon replacements, and combustion toxicity for turbine engine exhaust.
  - (U) Assessed and related human health risks to environmental clean-up standards for groundwater contaminants such as trichlorethylene.
  - (U) Developed technology to assess environmental and occupational safety of alternative compounds for use in Air Force weapon systems.
- (U) $1,963 Total

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 6302 Occupational and Environmental Toxic Hazards in Air Force Operations	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,200	0	0	Cont
(U) Current Budget Submit	1,963	0	0	Cont

(U) Change Summary Explanation:

Funding: Beginning in FY 1996, Project 6302 is consolidated into Project 7757.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602720A, Environmental Quality Technology.
- (U) PE 0602777A, Systems Health Hazard Prevention Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 6893 Manned Weapon System Effectiveness

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
6893 Manned Weapon System Effectiveness	609	0	0	0	0	0	0	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops technology related to human vision and motion perception in manned weapon systems. The goal is to determine aircrew weaknesses and strengths in these two critical human characteristics to assess effectiveness for: safety of flight; visual countermeasures; and air-to-ground, air-to-air, and space-based operations.

(U) FY 1995 ($ in Thousands):

- (U) $114 Complete development of camouflage, concealment, deception, and obstruction techniques to disrupt target acquisition and intelligence gathering.
  - (U) Developed and tested human vision performance model in decision aid used to predict target infrared signatures.
- (U) $294 Explore human information processing and alternate control techniques for aircrew technologies.
  - (U) Developed direct vestibular stimulation techniques to improve training fidelity and eliminate motion platforms.
- (U) $201 Examine crew visual performance in micro-G and high-speed environments.
  - (U) Collected visual accommodation data during sustained Air Force operations on-orbit using visual function tester.
- (U) $609 Total

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 6893 Manned Weapon System Effectiveness	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	629	0	0	Cont
(U) Current Budget Submit	609	0	0	Cont

(U) Change Summary Explanation:

Funding: Beginning in FY 1996, Project 6093 is consolidated into Project 7184.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0602702F, Command, Control, and Communications.
- (U) PE 0603205F, Aerospace Vehicle Technology.
- (U) PE 0603227F, Advanced Simulator Technology.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0603245F, Advanced Fighter Technology Integration.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 7184 Crew Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
7184 Crew Technology	4,831	24,362	29,221	28,681	29,219	30,113	32,164	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Through FY 1995, this project develops procedures and technologies to optimize interfaces between Air Force personnel and weapon systems. Information about the characteristics of human operators is gathered and analyzed to provide design data for system control and display development. The goal is to develop, verify, and transition data, methods, and technologies to improve the human interface with Air Force systems. Beginning in FY 1996 and beyond, the following Mission Description will reflect work previously reported under Projects 6893, 7930, and a portion of 7231. This project develops technology required to improve human performance, protection, and survivability in operational environments. This is accomplished by defining the physical parameters, capabilities, and limits of systems operators; determining human responses to operational stressors such as noise, impact, vibration, hostile fire, sustained acceleration, spatial disorientation, altitude, workload, and sustained operations; and optimizing the human-machine interface. The project produces human factors design criteria, guidelines, and automated design tools for the development of effective technologies for information display, team communications, crew scheduling and fatigue management, control interfaces, emergency escape, crash protection, acceleration protection, and aircrew life support.

(U) FY 1995 ($ in Thousands):

- (U) $628 Develop unobtrusive, reliable predictors of human system effectiveness.
  - (U) Completed analysis of the role of attention allocation in situation awareness.
  - (U) Developed a portable version of a monitor for measuring physiological variables to assess mental workload.
- (U) $3,043 Develop system design technologies for greater integration of human performance data and crew system interfaces.
  - (U) Completed development of multi-media visualization technology for human performance data to optimize crew systems design.
  - (U) Demonstrated capability to perform digital laser whole body scans for accurate definition of equipped aircrew members.
- (U) $1,160 Develop technology for visual displays and symbology for improvement of human-machine interfaces.
  - (U) Developed technology for advanced hybrid optical elements to provide a see-through helmet-mounted display with resolution, luminance, and contrast performance approaching that of current full-size displays.
  - (U) Verified standards for cockpit Head-Down Display symbology.
- (U) $4,831 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7184 Crew Technology	

(U) FY 1996 ($ in Thousands):

- (U) $2,630 Develop human information processing and alternative control technologies and reliable, unobtrusive predictors of human system effectiveness.
  - (U) Demonstrate integrated eye-voice-electromyographic control in a complex simulation environment.
  - (U) Complete portable, personal computer-based version of brain actuated controller.
  - (U) Complete demonstration of a neural-based Workload Redline concept which combines physiological, performance, and system measurements to predict mental work overload.
  - (U) Complete concept evaluation of airborne physiological monitor for night, low-level, high-speed flight environments.
- (U) $6,926 Develop system design technologies for integration of human performance data and crew system interfaces including a task time estimator.
  - (U) Enhance a computer-aided design model of an aircraft flight line maintenance technician with the capability to estimate remove/repair task times.
  - (U) Develop computer-aided design technology incorporating actual aircraft controls to provide a totally virtual cockpit accommodation model.
  - (U) Demonstrate the mating of crewstation computer-aided design technology with behavioral data visualization technology to produce a performance-sensitive design tool.
- (U) $2,845 Develop visual displays and symbology for improvement of human-machine interfaces.
  - (U) Demonstrate combined use of head-, eye-, brain-, and voice-actuated control of a man-machine system.
  - (U) Evaluate improved symbology set for aircraft off-boresight targeting with helmet-mounted displays.
- (U) $3,570 Develop injury threshold determination criteria and related technologies for improved protection equipment for aircrew and support personnel.
  - (U) Determine windblast exposure limits.
  - (U) Develop six degree-of-freedom human body model with acceleration limits for small aircrew members.
  - (U) Develop six degree-of-freedom head/neck model to be used for "safe to fly" evaluation of advanced concept helmet-mounted displays.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7184 Crew Technology	

- (U) $2,022 Develop technologies to measure and predict human auditory responses and to provide criteria for voice communication for particular Air Force weapon systems and base operations.
  - (U) Complete development of three-dimensional audio technology for improved communications capability.
  - (U) Develop and demonstrate three-dimensional audio technologies for enhanced survivability and situational awareness.
  - (U) Develop and transition lightweight Active Noise Reduction (ANR) headset technology for improved voice communications capability and reduced operator noise-induced hearing loss.
- (U) $3,136 Develop technologies for evaluating and improving aircrew protection and effectiveness in operational environments.
  - (U) Continue development of technologies to reduce effects of high-G acceleration on pilot performance.
  - (U) Continue development of advanced life support equipment technologies.
- (U) $3,233 Develop technologies for sustained aircrew operations and integration of life support systems into aircraft to improve aircrew safety and performance.
  - (U) Develop and evaluate fatigue management system and team communication strategies for enhanced aircrew sustained operational performance.
  - (U) Continue applied research in oxygen generation system technologies for aircraft and field hospital applications.
- (U) $24,362 Total

(U) FY 1997 ($ in Thousands):

- (U) $1,946 Develop unobtrusive, reliable predictors of human systems effectiveness.
  - (U) Develop an analytical description of crew performance in Theater Missile Defense attack operations mission.
  - (U) Complete the integration of memory probes, attention allocation, and other mental components into an overall situation awareness conceptual model.
- (U) $8,468 Develop system design technologies for greater integration of human performance data and crew system interfaces.
  - (U) Complete software for whole body, three-dimensional anthropometric scanning system to collect and reduce data.
  - (U) Demonstrate intelligent agents for multi-operator performance in distributed battle management platforms.
  - (U) Develop analytic methodology for cognitive engineering in support of information dominance.
- (U) $4,489 Develop visual displays and symbology technology for improved human-machine interfaces and demonstrate integrated air-to-air virtual cockpit technology.
  - (U) Evaluate improved image intensifier tube for night vision goggle technology.
  - (U) Demonstrate integrated air-to-air virtual cockpit technology.
  - (U) Develop binocular helmet-mounted display (HMD) specifications and HMD test standards.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7184 Crew Technology	

- (U) $4,598 Develop injury criteria and technology for improved aircrew and support personnel protection equipment.
  - (U) Verify whole-body restraint concepts for large and small crew members.
  - (U) Formulate parachute opening shock criteria that will minimize aircrew limb injury.
  - (U) Develop multi-media work environment for use by engineers who access the Biodynamic Data Bank to evaluate concepts for aircrew protection.
  - (U) Develop manikin-based injury prediction methodology.
- (U) $2,415 Develop technologies to measure and predict the effects of human auditory responses and to provide criteria for voice communication for particular Air Force weapon systems and base operations.
  - (U) Develop and demonstrate human-centered audio technologies for improved situational awareness, increased communications capability, and improved human system interfaces for Air Force weapon systems.
  - (U) Develop and transition audio performance measurement technologies for assessment of individual auditory localization ability in operational situations.
  - (U) Develop advanced models, criteria, and technologies for improving human audio communication for Air Force weapon systems and for degrading communications capabilities of opposing forces.
- (U) $3,560 Develop technologies for evaluating and improving personal protection and effectiveness of aircrew and support personnel operating in hazardous environments.
  - (U) Develop and evaluate technologies to reduce the effects of high-G acceleration on pilot performance.
  - (U) Continue development of advanced life support equipment technologies.
- (U) $3,745 Develop technologies for sustained aircrew operations and integration of life support systems into aircraft to improve aircrew safety and performance.
  - (U) Demonstrate fitness for duty performance metrics and team decision making strategies for enhanced aircrew sustained operational performance.
  - (U) Continue development of ceramic oxygen generation system technology for aircraft and field hospital applications.
  - (U) Transition advanced spatial disorientation demonstrator technologies and continue optimization of spatial disorientation countermeasures.
- (U) $29,221 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7184 Crew Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,676	27,397	27,428	Cont
(U) Current Budget Submit	4,831	24,362	29,221	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase in FY 1996 is due to incorporation of 06 account laboratory operations funds plus incorporation of work from Projects 6893, 7930, and a portion of Project 7231 into this project. Horizontal/vertical increase in FY 1997 is due to increased emphasis on crew escape.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary ($ in Thousands)**

(U) Related Activities:

- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0602702F, Command, Control, and Communications.
- (U) PE 0603205F, Aerospace Vehicle Technology.
- (U) PE 0603227F, Advanced Simulator Technology.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0603245F, Advanced Fighter Technology Integration.
- (U) PE 0604601F, Chemical/Biological Warfare Defense Equipment.
- (U) PE 0604703F, Aeromedical/Casualty Care Systems Development.
- (U) PE 0604706F, Life Support Systems.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 7231 Safety and Aircrew Effectiveness in Mechanical Force Environments

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
7231 Safety and Aircrew Effectiveness in Mechanical Force Environments	2,446	0	0	0	0	0	0	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project determines human response to mechanical forces including noise, impact, vibration, and hostile fire. This information is used for safe and effective escape/ejection systems, acceleration protection equipment, aircrew restraint devices, and for reducing crew station vulnerability. This project also develops technology based on understanding of the human auditory system for activities such as operator-centered communications, jamming, and noise exposure criteria. This project also develops telepresence technology for remote operation of mechanical systems by Air Force personnel.

(U) FY 1995 ($ in Thousands):

- (U) $1,614 Develop injury threshold determination criteria and related technologies for improved protection equipment for aircrew and support personnel.
  - (U) Determined x-z axis coupling coefficients for multi-axis acceleration.
  - (U) Determined effect of off-axis acceleration on head/neck response.
  - (U) Developed specifications for small manikins.
  - (U) Determined response of a new manikin to impact acceleration.
- (U) $473 Develop technologies to measure and predict human auditory responses and to provide criteria for voice communication for Air Force weapon systems and base operations.
  - (U) Developed and integrated three-dimensional audio/helmet-mounted display technology applications into Air Force systems.
  - (U) Developed technologies to enhance combined human visual/auditory/vestibular perception in time-critical mission scenarios.
  - (U) Developed methodologies and criteria for the design and application of auditory symbology.
- (U) $359 Develop aircraft noise and sonic boom technology to assess and reduce adverse impacts of noise produced by Air Force operations.
  - (U) Developed noise prediction model for subsonic military operating areas and ranges.
  - (U) Developed technology to assess topography effects on aircraft noise propagation.
  - (U) Verified single event sonic boom prediction model.
- (U) $2,446 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7231 Safety and Aircrew Effectiveness in Mechanical Force Environments	

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,532	0	0	Cont
(U) Current Budget Submit	2,446	0	0	Cont

(U) Change Summary Explanation:

Funding: Beginning in FY 1996, Project 7231 is consolidated into Projects 7184 and 7757.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0603205F, Aerospace Vehicle Technology.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0603245F, Advanced Fighter Technology Integration.
- (U) PE 0604706F, Life Support Systems.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 7719 Force Acquisition and Distribution Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
7719 Force Acquisition and Distribution Technology	2,515	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops personnel qualification and aptitude measurement methods, job specification standards, and manpower and personnel models to provide methods and tools for optimal selection, classification, and assignment of personnel.

(U) FY 1995 ($ in Thousands):

- (U) $782 Develop technologies to help identify, classify, and retain various categories of Air Force personnel.
  - (U) Developed benchmarked occupational learning difficulty ratings to help determine the most efficient entry-level and career job assignment aptitude criteria.
  - (U) Developed a job structuring computer-based decision aid to assist career field managers in designing the most efficient force to achieve mission accomplishment.
  - (U) Developed a modeling approach to determine key manpower, personnel, and training interfaces to ensure that new weapon systems and major modifications are procured at the lowest possible life cycle costs.
- (U) $1,361 Develop technologies to assess individual qualities/abilities (e.g., cognitive, physical, spatial, etc.) of Air Force personnel.
  - (U) Collected technical school performance data to verify experimental abilities measurement test battery.
  - (U) Developed noncognitive measures to explore potential for incremental validity over cognitive measures.
  - (U) Collected date to assess gender effects on test performance.
  - (U) Conducted studies of effects of feedback and practice on test validity and evaluated long term stability of test performance.
  - (U) Developed and evaluated validity and reliability of psychomotor aptitude battery.
  - (U) Collected repeated measurements data for evaluation of tests as performance assessment instruments.
  - (U) Collected data on officer candidates to evaluate tests as officer selection instruments.
  - (U) Completed development of cognitive task analysis methodologies for identifying underlying mental abilities required for complex high technology jobs.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7719 Force Acquisition and Distribution Technology	

- (U) $372 Develop crew resources management test technology for selecting Air National Guard and Air Force Reserve pilots.
  - (U) Interviewed experienced C-130 pilots and collected crew resource management performance events and alternative behavioral responses.
  - (U) Interviewed experienced and novice C-130 pilots to evaluate crew resource management performance alternatives for development of test scoring keys.
  - (U) Collected test data on pilot ability measures to evaluate performance of minorities.
  - (U) Collected test data to determine gains in retesting for pilot ability measures.
- (U) $2,515 Total

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7719 Force Acquisition and Distribution Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,702	0	0	Cont
(U) Current Budget Submit	2,515	0	0	Cont

(U) Change Summary Explanation:

Funding: Beginning in 1996, Project 7719 is consolidated into Project 1123.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602233N, Mission Support Technology: Personnel, Training, and Simulation Technology Area.
- (U) PE602785A, Manpower, Personnel, and Training Technology.
- (U) PE 0603227F, Personnel, Training, and Simulation Technology.
- (U) PE 0604243F, Manpower, Personnel, and Training Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 7755 Aircrew Physiology Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
7755 Aircrew Physiology Technology	1,043	7,231	6,682	6,788	6,798	6,880	7,095	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** The human operator is the enabling factor in aerospace systems. The goal of this project is to optimize aircrew effectiveness through developing an understanding of: (1) biodynamic conditions affecting aircrew selection and retention; (2) methods of early disease detection; (3) impact of asymptomatic disease on aircrew performance; (4) therapeutic drug effects on flight safety; and (5) physiological factors affecting operational readiness and effectiveness.

(U) FY 1995 ($ in Thousands):

- (U) $805 Develop biodynamic technologies for new aircrew standards.
  - (U) Developed standards (i.e., cardiovascular, vision/optical devices, neuropsychiatric and hearing/vestibular standards) to improve aircrew selection, retention and performance.
  - (U) Developed aircrew performance-based standards in areas such as high-G acceleration, microgravity, and dehydration.
  - (U) Developed protocol to assess physiological factors affecting female aircrew (i.e., unique stressors of mixed-gender squadrons).
  - (U) Culminated 30-year follow-up of certain cardiac conditions; resulted in significant expansion of waiver criteria - doubled number eligibles.
- (U) $238 Develop operational performance enhancement technologies.
  - (U) Patented a three-dimensional eye tracking device; has future as target acquisition enhancement device.
  - (U) Developed Night Vision Goggle preflight test lane to allow aircrew to assess and adjust goggles prior to flight.
- (U) $1,043 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7755 Aircrew Physiology Technology	

(U) FY 1996 ($ in Thousands):

- (U) $5,742 Develop biodynamic technologies for improving aircrew standards.
  - (U) Refine standards (i.e., cardiovascular, vision/optical devices, neuropsychiatric and hearing/vestibular standards) to improve aircrew selection, retention and performance.
  - (U) Evaluate aircrew performance-based standards in areas such as high-G acceleration, microgravity, and dehydration.
  - (U) Continue to develop better capability to assess physiological factors affecting female aircrew (i.e., obstetrics-gynecology (ob-gyn), orthopedic, hyperbaric oxygen therapy, G-tolerance).
- (U) $1,489 Develop operational performance enhancement technologies.
  - (U) Develop technologies and procedures to minimize impact of dehydration, illness, medications, and physical deconditioning on aircrew performance in the aviation environment.
  - (U) Develop alternative response techniques for decompression sickness incidents.
- (U) $7,231 Total

(U) FY 1997 ($ in Thousands):

- (U) $5,303 Develop biodynamic technologies for improving aircrew standards.
  - (U) Continue to refine standards (i.e., cardiovascular, vision/optical devices, neuropsychiatric and hearing/vestibular standards) to improve aircrew selection, retention and performance.
  - (U) Continue to evaluate aircrew performance-based standards in areas such as high-G acceleration, microgravity, and dehydration.
  - (U) Continue to assess physiological factors affecting female aircrew (i.e., ob-gyn, orthopedic, hyperbaric oxygen therapy, G-tolerance).
- (U) $1,379 Develop operational performance enhancement technologies.
  - (U) Develop and evaluate aircrew vision enhancement technologies.
  - (U) Develop methods to identify and remediate physiological impairments arising from high performance aircraft flight.
- (U) $6,682 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7755 Aircrew Physiology Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,129	7,824	7,508	Cont
(U) Current Budget Submit	1,043	7,231	6,682	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizonal changes are due to incorporation of 06 account laboratory operations funds into this project.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary**:

(U) Related Activities:

- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0604601F, Chemical/Biological Warfare Defense Equipment.
- (U) PE 0604703F, Aeromedical/Casualty Care Systems Development.
- (U) PE 0604706F, Life Support Systems.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 7757 Toxicology/Radiation/Noise Hazards

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
7757 Toxicology/Radiation/Noise Hazards	4,353	13,599	14,352	14,364	14,736	15,293	15,602	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project enables the safe operational use of Air Force weapon systems through technology development related to the effects and applications of hazardous materials, noise, and electromagnetic and space radiation used in, or resulting from, Air Force operations. The radiation portion of the project addresses areas such as: safety; risk assessment; mission planning and countermeasures in combat; less than lethal applications for special operations and law enforcement; and biologic effects of exposure to radiofrequency/microwave radiation, lasers, broad-band munitions, and ionizing radiation. Toxicological technology is developed to assess human tolerance levels for chemicals, fuels, and materials to establish exposure criteria and perform trade off analyses between weapon system performance and occupational health and environmental support specifications. Technology to assess and reduce the environmental impact of noise generated by Air Force operations is also developed. This project provides consultation support to other DOD programs by using unique Air Force resources to extend capabilities for development and evaluation of technology to assess and counter toxicological, radiation, and noise hazards.

(U) FY 1995 ($ in Thousands):

- (U) $4,353 Develop technology for assessing bioeffects and applications of directed energy in Air Force operations.
  - (U) Transitioned the first laser protective visor technology for Air Force night operations.
  - (U) Developed technology to assess bioeffects of ultra-wide band and pulsed microwaves and radiofrequency radiation.
- (U) $4,353 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7757 Toxicology/Radiation/Noise Hazards	

(U) FY 1996 ($ in Thousands):

- (U) $8,160 Develop technology to exploit the effects and applications of directed energy in Air Force operations.
  - (U) Develop technology to assess the operational impact of laser air defense weapons on visual delivery of precision guided munitions.
  - (U) Develop measures and countermeasures to exploit less-than-lethal biological effects of electromagnetic radiation for Air Force security, peacekeeping, and warfighting operations.
  - (U) Develop scientific database and methods for setting risk-based health and safety standards that protect personnel from harmful exposure to electromagnetic radiation with minimal operational impact.
  - (U) Assess health and safety impact of newly fielded and emerging high power microwave technologies.
- (U) $4,759 Develop and assess toxicological technology related to Air Force materials, processes, and clean up standards.
  - (U) Provide systems managers with critical information for risk versus benefit decisions for new materials such as Halon replacements, alternative solvents, and combustion toxicity for composite materials.
  - (U) Continue to develop technology to assess potential environmental hazards and occupational safety of current and proposed fuels for use in Air Force weapon systems.
  - (U) Continue to assess and relate human health risks to clean-up standards for groundwater contaminants such as trichloroethylene.
  - (U) Develop human health-based clean-up standards for soil contaminants such as total petroleum hydrocarbons (TPH).
- (U) $680 Develop measuring and modeling technology to assess and reduce adverse impacts of aircraft noise and sonic boom produced by Air Force operations.
  - (U) Demonstrate airbase noise measurement technology.
  - (U) Develop Department of Defense manual for noise assessment.
  - (U) Update aircraft noise model to allow assessment for select operational Air Force aircraft.
  - (U) Verify model for topography effects on aircraft noise propagation.
- (U) $13,599 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7757 Toxicology/Radiation/Noise Hazards	

(U) FY 1997 ($ in Thousands):

- (U) $8,610 Develop technology to exploit the effects and applications of directed energy in Air Force operations.
  - (U) Produce interim ultra-short pulse laser safety standard and continue developing technology to assess occupational safety and operational threats from lasers.
  - (U) Continue developing electromagnetic radiation bioeffects measurement and analysis methods for use in setting risk-based health and safety standards for personnel exposure.
  - (U) Continue developing technologies for assessing bioeffects of less-than-lethal directed energy emissions.
  - (U) Develop analytical algorithms for calculating and predicting direct and inverse scattering of laser and radiofrequency radiation.
- (U) $5,025 Develop and assess toxicological technology related to Air Force materials and processes.
  - (U) Continue toxicological assessment of next generation replacements for Halons and ozone depleting solvents to protect Air Force personnel and provide systems managers with risk versus benefit decision tools.
  - (U) Continue to develop and improve methods and models to assess chemical mixture toxicity in humans, relate human health effects to cleanup standards, and explore biomarkers as an indicator of exposure.
  - (U) Continue development of metabolic techniques for cell culture exposure, species extrapolation for enzymes diversity, and suitable alternatives to animal use for transition to operational toxicology applications.
  - (U) Provide systems managers with critical information for risk versus benefits decision for combustion toxicity of turbine engine exhaust.
- (U) $717 Develop technology to assess and reduce adverse impacts of aircraft noise and sonic booms produced by Air Force operations.
  - (U) Develop reciprocity model for structure damage from jet noise.
  - (U) Develop technology to assess human annoyance response to sonic booms and low level aircraft overflights.
- (U) $14,352 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7757 Toxicology/Radiation/Noise Hazards	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,612	14,724	15,842	Cont
(U) Current Budget Submit	4,353	13,599	14,352	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizonal increase in FY 1996 is due to incorporation of 06 account laboratory operations funds plus incorporation of work for Project 6302 and a portion of Project 7231 in this project. Horizonal increase in FY 1997 is due to increased emphasis on occupational safety hazards.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602720A, Environmental Quality Technology.
- (U) PE 0602777A, Systems Health Hazard Prevention Technology.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0604706F, Life Support Systems.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602202F Armstrong Lab Exploratory Development

PROJECT NO. AND NAME: 7930 Advanced Crew Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
7930 Advanced Crew Technology	1,995	0	0	0	0	0	0	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project studies human response to physiological stressors such as rapid-onset sustained acceleration, spatial disorientation, altitude, workload, and sustained operations. Design criteria and brass-board protective technologies and procedures are developed to improve crew performance in these challenging environments. Additional tasks involve the evaluation, cockpit integration, and man-rating of life support equipment.

(U) FY 1995 ($ in Thousands):

- (U) $1,045 Develop technologies for evaluating and improving aircrew protection and effectiveness in operational environments.
  - (U) Developed technologies to improve aircrew protection and effectiveness in a high-G acceleration environment.
  - (U) Developed advanced life support equipment technology to improve aircrew protection and effectiveness at high altitude.
- (U) $618 Develop technologies for sustained aircrew operations and integration of life support technologies into aircraft to improve aircrew safety and performance.
  - (U) Developed technologies to enhance aircrew sustained operational performance.
  - (U) Developed spatial disorientation awareness training methods.
  - (U) Developed technologies to optimize cockpit display symbology and spatial disorientation countermeasures.
  - (U) Developed technologies for oxygen generation.
- (U) $332 Develop technologies and performed model simulation and analysis for personnel working in a toxic environment.
- (U) $1,995 Total

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Armstrong Lab Exploratory Development
PROJECT NO. AND NAME 7930 Advanced Crew Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,216	0	0	Cont
(U) Current Budget Submit	1,995	0	0	Cont

(U) Change Summary Explanation:

Funding: Beginning in FY 1996, Project 7930 is consolidated into Project 7184.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602202F, Aerospace Flight Dynamics.
- (U) PE 0603205F, Aerospace Vehicle Technology.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0603245F, Advanced Fighter Technology Integration.
- (U) PE 0604601F, Chemical/Biological Warfare Defense Equipment.
- (U) PE 0604703F, Aeromedical/Casualty Care Systems Development.
- (U) PE 0604706F, Life Support Systems.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602203F Aerospace Propulsion

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	69,440	72,237	74,906	75,304	75,539	76,571	79,929	Continuing	Continuing
06PP Directorate Operations	22,789	0	0	0	0	0	0	Continuing	Continuing
3012 Ramjet Technology	2,346	7,680	7,379	7,356	6,945	7,108	7,844	Continuing	Continuing
3048 Fuels and Lubrication	8,861	15,355	13,390	12,414	12,254	12,218	12,880	Continuing	Continuing
3066 Turbine Engine Technology	25,675	33,978	39,181	40,080	41,039	41,982	43,125	Continuing	Continuing
3145 Aerospace Power Technology	9,769	15,224	14,956	15,454	15,301	15,263	16,080	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Applied Research program develops airbreathing propulsion and aerospace power technologies. The prime areas of focus are turbine engines, ramjets, dual-mode ramjets, combined cycle engines, fuels, lubricants, and aerospace power technologies. Technology advances in turbine engine propulsion and lubrication systems are part of the Integrated High Performance Turbine Engine Technology (IHPTET) program and will increase engine performance, reduce specific fuel consumption, and lower cost of ownership. Ramjet/dual-mode ramjet and combined cycle engines will increase weapon lethality/effectiveness against time-critical targets via high-speed propulsion systems. Fuels efforts will reduce system cost, maintenance, and the usage of hazardous cleaning materials while increasing aircraft performance and life through development of thermally stable and high heat sink fuels. Power system technologies are focused to eliminate troublesome, centralized hydraulic systems by replacement with highly reliable electric systems. Power conditioning, thermal management, and battery improvements will significantly enhance reliability, reduce weight, and lower life cycle costs. Starting in FY 1996, separate infrastructure projects have been eliminated. All efforts in this program element contain the resources necessary, including civilian salaries, to manage, conduct, and document the technical activities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602203F Aerospace Propulsion

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	73,014	78,592	77,901	Cont
(U) Appropriated Value	74,406	75,070		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-3,397	-1,453		
b. SBIR	-757	-947		
c. Omnibus/Other Above Threshold Reprogrammings	-788	-433		
d. Below Threshold Reprogrammings	-24			
(U) Current Budget Submit	69,440	72,237	74,906	Cont

(U) Change Summary Explanation:

Funding: Vertical decreases to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal changes are due to budget constraints and priorities within the S&T Program. Turbine engine efforts restored to achieve Phase II Integrated High Performance Turbine Engine Technology goals by FY 1997.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

2 - Applied Research | **0602203F Aerospace Propulsion**

PROJECT NO. AND NAME
06PP Directorate Operations

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
06PP Directorate Operations	22,789	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Provides management and support for the Aero Propulsion and Power Directorate, Wright-Patterson AFB, OH. Includes pay and benefits for civilian personnel, travel, transportation, rentals, communications, utilities, and procurement of supplies and equipment. This project will be terminated in FY 1996 and its contents distributed to the technical projects.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	22,789	0	0	Cont
(U) Current Budget Submit	22,789	0	0	Cont

(U) Change Summary Explanation:

Funding: There have been no vertical changes to this project since the previous President's Budget. Project funding incorporated under technical projects after FY 1995.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602203F Aerospace Propulsion

PROJECT NO. AND NAME
3012 Ramjet Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3012 Ramjet Technology	2,346	7,680	7,379	7,356	6,945	7,108	7,844	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Establishes technology base for advanced propulsion concepts including integral rocket ramjets for missile propulsion providing increased average velocity and lethality along with combined/advanced-cycle engines and hydrocarbon fueled dual-mode combustion (subsonic/supersonic burning) ramjets for high-speed vehicles to support future missions such as rapid strike against time-critical targets.

(U) FY 1995 ($ in Thousands):

- (U) $2,346 Develop ramjet components (inlets, combustors, nozzles, fuel systems, inlet/port covers, boost motors, etc.) for airbreathing propulsion applications. This effort facilitates technology transition to current and future air vehicles with greater range, increased velocity, and increased maneuverability which enhance weapon effectiveness.
  - (U) Completed testing of high energy gas generator fuels and selected candidate which met 100% of energy density goal.
  - (U) Verified the secondary combustion performance of the selected high energy gas generator fuel via ramburner tests over a simulated flight envelope.
  - (U) Completed testing of nozzleless boost motor design which will meet 100% of the total impulse goal.
  - (U) Assessed concepts/materials for eliminating debris (foreign object damage) during the rocket-to-ramjet transition process.
- (U) $2,346 Total

(U) FY 1996 ($ in Thousands):

- (U) $4,810 Develop ramjet components (inlets, dual mode combustors, ramburners, nozzles, fuel systems, inlet/port covers, boost motors, etc.) for airbreathing propulsion applications. This effort facilitates technology transition to current and future air vehicles with greater range, increased velocity, and increased maneuverability which enhance weapon effectiveness.
  - (U) Complete sub-scale testing of consumable ramjet structures for elimination of debris during rocket/ramjet transition.
  - (U) Accomplish rocket/ramjet transition test to complete boron fuel technology transfer from Germany to U.S.
  - (U) Identify test techniques/instrumentation/diagnostics for test rig integration to enable and expedite development of dual-mode combusters.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602203F Aerospace Propulsion
PROJECT NO. AND NAME 3012 Ramjet Technology	

- (U) $2,870 Investigate unique concepts for combining advanced propulsion cycles for high-speed aerospace vehicles. This effort supports technology transition for next generation reconnaissance/strike vehicles (manned and unmanned) and airbreathing boosters.
  - (U) Complete testing of two-dimensional sector test rig to demonstrate technology feasibility of critical combustor concept for Mach 0-6 turboramjet systems.
  - (U) Design and initiate fabrication of annular sector test rig for evaluating critical combustor component operation of Mach 0-6 turboramjet systems.
  - (U) Investigate techniques for continuous operation of the pulsed detonation wave cycle with potential for very high thrust-to-weight missile engine.
- (U) $7,680 Total

(U) FY 1997 ($ in Thousands):

- (U) $4,758 Develop ramjet components (inlets, dual mode combustors, ramburners, nozzles, fuel systems, inlet/port covers, boost motors, etc.) for airbreathing propulsion applications. This effort facilitates technology transition to current and future air vehicles with greater range, increased velocity, and increased maneuverability which enhance weapon effectiveness.
  - (U) Complete testing of full-scale flight weight consumable structures for eliminating debris during rocket/ramjet transition.
  - (U) Determine applicability and quantify benefits of advanced ramjet propulsion technologies (insensitive munitions, low-observables, self throttling, high energy fuels, structures, etc.) for ramjet operation from launch condition through Mach 6 operation.
  - (U) Determine propulsion performance of dual-mode ramjet components utilizing advanced test technologies, instrumentation, and diagnostics
- (U) $2,621 Investigate unique concepts for combining advanced propulsion cycles for high-speed aerospace vehicles. This effort supports technology transition for next generation reconnaissance/strike vehicles (manned and unmanned) and airbreathing boosters.
  - (U) Complete fabrication and testing of annular sector test rig to demonstrate performance of critical combustor components for application to Mach 0-6 turboramjet engines.
  - (U) Complete preliminary design of combined cycle engine demonstrator.
  - (U) Evaluate detonation engine operation in a combustor which is compatible with missile applications.
- (U) $7,379 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602203F Aerospace Propulsion

PROJECT NO. AND NAME
3012 Ramjet Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,527	8,700	8,423	Cont
(U) Current Budget Submit	2,346	7,680	7,379	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal changes are due to Congressional cut of $4.1 million in FY 1995. Increase in FY 1996 and beyond due to incorporation of Project 06PP, Directorate Operations.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0603216F, Aerospace Propulsion and Power Technology.
- (U) Program is reported to/ coordinated by the Joint Army/Navy/NASA/Air Force (JANNAF) executive committee.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

2 - Applied Research | **0602203F Aerospace Propulsion**

PROJECT NO. AND NAME
3048 Fuels and Lubrication

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3048 Fuels and Lubrication	8,861	15,355	13,390	12,414	12,254	12,218	12,880	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops advanced fuels, lubricants, and component technologies for use in aircraft and missile engines. Conventional petroleum and alternate fuels are developed and evaluated for Air Force applications. Fuels and lubricants must be thermally stable, cost-effective, and operate at higher temperatures.

(U) FY 1995 ($ in Thousands):

- (U) $2,240 Develop high thermal stability and endothermic hydrocarbon fuels to provide higher heat capacity and operating temperatures for aircraft and missile systems. This technology is for current and future aircraft to reduce maintenance caused by fuel system fouling/coking, and provide cooling for increased avionics loads and higher engine operating temperatures.
  - (U) Completed testing of two additives for JP-8+100 in reduced scale fuel system simulator.
  - (U) Quantified cost savings and reduced fuel system maintenance achievable with JP-8+100 in F-16s with F100-PW-200 engines.
- (U) $963 Develop high performance, low emissions, robust combustor concepts for advanced turbine engines. This will reduce the risk and cost associated with developing high performance, low maintenance engines that operate efficiently within air pollution guidelines and have high thrust-to-weight ratio and low specific fuel consumption.
  - (U) Evaluated high performance, low emissions, single cup, trapped vortex combustor.
  - (U) Evaluated advanced fuel/air mixing concepts through dome and liner geometry variation and validated probability density function computer model to reduce risk in developing Integrated High Performance Turbine Engine Technology (IHPTET) combustors.
- (U) $5,658 Develop lubricant technology to permit efficient high-speed rotation of turbine engine components. This technology includes conventional and advanced lubricants and mechanical systems extended to their highest temperature limitations, and approaches such as magnetic levitation and solid and vapor lubrication for advanced engines with operating conditions that exceed the capabilities of conventional approaches.
  - (U) Developed advanced bearing materials and surface coatings exhibiting effective corrosion resistance and performance with high temperature liquid lubricants.
  - (U) Developed vapor phase lubrication technology to meet requirements of expendable engines over their full mission cycle.
- (U) $8,861 Total

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PROJECT NO. AND NAME 3048 Fuels and Lubrication	

(U) FY 1996 ($ in Thousands):

- (U) $6,217 Develop high thermal stability and endothermic hydrocarbon fuels to provide higher heat capacity and operating temperatures for aircraft and missile systems. This technology is for current and future aircraft to reduce fuel systems fouling/coking, and provide cooling for increased avionics loads, higher engine temperatures, and reduced fuel consumption.
  - (U) Demonstrate performance and cost benefits of JP-8+100 fuel to reduce fuel system maintenance.
  - (U) Develop advanced fuel system components that allow the utilization of the heat sink of JP-8+100 fuel.
- (U) $2,279 Develop high performance, low emissions, robust combustor concepts for advanced turbine engines. This will reduce the risk and cost associated with developing high performance, low maintenance engines that operate efficiently within air pollution guidelines and have high thrust-to-weight ratio and low specific fuel consumption.
  - (U) Develop and evaluate a high performance, low emissions trapped vortex combustor concept in atmospheric rig tests using a full-scale sector of an annular combustor to validate this revolutionary concept for gas turbine engines.
  - (U) Evaluate advanced fuel injector concepts to select the best candidate for increased combustion performance and low emissions in advanced gas turbine engines.
- (U) $6,859 Develop lubricant technology to permit efficient high-speed rotation of turbine engine components. This technology includes conventional and advanced lubricants and mechanical systems extended to their highest temperature limitations and approaches such as magnetic levitation and solid and vapor lubrication for advanced engines with operating conditions that exceed the capabilities of conventional approaches.
  - (U) Develop liquid lubricants to 600°F bulk oil temperature to increase thermal stability and life while decreasing friction, wear, deposit formation, and corrosively in current and future engines.
  - (U) Validate vapor phase lubrication and magnetic levitation as technology alternatives to liquid lubricants at temperatures exceeding 700°F.
- (U) $15,355 Total

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2 - Applied Research	0602203F Aerospace Propulsion
PROJECT NO. AND NAME 3048 Fuels and Lubrication	

(U) FY 1997 ($ in Thousands):

- (U) $4,920 Develop high thermal stability hydrocarbon fuels to provide higher heat capacity and operating temperatures for aircraft and missile systems. This technology is for current and future aircraft to reduce fuel systems fouling/coking, and provide cooling for increased avionics loads, higher engine temperatures, and reduced fuel consumption.
  - (U) Validate performance and cost benefits of JP-8+100 fuel to increase sortie generation.
  - (U) Validate advanced fuel system components that allow the utilization of the heat sink of JP-8+100 fuel.
- (U) $2,929 Develop high performance, low emissions, robust combustor concepts for advanced turbine engines. This will reduce the risk and cost associated with developing high performance, low maintenance engines that operate efficiently within air pollution guidelines and have high thrust-to-weight ratio and low specific fuel consumption.
  - (U) Evaluate the high performance, low emissions, full-scale sector of a trapped vortex combustor at 20 atmospheric pressure for transition to Phase III Integrated High Performance Turbine Engine Technology (IHPTET).
  - (U) Evaluate the effectiveness of a turbocooler fuel/air heat exchanger for cooling the turbine vanes in advanced IHPTET Phase III combustor.
  - (U) Evaluate the best fuel injector concept in a high pressure combustion rig to fully characterize combustion performance and emissions levels.
- (U) $5,541 Develop lubricant technology to permit efficient high-speed rotation of turbine engine components. This technology includes conventional and advanced lubricants and mechanical systems extended to their highest temperature limitations, and approaches such as magnetic levitation and solid and vapor lubrication for advanced engines with operating conditions that exceed the capabilities of conventional approaches.
  - (U) Verify vapor phase lubrication as primary system in expendable and limited life gas turbine engines.
  - (U) Verify magnetic levitation and control as full replacement for conventional lubricants and bearings in an advanced gas generator.
- (U) $13,390 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602203F Aerospace Propulsion
PROJECT NO. AND NAME 3048 Fuels and Lubrication	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	9,545	14,156	12,745	Cont
(U) Current Budget Submit	8,861	15,355	13,390	Cont

(U) Change Summary Explanation:

Funding: Vertical increases to this project since the previous President's Budget are due to additional emphasis placed on demonstration of JP8+100. Horizontal increase in FY 1996 and beyond due to incorporation of Project 06PP, Directorate Operations.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603216F, Aerospace Propulsion and Power Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE March 1996

2 - Applied Research | **0602203F Aerospace Propulsion**

PROJECT NO. AND NAME
3066 Turbine Engine Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3066 Turbine Engine Technology	25,675	33,978	39,181	40,080	41,039	41,982	43,125	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops technology to increase propulsion system operational reliability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. Analytical and experimental efforts are conducted in fans/compressors, high temperature combustors, turbines, internal flow systems, controls, exhaust systems, and structural design. This project supports the Integrated High Performance Turbine Engine Technology (IHPTET) program.

(U) FY 1995 ($ in Thousands):

- (U) $18,750 Develop core engine components for turbofan/turbojet engines for fighters, attack aircraft, bombers, and transports. These components will provide aircraft engines with higher performance, increased durability, reduced fuel consumption, and lower life cycle cost.
  - (U) Demonstrated advanced compressors with higher aerodynamic efficiencies, lower manufacturing costs, increased robustness, higher compressor exit temperature capability, lower weight, and improved seals.
  - (U) Demonstrated advanced combustors with higher combustion efficiencies, lower manufacturing costs, increased robustness, higher combustion temperature, lower weight, and improved burner pattern factor.
  - (U) Demonstrated advanced turbines with higher aerothermodynamic efficiencies, lower manufacturing costs, increased robustness, higher turbine inlet temperature capability, lower weight, and improved cooling effectiveness.
- (U) $3,196 Develop turbine engine components (fans, low pressure turbines, engine controls, exhaust nozzles, and integration technology) for turbofan/turbojet engines for fighters, attack aircraft, bombers, and transports. These components will provide aircraft engines with lower life cycle cost, increased durability, higher performance, and reduced fuel consumption.
  - (U) Demonstrated advanced fans with higher aerodynamic efficiencies, lower manufacturing costs, increased robustness, higher flow distortion tolerance capability, lower weight, and reduced tip losses.
- (U) $2,397 Develop components for expendable engines for missile and unmanned air vehicle applications. These components will provide expendable engines with reduced cost, reduced fuel consumption, and increased specific thrust, greatly expanding the operating envelopes of cruise missiles.
  - (U) Demonstrated advanced turbine with higher aerothermodynamic efficiencies, lower manufacturing costs, increased robustness, higher inlet temperature capability, lower weight, and improved cooling effectiveness.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602203F Aerospace Propulsion
PROJECT NO. AND NAME 3066 Turbine Engine Technology	

- (U) $1,332 Develop components for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, and theater transports. These components will provide aircraft engines with lower life cycle cost, increased durability, higher performance, and reduced fuel consumption.
  - (U) Demonstrated advanced compressors with higher aerodynamic efficiencies, lower manufacturing costs, increased robustness, higher compressor exit temperature capability, lower weight, and improved seals.
- (U) $25,675 Total

(U) FY 1996 ($ in Thousands):

- (U) $26,270 Develop core engine components for turbofan/turbojet engines for fighters, attack aircraft, bombers, and transports. These components will provide aircraft engines with higher performance, increased durability, reduced fuel consumption, and lower life cycle cost.
  - (U) Design and fabricate advanced compressors with higher aerodynamic efficiencies, lower manufacturing costs, increased robustness, higher compressor exit temperature capability, lower weight, and improved seals.
  - (U) Design and fabricate advanced combustors with higher combustion efficiencies, lower manufacturing costs, increased robustness, higher combustion temperature, lower weight, and improved temperature patterns.
  - (U) Design and fabricate advanced turbines with higher aerothermodynamic efficiencies, lower manufacturing costs, increased robustness, higher turbine inlet temperature, lower weight, and improved cooling effectiveness.
- (U) $3,040 Develop turbine engine components (fans, low pressure turbines, engine controls, exhaust nozzles, and integration technology) for turbofan/turbojet engines for fighters, attack aircraft, bombers, and transports. These components will provide aircraft engines with higher performance, increased durability, reduced fuel consumption, and lower life cycle cost.
  - (U) Design and fabricate advanced fan with higher aerodynamic efficiencies, lower manufacturing costs, increased robustness, and lower weight.
- (U) $3,156 Develop components for expendable engines for missile and unmanned air vehicle applications. These components will provide expendable engines with reduced cost, reduced fuel consumption, and increased specific thrust, greatly expanding the operating envelopes of cruise missiles.
  - (U) Design and fabricate advanced combustor with higher aerothermodynamic efficiencies, lower manufacturing costs, increased robustness, and lower weight.
- (U) $1,512 Develop components for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, and theater transports.
  - (U) Demonstrate advanced turbine with higher aerodynamic efficiencies, lower manufacturing costs, increased robustness, higher turbine inlet temperature, lower weight, and improved cooling effectiveness.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602203F Aerospace Propulsion
PROJECT NO. AND NAME 3066 Turbine Engine Technology	

- (U) $33,978 Total

(U) FY 1997 ($ in Thousands)

- (U) $26,659 Develop core engine components for turbofan/turbojet engines for fighters, attack aircraft, bombers, and transports. These components will provide aircraft engines with higher performance, increased durability, reduced fuel consumption, and lower life cycle cost.
  - (U) Demonstrate advanced compressors with higher aerodynamic efficiencies, lower manufacturing costs, increased robustness, higher compressor exit temperature capability, lower weight, and improved seals.
  - (U) Demonstrate advanced combustors with higher combustion efficiencies, lower manufacturing costs, increased robustness, higher combustion temperature, lower weight, and improved temperature patterns.
  - (U) Demonstrate advanced turbines with higher aerothermodynamic efficiencies, lower manufacturing costs, increased robustness, higher turbine inlet temperature, lower weight, and improved cooling effectiveness.
- (U) $6,962 Develop turbine engine components (fans, low pressure turbines, engine controls, exhaust nozzles, and integration technology) for turbofan/turbojet engines for fighters, attack aircraft, bombers, and transports. These components will provide aircraft engines with higher performance, increased durability, reduced fuel consumption, and lower life cycle cost.
  - (U) Demonstrate advanced fan with higher aerodynamic efficiencies, lower manufacturing costs, increased robustness, and lower weight.
- (U) $2,862 Develop components for expendable engines for missile and unmanned air vehicle applications. These components will provide expendable engines with reduced cost, reduced fuel consumption, and increased specific thrust, greatly expanding the operating envelopes of cruise missiles.
  - (U) Demonstrate advanced combustor with higher aerothermodynamic efficiencies, lower manufacturing costs, increased robustness, and lower weight.
- (U) $2,698 Develop components for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, and theater transports.
  - (U) Demonstrate advanced turbine with higher aerodynamic efficiencies, lower manufacturing costs, increased robustness, higher turbine inlet temperature, lower weight, and improved cooling effectiveness.
- (U) $39,181 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602203F Aerospace Propulsion
PROJECT NO. AND NAME 3066 Turbine Engine Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	27,630	38,490	40,006	Cont
(U) Current Budget Submit	25,675	33,978	39,181	Cont

(U) Change Summary Explanation:

Funding: Vertical decreases to this project since the previous President's Budget are due to budget constraints and priorities with the Science and Technology (S&T) Program. Horizontal increase in FY 1996 and beyond due to incorporation of Project 06PP, Directorate Operations; also, turbine engine efforts restored to achieve Phase II Integrated High Performance Turbine Engine Technology goals by FY 1997.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary ($ in Thousands):**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0603202F, Aircraft Propulsion Subsystem Integration.
- (U) PE 0603216F, Aerospace Propulsion and Power Technology.
- (U) PE 0602122N, Aircraft Technology.
- (U) PE 0603210N, Aircraft Propulsion.
- (U) PE 0603003A, Aviation Advanced Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602203F Aerospace Propulsion

PROJECT NO. AND NAME
3145 Aerospace Power Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3145 Aerospace Power Technology	9,769	15,224	14,956	15,454	15,301	15,263	16,080	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops technologies for aerospace power generation, conversion, and transmission systems including advanced electrical power component and subsystem technologies. Power components are developed for aircraft and flight line equipment to increase reliability, maintainability, commonality, and supportability. This project supports an initiative which uses electrical power to replace hydraulic and pneumatic power and their costly logistics support. Essentially, all power electronics technology being developed has dual-use opportunities. Specific application areas include electric automobiles, electric brakes, electrically actuated power steering, and a wide range of variable speed industrial motor drive applications.

(U) FY 1995 ($ in Thousands):

- (U) $9,174 Develop aerospace batteries and power generation, conversion, and transmission components for aircraft systems. These components provide aircraft with a high degree of self-sufficiency, improved reliability, maintainability, and supportability, all yielding a quicker aircraft turn-around time. In addition, ground support equipment requirements will be dramatically reduced.
  - (U) Conducted rig test of electrical generator with magnetic bearings to improve reliability by two-fold for engine start and auxiliary power unit systems.
  - (U) Designed internal starter/generator which will allow elimination of engine mounted gearbox and improve reliability by five-fold over existing electrical generators.
  - (U) Designed electrical components (semiconductor switches, capacitors, smart circuit breakers) essential for fault tolerant electrical power.
- (U) $448 Develop battery systems for guidance, navigation, and control functions for missile systems. Batteries with higher power density, longer life, increased reliability, and rechargability will provide missiles systems with greater reliability and reduced maintenance costs.
  - (U) Designed and fabricated bipolar lithium battery cell to optimize packaging and increase energy density providing a two-fold improvement over current lithium cell designs.
- (U) $147 Develop special purpose power components for advanced surveillance and communications systems, as well as ground power applications.
  - (U) Validated a high temperature superconducting coil component for use in high-power electrical generators. Provides improved efficiency over existing electrical generators which support air base electrical power needs.
- (U) $9,769 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602203F Aerospace Propulsion

PROJECT NO. AND NAME
3145 Aerospace Power Technology

(U) FY 1996 ($ in Thousands):

- (U) $13,458 Develop aerospace batteries and power generation, conversion, and transmission components for aircraft systems. These components provide aircraft with a high degree of self-sufficiency, improved reliability, maintainability, and supportability, all yielding a quicker aircraft turn-around time. In addition, ground support equipment requirements will be dramatically reduced.
  - (U) Rig test components to engine start/auxiliary power unit systems to improve reliability by two-fold.
  - (U) Design and fabricate electrical components essential for a fault tolerant electrical power system.
  - (U) Test high temperature semiconductor switches to demonstrate increased operating temperature and improved reliability.
- (U) $1,236 Develop battery systems for guidance, navigation, control functions for missile systems, and for use in navigational aids, radios and sensors for special operations forces. Batteries with higher power density, longer life, increased reliability, and rechargability will provide missiles systems and special operations forces with greater reliability and reduced maintenance costs.
  - (U) Develop lithium cell components for use in rechargeable batteries--a three-fold reduction in mass/volume over existing batteries.
- (U) $530 Develop special purpose power components for advanced surveillance and communications systems, as well as ground power applications.
  - (U) Complete electromagnetic interference (EMI) and thermal modeling activities for aircraft power systems.
- (U) $15,224 Total

(U) FY 1997 ($ in Thousands):

- (U) $13,167 Develop aerospace batteries and power generation, conversion, and transmission components for aircraft systems. These components provide aircraft with a high degree of self-sufficiency, improved reliability, maintainability, and supportability, all yielding a quicker aircraft turn-around time. In addition, ground support equipment requirements will be dramatically reduced.
  - (U) Demonstrate electrical components essential for a fault tolerant electrical power system.
  - (U) Complete test and demonstration of high temperature semiconductor switches to demonstrate increased operating temperature and improved reliability.
  - (U) Complete fabrication and begin testing internal engine starter/generator which leads to elimination of engine gear box.
- (U) $1,252 Develop battery systems for guidance, navigation, control functions for missile systems, and for use in navigational aids, radios and sensors for special operations forces. Batteries with higher power density, longer life, increased reliability, and rechargability will provide missiles systems and special operations forces with greater reliability and reduced maintenance costs.
  - (U) Demonstrate lithium cells for use in rechargeable batteries--allows three-fold reduction in mass and volume over existing batteries.
- (U) $537 Develop special purpose power components for advanced surveillance and communications systems, as well as ground power applications.
  - (U) Develop next generation electrical conductors with 50% increase in current density and higher operating temperature for advanced lightweight electrical generators.

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2 - Applied Research	0602203F Aerospace Propulsion
PROJECT NO. AND NAME 3145 Aerospace Power Technology	

– (U) $14,956 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	10,523	17,246	16,727	Cont
(U) Current Budget Submit	9,769	15,224	14,956	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase in FY 1996 and beyond due to corporation of Project 06PP, Directorate Operations.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

– (U) PE 0603216F, Aerospace Propulsion and Power Technology.

– (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

2 - Applied Research | **0602204F Aerospace Avionics**

	COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	63,330	65,789	71,261	74,737	77,913	78,888	82,058	Continuing	Continuing
06AA	Laboratory Operations	39,132	0	0	0	0	0	0	Continuing	Continuing
2000	Active Electronic Countermeasures	1,957	6,724	7,641	8,023	8,402	8,731	8,890	Continuing	Continuing
2001	Electro-Optical Technology	1,796	5,118	5,816	6,106	6,395	6,645	6,766	Continuing	Continuing
2002	Microwave Technology	4,828	9,403	9,450	9,681	9,600	9,156	10,431	Continuing	Continuing
2003	Avionics System Design Technology	273	7,811	8,877	9,321	9,761	10,142	10,329	Continuing	Continuing
2004	Reconnaissance/Strike Electro-Optical Sensors	1,024	3,266	3,710	3,895	4,079	4,239	4,316	Continuing	Continuing
6095	Inertial Reference and Guidance Technology	1,634	3,483	3,958	4,156	4,351	4,522	4,605	Continuing	Continuing
6096	Microelectronics Technology	3,669	9,591	8,636	9,223	9,840	8,971	9,752	Continuing	Continuing
7622	Reconnaissance Strike Radio Frequency Sensors	2,073	5,593	6,356	6,673	6,989	7,262	7,395	Continuing	Continuing
7629	Fire Control Avionics	3,133	6,678	7,589	7,969	8,345	8,672	8,831	Continuing	Continuing
7633	Passive Electronic Countermeasures	2,894	6,166	7,007	7,357	7,705	8,006	8,153	Continuing	Continuing
7662	Avionics Data Transmission and Reception	917	1,956	2,221	2,333	2,446	2,542	2,590	Continuing	Continuing

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

(U) **A. Mission Description and Budget Item Justification:** This Applied Research program develops and establishes the feasibility of technology for Air Force avionics needs to include target detection and classification, fire control, navigation, communication, jamming and deception of hostile defenses, avionics architectures, data processing, and electronic devices. Advances in avionics are needed to multiply weapons effectiveness, enhance reliability, and reduce life cycle costs. In FY 1996, the 06AA infrastructure project was eliminated. All efforts in this program element contain the resources necessary, including civilian salaries, to manage, conduct, and document the technical activities.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	66,601	74,256	73,561	Cont
(U) Appropriated Value	67,957	68,500		
(U) Adjustments to Appropriated Value				Cont
a. Congressional/General Reductions	-3,187	-1,334		
b. SBIR	-691	-1,067		
c. Omnibus/Other Above Threshold Reprogrammings	-720	-310		
d. Below Threshold Reprogrammings	-29			
(U) Current Budget Submit	63,330	65,789	71,261	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increases are due to increased emphasis on avionics technology development. Beginning in FY 1996, Project 06AA, Laboratory Operations, resources have been distributed to the technical efforts.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

2 - Applied Research | **0602204F Aerospace Avionics**

PROJECT NO. AND NAME
06AA Laboratory Operations

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
06AA Laboratory Operations	39,132	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Provides for management and support of Wright Laboratory's Avionics and Electronics Technology Directorates, Wright-Patterson AFB, OH. It includes civilian pay, travel, utility costs, and building maintenance.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	41,152	0	0	Cont
(U) Current Budget Submit	39,132	0	0	Cont

(U) Change Summary Explanation:

Funding: Beginning in FY 1996, Project 06AA funding will be distributed into the technical projects.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2000 Active Electronic Countermeasures

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2000 Active Electronic Countermeasures	1,957	6,724	7,641	8,023	8,402	8,731	8,890	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops technologies to jam, deceive, or disable electronic threats throughout the electromagnetic spectrum. The project includes tasks to develop countermeasure concepts against radar, infrared (IR), and electro-optical threat weapon systems as well as command, control, and communications networks. Various links and sensors of threat air defense systems are analyzed and a database of countermeasure techniques and technology is generated from which specific self-protection or support countermeasures equipment can be developed. Countermeasure capabilities against advanced threats are vital for operational aircraft survival in future hostile environments.

(U) FY 1995 ($ in Thousands):

- (U) $571 Develop technologies for on-board and expendable (active flare) countermeasures to counter IR-guided missiles.
  - (U) Designed and evaluated combined (on-board and off-board) countermeasure concept using non-laser-based IR sources.
- (U) $618 Develop off-board radio frequency (RF) countermeasure concepts (active decoys) to assure the survivability of our aircraft against advanced radar threats.
  - (U) Defined and demonstrated key technologies for a distributed architecture decoy countermeasure concept. This approach will be effective against advanced radar threats.
  - (U) Evaluated new countermeasures concepts that exploit a combination of on-board and off-board RF jamming sources.
- (U) $768 Develop affordable, on-board RF countermeasure technologies and concepts to support affordable solutions for aircraft self-protection.
  - (U) Evaluated cyclostationary processing concepts to accurately identify and reproduce signals for effective jamming.
- (U) $1,957 Total

(U) FY 1996 ($ in Thousands):

- (U) $2,215 Develop technologies for on-board and off-board (active IR decoys) countermeasures to counter IR-guided missiles.
  - (U) Evaluate concepts for countering imaging IR missile seekers using on-board IR jamming resources.
  - (U) Continue in-house evaluation, using the Dynamic Infrared Missile Evaluator, of both on-board and off-board countermeasures concepts against various types of advanced missile seeker threats.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2000 Active Electronic Countermeasures

- (U) $1,019 Develop affordable, off-board radio frequency (RF) countermeasure concepts (active decoys) for survivability against advanced radar threats.
  - (U) Evaluate digital RF memory chip technology for application to active decoys.
  - (U) Investigate techniques and jamming modulations for active decoys to ensure effective countering of advanced radar threats.
- (U) $1,860 Develop on-board RF technology and concepts to achieve affordable solutions to countermeasures requirements related to radar-controlled lethal threat systems.
  - (U) Evaluate concepts to affordably counter monopulse tracking radars.
  - (U) Continue development of the coherent digital exciter jammer subsystem to help provide affordable countermeasures against advanced radar threats.
- (U) $1,630 Develop on-board RF countermeasures technology and concepts to jam communications and data links of enemy air defense systems.
  - (U) Evaluate cyclostationary signal processing techniques.
  - (U) Develop concepts to jam data signals used for command and control of hostile lethal threat systems.
- (U) $6,724 Total

(U) FY 1997 ($ in Thousands):

- (U) $2,128 Develop technologies for on-board and off-board (active infrared (IR) decoys) countermeasures to counter IR-guided missiles.
  - (U) Continue development and in-house evaluation of on-board IR countermeasures against imaging missile seekers.
  - (U) Continue development of IR flare technology using advanced materials.
  - (U) Continue to develop concepts for countermeasures against laser beamrider missiles.
  - (U) Continue to develop concepts for countermeasures against night vision devices which are used to augment IR missile launchers.
- (U) $1,572 Develop off-board RF countermeasures concepts (active decoys) for affordable survivability against radar threats.
  - (U) Test active decoys using advanced jamming modulations tailored to counter coherent radar threats.
  - (U) Identify countermeasures techniques and technology for decoys operating in the high-millimeter band frequency range.
- (U) $2,080 Develop affordable, on-board RF technology and concepts to achieve solutions to countermeasures requirements related to radar-controlled lethal threat systems.
  - (U) Investigate integrated angle, doppler, and range deception techniques to effectively jam coherent monopulse radars.
  - (U) Fabricate and test narrow-band, digital RF memory architecture.
  - (U) Test and evaluate a unique modulation component for digital jamming.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2000 Active Electronic Countermeasures

- (U) $1,861 Develop on-board radio frequency (RF) countermeasure technologies and concepts to support jamming systems against voice and data communications which are key elements of enemy air defense systems.
  - (U) Fabricate and test breadboard hardware that will jam the special data signals used for command and control of hostile lethal threat systems.
  - (U) Develop techniques to jam communications systems which use featureless waveforms.
- (U) $7,641 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,058	7,590	7,518	Cont
(U) Current Budget Submit	1,957	6,724	7,641	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increase in FY 1996 is due to incorporation of Project 06AA infrastructure funding. Horizontal increase in FY 1997 is due to increased emphasis on avionics technology development.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:
- (U) PE 0603270F, Electronic Combat Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2001 Electro-Optical Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2001 Electro-Optical Technology	1,796	5,118	5,816	6,106	6,395	6,645	6,766	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project evaluates new materials and devices for airborne optical sensing, optical processing, and laser target designation. Electro-optical technologies provide faster, more accurate detection and targeting capability combined with the benefits of low weight and low-power requirements.

(U) FY 1995 ($ in Thousands):

- (U) $501 Develop and evaluate materials and devices for laser targeting and countermeasures.
  - (U) Demonstrated increased power of tunable infrared source.
  - (U) Evaluated materials for short pulse infrared sources.
- (U) $724 Develop high-throughput, real-time, optical processing technology for imaging and target recognition.
  - (U) Developed novel photolithographic processes for integrated circuit production.
  - (U) Demonstrated optical interconnections for improved image processing.
- (U) $571 Develop and evaluate detectors for targeting and tracking of air and ground targets.
  - (U) Analyzed the utility of arrays of ultra-violet-sensitive diode sensors.
- (U) $1,796 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2001 Electro-Optical Technology

(U) FY 1996 ($ in Thousands):
- (U) $881 Develop short pulse infrared (IR) source technology for target recognition and designation.
  - (U) Develop solid state and semiconductor technologies for application to target recognition and designation.
- (U) $881 Develop electro-optical detector technology for advanced reconnaissance and strike sensors.
  - (U) Demonstrate improved discrimination capability of detector arrays which use quantum well technology to provide dual-color inputs.
- (U) $1,008 Develop high-throughput, real-time optical processing technology for imaging and target recognition.
  - (U) Design sources and components for greater speed and testability of optical subsystems.
- (U) $2,348 Develop ultra-violet technology for imaging, tracking, and jet engine analysis.
  - (U) Develop semiconductor technology for high performance detector arrays/laser diodes.
- (U) $5,118 Total

(U) FY 1997 ($ in Thousands):
- (U) $2,034 Develop short pulse infrared and ultraviolet source technologies for target recognition and designation.
  - (U) Continue development and evaluation of solid state and semiconductor technologies for application to target recognition and designation.
- (U) $683 Develop electro-optical detector technology for advanced reconnaissance and strike sensors.
  - (U) Evaluate quantum well detectors and multiplexers for improvement in target detection.
- (U) $1,489 Develop high-throughput, real-time optical processing technology to improve precision in imaging and target recognition.
  - (U) Develop and evaluate sources and components for greater speed and testability of optical subsystems.
- (U) $1,610 Develop ultraviolet technology for imaging, tracking, and jet engine analysis.
  - (U) Continue development and evaluation of semiconductor technology to improve the performance and reliability of detector arrays.
- (U) $5,816 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2001 Electro-Optical Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,889	5,777	5,772	Cont
(U) Current Budget Submit	1,796	5,118	5,816	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increase in FY 1996 is due to incorporation of Project 06AA infrastructure funding. Horizontal increase in FY 1997 is due to increased emphasis on avionics technology development.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0602702F, Command, Control, and Communications.
- (U) PE 0603270F, Electronic Combat Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

2 - Applied Research | **0602204F Aerospace Avionics**

PROJECT NO. AND NAME
2002 Microwave Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2002 Microwave Technology	4,828	9,403	9,450	9,681	9,600	9,156	10,431	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Develops the technologies that include solid state and vacuum electronic power devices and amplifiers, low noise and signal control components, high-temperature electronics, multi-function monolithic integrated circuits, multi-chip assemblies including transmit/receive modules, high density packaging and interconnects, and advanced phased array antenna technology. This project focuses on the generation, control, reception, and processing of microwave and millimeter wave power. The requirements for device and component technology developments are based on Air Force and other DOD weapon system needs in the areas of radar, communications, electronic warfare (EW), navigation, and smart weapons applications.

(U) FY 1995 ($ in Thousands):

- (U) $2,614 Develop advanced solid state devices and integrated circuit technology to enable new and upgraded aircraft electronic systems.
  - (U) Demonstrated an internally-impedance-matched, 25 watts output power, 30%-efficient satellite communications power amplifier operating over the 7.25-7.75 gigahertz frequency range.
  - (U) Developed advanced transistor structures and fabrication techniques for microwave power amplifiers that have improved power dissipation and enhanced reliability.
  - (U) Developed reliable, high-operating-temperature electronics for microwave transmitters used in airborne applications.
  - (U) Investigated silicon carbide semiconductor materials and metal contacts for use in microwave transistors.
  - (U) Developed silicon carbide field effect transistors for reliable high-power (20 watts) operation at ten gigahertz and six decibel gain.
- (U) $571 Develop millimeter wave components to provide enhanced weapon transceiver capability.
  - (U) Investigated low-cost, micro-machined, millimeter wave circuits in the 60 gigahertz frequency range.
  - (U) Investigated 35 gigahertz, monolithic integrated circuit signal control components for millimeter wave frequency, modulated, continuous wave terminal guidance radars.
- (U) $645 Develop solid state phased array radar electronic combat and communications technology which includes multi-chip assemblies.
  - (U) Demonstrated high-power, high-efficiency, transistor amplifiers for phased array radars to increase performance and power efficiency in the 7-11 gigahertz frequency band.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics
PROJECT NO. AND NAME 2002 Microwave Technology	

- (U) $428 Develop advanced vacuum electronic devices for new and upgraded airborne radar and electronic combat systems.
  - (U) Developed non-thermionic cathodes and junction emitters for microwave tubes.
  - (U) Developed millimeter wave power modules for communications and electronic warfare (EW) transmitters producing 50 watts of output power and >30 decibel gain over the 20 to 40 gigahertz frequency range.
- (U) $570 Develop microwave/digital mixed mode components for an advanced airborne multi-function phased array capability.
  - (U) Developed indium phosphide heterojunction bipolar transistor and high electron mobility transistor single chip monolithic integrated circuits for 7-11 gigahertz receiver applications.
  - (U) Developed advanced analytical methods for evaluating mixed-mode integrated components.
- (U) $4,828 Total

(U) FY 1996 ($ in Thousands):

- (U) $2,051 Develop mixed-mode, microwave/digital multi-function integrated circuits components for radar and EW receivers and for digital phased array radars.
  - (U) Demonstrate single chip monolithic integrated circuits for 7-11 gigahertz receiver applications.
  - (U) Continue to develop advanced analytical methods for evaluating mixed-mode integrated components.
  - (U) Develop miniature digital receivers for radar and electronic combat phased array systems.
- (U) $1,791 Develop high-power, solid state amplifiers for radar and communications applications.
  - (U) Continue development of high-power, high-efficiency amplifiers for phased array radars to improve their performance and efficiency on the 7-11 gigahertz frequency band.
  - (U) Design high-power transmit amplifiers for precision guided weapons.
  - (U) Design advanced transistors and fabrication techniques for microwave power amplifiers that have improved power dissipation and enhanced reliability.
- (U) $1,791 Develop reliable, high-operating-temperature electronics for microwave transmitters used in airborne applications.
  - (U) Develop and evaluate candidate materials that will improve the reliability of microwave transistors.
  - (U) Develop integrated circuits for reliable, high-power operation of advanced EW and radar applications.
- (U) $1,697 Develop high-power vacuum electronics devices and components for EW, radar, and communications applications.
  - (U) Design components for advanced microwave tubes.
  - (U) Develop millimeter wave power modules to increase range of communications and electronic combat transmitters over the 20 to 40 gigahertz frequency range.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2002 Microwave Technology

- (U) $2,073 Develop millimeter wave integrated circuits for terminal guidance and communications systems.
  - (U) Continue development of low-cost, micro-machined, millimeter wave circuits in the 60 gigahertz frequency range.
  - (U) Continue development of integrated circuit signal control components to improve the performance and reliability of millimeter wave terminal guidance radars.
- (U) $9,403 Total

(U) FY 1997 ($ in Thousands):

- (U) $2,050 Develop mixed-mode, microwave/digital multi-function integrated circuits components for radar and electronic warfare (EW) receivers and for digital phased array radars.
  - (U) Design single chip integrated circuits for 1-20 gigahertz receiver applications.
  - (U) Continue to develop advanced analytical methods for evaluating mixed-mode integrated components.
  - (U) Design and develop mixed-mode signal control component for reduced weight and volume of airborne receiver systems.
- (U) $1,930 Develop high-power, solid state amplifiers for radar and communications applications.
  - (U) Design and develop high-power, high-efficiency amplifiers for phased array radars which increase the performance and efficiency on the 1-20 gigahertz frequency band.
  - (U) Develop high-power transmit amplifiers for precision guided weapons.
  - (U) Develop advanced transistors and fabrication techniques for microwave power amplifiers that have improved power dissipation and enhanced reliability.
- (U) $1,760 Develop reliable, high-operating-temperature electronics for microwave transmitters used in airborne applications.
  - (U) Continue development of candidate materials that will improve the reliability of microwave transistors.
  - (U) Develop integrated circuits for reliable, high-power operation of advanced electronic warfare and radar applications.
- (U) $1,762 Develop high-power vacuum electronics devices and components for EW, radar, and communications applications.
  - (U) Fabricate components for advanced microwave tubes to improve reliability of radio frequency subsystems.
  - (U) Continue fabrication and testing of millimeter wave power modules to increase range capability of communications and electronic combat transmitters over the 20 to 40 gigahertz frequency range.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics
PROJECT NO. AND NAME 2002 Microwave Technology	

- (U) $1,948 Develop millimeter wave integrated circuits for terminal guidance and communications systems.
  - (U) Evaluate low-cost, micro-machined, millimeter wave circuits in the 60 gigahertz frequency range.
  - (U) Continue development and initiate test of integrated circuit signal control components to improve the performance and reliability of millimeter wave terminal guidance radars.
- (U) $9,450 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,078	10,613	10,003	Cont
(U) Current Budget Submit	4,828	9,403	9,450	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increase in FY 1996 is due to incorporation of Project 06AA infrastructure funding. Horizontal increase in FY 1997 is due to increased emphasis on avionics technology development.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603270F, Electronic Combat Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2003 Avionics System Design Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2003 Avionics System Design Technology	273	7,811	8,877	9,321	9,761	10,142	10,329	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Develops advanced avionics technology for digital processing, software tools and techniques, and systems architectures. Develops new concepts, demonstrates feasibility, and advances technology for Air Force avionics system needs. Specifically advances technology for avionics displays, digital processing hardware, sensor integration, and real-time distributed software to improve weapon system performance and avionics availability. Advances in these avionics technologies will multiply weapon systems effectiveness, enhance reliability, and reduce life cycle costs.

(U) FY 1995 ($ in Thousands):

- (U) $95 Develop advanced processor and software technologies to provide for increased functionality and flexibility of embedded, real-time airborne data processing.
  - (U) Tested a computer-aided design tool suite (with built-in-self-test capabilities) on very large-scale integration chip designs. Refined tools and then demonstrated them on large (200 thousand-gate) application-specific integrated circuit.
- (U) $178 Develop advanced integration, fusion, and data management technologies that enable increased exploitation of avionics assets to provide for more cost-effective system solutions.
  - (U) Selected an object-oriented database development methodology, specified an application program interface, and selected an operating system and interface for a consolidated database management system.
  - (U) Developed preliminary design for an avionics data network using off-the-shelf, scalable, coherent interface components.
- (U) $273 Total

(U) FY 1996 ($ in Thousands):

- (U) $1,437 Develop advanced technologies to increase functionality and flexibility of embedded, real-time airborne data processing.
  - (U) Develop a process to translate old computer code from existing avionics processors into advanced commercial-based avionics.
  - (U) Develop technology for measuring the performance of distributed, multi-processor avionics software.
  - (U) Identify Ada 9X features for incorporation into distributed, multi-processor avionics applications.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2003 Avionics System Design Technology

– (U) $2,381	Develop advanced integration, fusion, and data management technologies that enable increased exploitation of avionics assets to provide for more cost-effective system solutions. – (U) Develop a model of a scalable, coherent, interface network that will increase avionics reliability and improve real-time performance. – (U) Design an object-oriented data base management system scenario definition and validation, final object definition, manipulation, and control language specifications.
– (U) $2,381	Develop advanced machine intelligence technologies to provide a capability for improved communications, recognition, understanding of sensor data, and pilot aids. – (U) Evaluate associative control technology for application to avionics. – (U) Characterize avionics system requirements for application of commercial personal computer memory card technology. – (U) Develop dynamic, real-time scheduling methodology for distributed, multi-processor avionics architectures and determine scheduling requirements of real-time avionics applications. – (U) Complete feasibility study on reducing Global Positioning System (GPS) error through the mitigation of ionospheric effects.
– (U) $1,612	Develop affordable, supportable, producible high definition/resolution displays with all-digital interfaces, that are readable in sunlight, and that are highly reliable (>10,000 hours mean time between failure). – (U) Investigate technology to increase the optical efficiency of active matrix liquid crystal displays in order to facilitate dissemination of situational data to pilots. – (U) Perform an in-house evaluation and demonstration of high definition digital display, with several formats, for application to aircraft such as the Joint Surveillance Target Attack Radar System (JSTARS).
– (U) $7,811	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2003 Avionics System Design Technology

(U) FY 1997 ($ in Thousands):

- (U) $1,371 Develop advanced technologies to increase functionality and flexibility of embedded, real-time airborne data processing.
  - (U) Develop techniques and tools necessary for translating old computer code from existing avionics processors into advanced commercial-based avionics processors.
  - (U) Develop technology for quantifying trade offs between performance and costs for distributed, multi-processor avionics software.
  - (U) Develop and define a maturation strategy for incorporating Ada 9X features in a distributed, multi-processor avionics application.
- (U) $2,644 Develop advanced integration, fusion, and data management technologies that enable increased exploitation of avionics assets to provide for more cost-effective system solutions.
  - (U) Develop and test an avionics brassboard of a scalable, coherent, interface network that will increase avionics reliability and improve real-time performance.
  - (U) Develop distributed, fault-tolerant extensions to basic object-oriented data base management system.
  - (U) Analyze performance and environmental requirements of targeted aging platforms; select commercial-off-the-shelf candidate for demonstration of cost-effective upgrade capability.
- (U) $2,738 Develop advanced machine intelligence technologies to provide a capability for improved communications, recognition, understanding of sensor data, and pilot aids.
  - (U) Develop avionics insertion concepts for development of avionics breadboards which are compatible with commercial personal computer memory card standards.
  - (U) Design dynamic, real-time scheduling algorithms to improve the correlation of sensors.
  - (U) Continue evaluation of associative control process technology for application to avionics.
- (U) $2,124 Develop affordable, supportable, producible high definition/resolution displays with all-digital interfaces, that are readable in sunlight, and that are highly reliable (>10,000 hours mean time between failure).
  - (U) Investigate technology to increase the optical efficiency of active matrix liquid crystal displays to facilitate dissemination of situational data to the pilot.
  - (U) Develop field-emissive display for high-brightness, sunlight-readable cockpit flight instruments.
- (U) $8,877 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2003 Avionics System Design Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	287	8,818	8,734	Cont
(U) Current Budget Submit	273	7,811	8,877	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increase in FY 1996 is due to incorporation of Project 06AA infrastructure funding. Horizontal increase in FY 1997 is due to increased emphasis on avionics technology development.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) PE 0602301E, Intelligence System Program.
- (U) PE 0603217N, Maritime Avionics Subsystem Technologies.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2004 Reconnaissance/Strike Electro-Optical Sensors

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2004 Reconnaissance/Strike Electro-Optical Sensors	1,024	3,266	3,710	3,895	4,079	4,239	4,316	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Develops technologies which improve performance, supportability, and cost of passive and active electro-optical sensors for reconnaissance, acquisition, and strike of aerial and ground targets. The technologies developed in this project will increase target detection and identification ranges, system reliability, kill probability, and aircraft survivability while decreasing pilot workload and system cost.

(U) FY 1995 ($ in Thousands):

- (U) $600 Develop advanced electro-optical sensor technology for air-to-ground reconnaissance/targeting in adverse-weather and improved countermeasure immunity.
  - (U) Demonstrated a scanning technique which allows a four-fold reduction in focal plane area, improving reliability and supportability.
  - (U) Completed design of breadboard sensor that combines navigation and single region of interest targeting capability.
- (U) $424 Develop advanced, air-to-surface, electro-optical (including multi-frequency) sensor technologies that are more uniform in response to target radiation and better adapted to interface with real-time processors for automated target recognition and enhanced situational displays.
  - (U) Demonstrated multiplexed field of view concept for improved image recognition capability.
- (U) $1,024 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2004 Reconnaissance/Strike Electro-Optical Sensors

(U) FY 1996 ($ in Thousands):

- (U) $1,633 Develop advanced electro-optical sensor technology for combined navigation and air-to-ground targeting in a multi-function sensor. This effort is aimed at alleviating the weight, drag, maintenance, and cost problems of a dual sensor approach.
  - (U) Conduct long-range demonstration of combined navigation and targeting capability.
  - (U) Complete fabrication of breadboard sensor system for combined navigation and targeting applications.
- (U) $816 Develop and demonstrate a low-cost, maintainable, high performance, non-mechanical method of directing the passive sensor field of view. Mechanical methods of scanning the target scene are inherently bulky, expensive, and unreliable. A non-mechanical approach will also permit use of low-cost staring focal plane arrays which will enhance overall performance.
  - (U) Demonstrate feasibility of small, portable, non-mechanical beam steering device.
  - (U) Characterize absolute pointing accuracy of a future phased array beam steering component.
- (U) $817 Develop and demonstrate frequency agile electro-optical technologies to enhance air-to-ground and air-to-air sensor performance, target detection ranges, and identification.
  - (U) Complete preliminary assessment of wavelength conversion materials which will provide the capability to tune the frequency of the laser, provide operation in varied atmospheric transmission regions and, in turn, permit longer operating ranges.
- (U) $3,266 Total

(U) FY 1997 ($ in Thousands):

- (U) $890 Develop advanced electro-optical sensor technology for combined navigation and air-to-ground targeting in a multi-function sensor. This thrust is aimed at alleviating the weight, drag, maintenance, and cost problems of a dual sensor approach.
  - (U) Complete development of algorithms that can perform targeting on multiple scenes at the same time.
  - (U) Complete development of electronic stabilization algorithms allowing for range enhancement of electro-optical sensor technology for combined navigation and air-to-ground targeting.
- (U) $520 Develop and demonstrate a low-cost, maintainable, high performance, non-mechanical method of directing the passive sensor field of view. Mechanical methods of scanning the target scene are inherently bulky, expensive, and unreliable. A non-mechanical approach will also permit the use of low-cost staring focal plane arrays which will enhance overall performance.
  - (U) Complete the design, fabrication, and absolute pointing accuracy verification of a phased array beam steering component.
- (U) $2,300 Develop and demonstrate frequency agile electro-optical technologies to enhance air-to-ground and air-to-air sensor performance, target detection ranges, and identification.
  - (U) Complete application and requirements analysis of electro-optical technologies for precision targeting of ground-based and airborne threats.
- (U) $3,710 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
2004 Reconnaissance/Strike Electro-Optical Sensors

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,076	3,685	3,650	Cont
(U) Current Budget Submit	1,024	3,266	3,710	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increase in FY 1996 is due to incorporation of Project 06AA infrastructure funding. Horizontal increase in FY 1997 is due to increased emphasis on avionics technology development.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603707F, Weather Systems Advanced Development.
- (U) PE 0604249F, LANTIRN Night Precision Attack.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
6095 Inertial Reference and Guidance Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
6095 Inertial Reference and Guidance Technology	1,634	3,483	3,958	4,156	4,351	4,522	4,605	Continuing	Continuing

(U) **A.** **Mission Description and Budget Item Justification**: Develops affordable technologies to satisfy the growing need for reliable precision navigation, guidance, and reference information to support precision targeting and strike, improved situation awareness, and multi-platform cooperative operations. The focus of this project is on: development of gyroscopes and accelerometers to meet the stringent needs of precision inertial navigation in military aircraft; navigation system integration technology; and low-observable antennas to be shared by several communication/navigation/identification functions. This project also focuses on techniques to exploit the capabilities of the Global Positioning System (GPS) in a hostile environment by providing jam-resistance, reduction of positional error, solutions for known operational deficiencies, and passive or low probability of detection inertial navigation aids. Technologies pursued under this project are critical to stealth operations, timely and effective reconnaissance and attack, force multiplication achieved through multi-platform shared resources, and affordable, supportable weapon systems.

(U) FY 1995 ($ in Thousands):

- (U) $922 Develop advanced solid state miniature inertial sensor technology suitable for airborne applications to reduce size, weight, power, and cost, and to increase system reliability.
  - (U) Completed analysis and design trade offs for a packaged, navigation-grade, micro-machined silicon accelerometer for highly reliable, all-solid state inertial guidance and navigation system.
  - (U) Completed design for a small, low-cost, precision fiber optic gyroscope for highly accurate registration of distributed sensors.
  - (U) Completed fabrication of optical sensor to measure airframe flexure to aid boresight compensation for sensors and weapons.
- (U) $251 Develop technology for reduced jamming vulnerability and increased precision targeting and strike accuracy of GPS and to exploit the benefits of GPS to improve offensive and defensive combat capabilities at reduced cost.
  - (U) Developed preliminary designs for signal acquisition techniques to improve the jam resistance of GPS use in navigation.
  - (U) Developed a wavefront simulator for testing GPS antenna electronics under realistic jamming conditions.
- (U) $461 Develop technology for low-observable, wideband, multi-function antennas for communications, navigation, and identification functions permitting a reduction in the number of antennas required and an increase in weapon systems survivability.
  - (U) Completed analysis for wideband digital antenna electronics for small low-loss, beam forming/beam null-steering communication, navigation, and identification antennas.
- (U) $1,634 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
6095 Inertial Reference and Guidance Technology

(U) FY 1996 ($ in Thousands):

- (U) $846 Develop reference sensors, system integration and estimation technology to generate a common precision reference to enable high-payoff multiple platform operations through sharing of sensor data.
  - (U) Complete detailed design of a small, low-cost, precision fiber optic gyroscope needed for multiple platforms to share information in a battle area.
- (U) $874 Develop advanced solid state miniature inertial sensor technology suitable for airborne applications to reduce size, weight, power, and cost, and to increase system reliability.
  - (U) Fabricate and test first iteration of a packaged, navigation-grade, micro-machined silicon accelerometer for highly reliable, all-solid state inertial guidance and navigation systems.
- (U) $883 Develop technologies to reduce jamming vulnerability and increase precision targeting and strike accuracy of Global Positioning System (GPS) and to exploit the benefits of GPS, improving offensive and defensive combat capabilities and reducing costs.
  - (U) Complete detailed design of signal acquisition techniques to improve the jam resistance of GPS.
- (U) $880 Develop technology for low-observable, wideband, multi-function antennas for communication, navigation, and identification functions to reduce the number of antennas required and to increase weapon systems survivability.
  - (U) Complete design of a wideband digital antenna electronics unit providing small, low-cost, low-loss, beam forming/null-steering communication, navigation, and identification antennas.
- (U) $3,483 Total

(U) FY 1997 ($ in Thousands):

- (U) $1,049 Develop reference sensors, system integration, and estimation technology to generate a common precision reference to enable high-payoff multiple platform operations through sharing of sensor data.
  - (U) Develop advanced reference and navigation algorithms to enable multiple platforms to share information in a battle area.
- (U) $1,041 Develop advanced solid state miniature inertial sensor technology to increase the reliability of inertial sensors required for aircraft and to reduce overall avionics size, weight, power, and cost.
  - (U) Fabricate and test second iteration of a packaged, navigation-grade, micro-machined silicon accelerometer for highly reliable, all-solid state inertial guidance and navigation systems.
- (U) $909 Develop technology for reduced jamming vulnerability and increased precision targeting and strike accuracy of GPS and to exploit the benefits of GPS to improve offensive and defensive combat capabilities at reduced cost.
  - (U) Test signal acquisition techniques to improve the jam resistance of GPS for aircraft navigation and reference systems.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics
PROJECT NO. AND NAME 6095 Inertial Reference and Guidance Technology	

- (U) $959 Develop technology for low-observable, wideband, multi-function antennas for communications, navigation, and identification functions to reduce the number of antennas required and to increase weapon systems survivability.
  - (U) Complete fabrication and laboratory evaluation of a breadboard wideband digital antenna electronics unit providing small, low-cost, low-loss, beam forming/null-steering communication, navigation, and identification antennas.
- (U) $3,958 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,719	3,931	3,894	Cont
(U) Current Budget Submit	1,634	3,483	3,958	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increase in FY 1996 is due to incorporation of Project 06AA infrastructure funding. Horizontal increase in FY 1997 is due to increased emphasis on avionics technology development.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0603203F, Advanced Avionics Integration.
- (U) PE 0602602F, Conventional Munitions.
- (U) PE 0603311F, Ballistic Missile Technology.
- (U) PE 0603363F, Armament Technology Integration.
- (U) PE 0603270F, Electronic Warfare Technology.
- (U) ARPA-Global Positioning System Guidance Package.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE March 1996

2 - Applied Research | **0602204F Aerospace Avionics**

PROJECT NO. AND NAME
6096 Microelectronics Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
6096 Microelectronics Technology	3,669	9,591	8,636	9,223	9,840	8,971	9,752	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: Develops technologies based on Air Force and other DOD weapon systems needs in the areas of radar, communications, electronic warfare, navigation, and smart weapons applications. This project focuses on: military-unique avionics devices and circuits; packaging and power distribution; design tools; and hardware design languages. Paramount to success is the development of design, packaging, and power management support technologies that provide for the utilization of Commercial Off-The-Shelf (COTS) products and military-unique avionics devices and circuits.

(U) FY 1995 ($ in Thousands):

- (U) $1,615 Develop advanced integrated circuits, including analog to digital converter circuits for military radio frequency (RF) and digital support electronics.
  - (U) Developed gallium arsenide-, indium phosphide-, and silicon carbide-based high-speed and low-power integrated circuits.
- (U) $1,482 Develop advanced packaging and power management technology for improved cost and reliability of military electronics.
  - (U) Developed microsensors for aircraft pressure sensing and missile accelerometers.
  - (U) Evaluated an advanced surface protective coatings process for integrated circuits.
- (U) $572 Develop advanced design tools and integrate them into a common software environment to design application specific integrated circuits and multi-chip modules for performance, affordability, and reliability improvements in digital processing hardware.
  - (U) Developed a baseline design for a radar signature prediction accelerator and develop design libraries for gallium arsenide circuits.
- (U) $3,669 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
6096 Microelectronics Technology

(U) FY 1996 ($ in Thousands):

- (U) $3,365 Develop advanced integrated circuits, including analog to digital converter circuits, for military radio frequency (RF) and digital support electronics.
  - (U) Develop digital integrated circuits for electronic engine control.
  - (U) Continue development of pressure and accelerometer microsensors to measure aircraft performance.
  - (U) Develop devices and integrated circuits for direct X-band analog-to-digital conversion for radar support electronics.
- (U) $2,408 Develop surface protective coatings and distributed power management and packaging technology.
  - (U) Evaluate circuits for direct X-band analog-to-digital conversion to improve reliability and performance of radar support electronics.
  - (U) Continue evaluation of an advanced surface protective coatings process for integrated circuits.
- (U) $1,766 Develop and integrate advanced design tools into a commercial software environment for affordable upgrades.
  - (U) Design model year upgrades of the radar signature prediction accelerator and advanced cockpit three-dimensional graphics generator.
- (U) $2,052 Develop hardware design language technology for more effective control of obsolete parts and logistic support costs for existing weapon systems.
  - (U) Develop hardware design language models and validation suites for existing weapon system electronics to allow for affordable replacement of obsolete parts.
- (U) $9,591 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics
PROJECT NO. AND NAME 6096 Microelectronics Technology	

(U) FY 1997 ($ in Thousands):

- (U) $3,328 Develop advanced integrated circuits, including analog to digital converter circuits for military radio frequency (RF) and digital support electronics.
  - (U) Optimize devices and fabrication processes for a transceiver chip set to improve performance and reliability of digital support electronics.
  - (U) Fabricate and test devices and integrated circuits for direct X-band analog-to-digital conversion to improve reliability and performance of radar support electronics.
  - (U) Continue development of devices and integrated circuits for mixed digital, RF electronics for reduced cost, weight, and volume and to increase commonality across multiple subsystems.
  - (U) Design and develop high-speed circuits to augment the capability of commercial circuits for processing complex RF signals.
- (U) $1,705 Develop surface protective coatings, distributed power management, microsensors, and digital engine control technology to improve the reliability of electronic subsystems.
  - (U) Evaluate advanced packaging techniques for the direct X-band analog-to-digital conversion to improve reliability and performance of radar support electronics.
  - (U) Design and develop direct mount electronic engine control circuits which can withstand very high temperatures.
  - (U) Integrate previously developed microsensor components to improve the reliability of navigation subsystem electronics.
  - (U) Complete evaluation of an advanced surface-protective coating process for integrated circuits.
- (U) $1,574 Develop and integrate advanced design tools into a commercial software environment for affordable model year upgrades.
  - (U) Demonstrate a rapid design approach to interface avionics sensors with the processor.
  - (U) Develop a reuse library for aircraft electronics integrated circuit designs.
- (U) $2,029 Develop hardware design language technology for more effective control of obsolete parts and logistic support costs for existing weapon systems.
  - (U) Complete the digital hardware design language validation suite.
  - (U) Develop methods for mixing analog and digital models in the same validation suite.
  - (U) Continue development of reengineering support tools and electronics libraries for aging aircraft electronics suites.
- (U) $8,636 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics
PROJECT NO. AND NAME 6096 Microelectronics Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,858	10,825	11,241	Cont
(U) Current Budget Submit	3,669	9,591	8,636	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. The horizontal increase in FY 1996 reflects an increased emphasis in electro-optical technology. Also, beginning in FY 1996, Project 06AA infrastructure funding was incorporated into the technical projects. The horizontal decrease in FY 1997 reflects current Air Force priorities.

Schedule: Not Applicable.

Technical: Not Applicable

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0602702F, Command, Control and Communications.
- (U) PE 0602705A, Electronics and Electronic Devices.
- (U) PE 0602234N, Materials, Electronics and Computers.
- (U) PE 0602712E, Materials and Electronics.
- (U) PE 0603739E, Manufacturing Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
7622 Reconnaissance Strike Radio Frequency Sensors

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
7622 Reconnaissance Strike Radio Frequency Sensors	2,073	5,593	6,356	6,673	6,989	7,262	7,395	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Develops technologies for reconnaissance and strike radio frequency (RF) sensors with emphasis on reliable, all-weather acquisition of surface and airborne targets with difficult to detect signatures due to reduced radar cross sections, concealment and camouflage measures, severe clutter, and/or heavy jamming.

(U) FY 1995 ($ in Thousands):
- (U) $799 Develop advanced air-to-air radar sensor and target detection technology, including multi-dimensional, adaptive algorithms, for improved target detection, clutter rejection, and electronic countermeasure mitigation.
  - (U) Evaluated adaptive beamforming techniques for electronic counter-countermeasures.
  - (U) Developed detection techniques using wavelet sub-band decomposition to mitigate terrain scattering.
- (U) $822 Develop air-to-ground sensor and discrimination technology for foliage penetration and targeting and advanced motion compensation techniques for ultra-high resolution synthetic aperture radar for use in precision mapping, targeting, and recognition.
  - (U) Demonstrated, through joint program with NASA, synthetic aperture radar using space-based radar.
  - (U) Developed design concept for radar motion compensation technical analysis tool by integrating existing government models.
- (U) $452 Develop two-dimensional imaging technology for enhanced all aspect air-to-air target identification capability.
  - (U) Developed advanced inverse synthetic aperture radar processing characteristics on available flight test data.
- (U) $2,073 Total

(U) FY 1996 ($ in Thousands):
- (U) $1,733 Develop advanced microwave sensor technology for air-to-air radar and target detection, including electronic protection, multi-dimensional image processing, adaptive algorithms that also explore reducing overall system life cycle cost.
  - (U) Develop and test a high quality radar signal generator for laboratory use in supporting microwave sensor technology development.
  - (U) Develop advanced techniques for mitigating direct path electronic countermeasures.
  - (U) Develop efficient and effective techniques (array manifolding and signal processing) to mitigate direct path interference for medium pulse repetition frequencies.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
7622 Reconnaissance Strike Radio Frequency Sensors

- (U) $1,175 Develop advanced technology for microwave sensors for air-to-ground and air-to-air clutter rejection.
  - (U) Examine and develop advanced techniques for mitigating radome multi-path reflection.
  - (U) Examine and develop advanced techniques for exploring mutual coupling solutions for adaptive algorithms to improve clutter rejection.
- (U) $1,510 Develop integrated radar/targeting engineering analysis tools to evaluate sensor targeting errors for front-line fighter aircraft.
  - (U) Develop display software for integrated synthetic aperture radar evaluation tools.
  - (U) Design support modules for radar expert analysis tools.
- (U) $1,175 Develop two-dimensional imaging technology for enhanced, all-aspect, air-to-air target identification capability.
  - (U) Generate synthetic signature validation on high-quality, two-dimensional imagery data.
  - (U) Develop preliminary radar system design concept using two-dimensional imaging technology.
  - (U) Integrate one-dimensional and two-dimensional algorithms and assess utility for target identification capability.
- (U) $5,593 Total

(U) FY 1997 ($ in Thousands):

- (U) $1,227 Develop advanced microwave sensor technology for air-to-air radar and target detection, including electronic protection, multi-dimensional image processing, adaptive algorithms that also explore reducing life cycle cost.
  - (U) Develop concept for an integrated analog/digital radio frequency (RF) system to reduce receiver hardware specifications and field maintenance.
- (U) $2,428 Develop tools and techniques that significantly reduce the cost and time to develop complex, synthetic, airborne radar environments.
  - (U) Develop user-friendly, automated, object-oriented programming system for penetrating foliage, maneuvering synthetic aperture radar, and mitigating hostile electromagnetic environments.
- (U) $2,430 Develop integrated radar/targeting engineering analysis tools to evaluate sensor targeting errors for front-line fighter aircraft.
  - (U) Establish baseline radar analysis library with emphasis on user-friendly, automated, object-oriented and reusable software.
- (U) $271 Develop two-dimensional radar imaging technology for enhanced all aspect air-to-air target identification capability.
  - (U) Develop two-dimensional imaging technology to enhance front-line fighter first-look, first-kill capability.
- (U) $6,356 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
7622 Reconnaissance Strike Radio Frequency Sensors

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,181	6,313	6,253	Cont
(U) Current Budget Submit	2,073	5,593	6,356	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increase in FY 1996 is due to incorporation of Project 06AA infrastructure funding. Horizontal increase in FY 1997 is due to increased emphasis on avionics technology development.

Schedule: Not Applicable.

Technical: Not Applicable

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) PE 0602782A, Command, Control and Communications (C3) Technology.
- (U) PE 0602232N, Navy C3 Technology.
- (U) PE 060379N, Advanced Technology Demonstration Program.
- (U) This project has been coordinated through the Project Reliance process (Joint Directors of Laboratories Sensor and Electronic Warfare Panels) to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
7629 Fire Control Avionics

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
7629 Fire Control Avionics	3,133	6,678	7,589	7,969	8,345	8,672	8,831	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops technologies and concepts for fire control that aid in precisely locating, identifying, and targeting airborne and surface targets (with emphasis on reduced signature targets and targets of opportunity) to enable new covert tactics for successful accomplishment of air-to-air and air-to-surface strike scenarios.

(U) FY 1995 ($ in Thousands):

- (U) $802 Develop air-to-air fire control, tracking, and sensor management technologies for a first-shot, first-kill capability. These technologies result in increased kill ratios, increased survivability, and reduced pilot workload.
  - (U) Completed coding of vector neural network tracking algorithms.
  - (U) Developed and coded multispectral radar signal fusion algorithm for high confidence hostile target identification.
  - (U) Laboratory tested multispectral radar signal fusion algorithms using operational radar data.
- (U) $284 Develop air-to-surface fire control, tracking, and sensor management technology for single pass precision accuracy weapon deployment, increased survivability, force multiplication, and reduced pilot workload. Evaluate both on-board and off-board targeting.
  - (U) Evaluated track accuracy requirements for tracking and weapon deployment solutions using off-board threat information.
- (U) $2,047 Develop advanced, model-based-vision target recognition technology for longer-range, all-aspect, real-time, high-confidence air-to-air and air-to-surface hostile target identification.
  - (U) Investigated thermal invariance theory for tactical target recognition.
  - (U) Demonstrated feasibility of high resolution synthetic signature scene generation capability to train automatic target recognition systems.
  - (U) Demonstrated feasibility of high resolution synthetic aperture radar signature and scene generation.
  - (U) Investigated theory for infrared thermal modeling to support high fidelity signature prediction.
  - (U) Developed and demonstrated robust, ultra-high range resolution algorithms for air-to-air and air-to-ground applications.
  - (U) Developed model-based-vision integrated environment for affordable algorithm development.
- (U) $3,133 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics
PROJECT NO. AND NAME 7629 Fire Control Avionics	

(U) FY 1996 ($ in Thousands):

- (U) $467 Develop advanced air engagement technologies for detection and tracking of conventional and low-cross-section threats to increase weapon system lethality and survivability.
  - (U) Complete evaluation of vector neural network tracking algorithm.
- (U) $1,670 Develop sensor management and fusion technologies to increase air combat situational awareness, increase range, and improve high-confidence target identification.
  - (U) Evaluate advanced multispectral radar signal fusion techniques in a laboratory environment.
  - (U) Explore sensor fusion concepts for integrating sensor data from all on-board offensive and defensive sensors.
- (U) $1,202 Develop innovative targeting techniques for surface strike applications utilizing all available (on-board and off-board) threat targeting information.
  - (U) Develop design for utilizing off-board information in support of various theater missile defense boost phase intercept concepts.
- (U) $1,268 Develop advanced automatic target recognition algorithm techniques.
  - (U) Develop advanced target information extraction techniques for using the radar phased information to estimate the location of radar target scatters to support improved performance automatic target recognition algorithms.
  - (U) Determine thermal features that remain constant (as a function of time and day and target thermal conditions) to support high performance infrared target recognition algorithms.
- (U) $601 Develop advanced synthetic signature and scene generation capability to train automatic target recognition algorithms.
  - (U) Demonstrate feasibility of using synthetic infrared target signatures to improve automatic target recognition algorithms.
  - (U) Perform verification experiments for high-fidelity, high-speed synthetic aperture radar signature and scene prediction.
- (U) $601 Develop analytical and empirical automatic target recognition modeling techniques to determine performance boundaries of automatic target recognition.
  - (U) Determine best automatic target recognition performance possible for two different target types using synthetic data to support sensor trade off studies.
- (U) $869 Develop robust, ultra high range radar algorithms for both air-to-air and air-to-ground applications.
  - (U) Evaluate performance of advanced, ultra high range radar algorithms compared to operational identification technologies.
- (U) $6,678 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics
PROJECT NO. AND NAME 7629 Fire Control Avionics	

(U) FY 1997 ($ in Thousands):

- (U) $405 Develop advanced aircraft air engagement technologies for detection and tracking of conventional and low cross section threats to increase weapon system lethality and survivability.
  - (U) Evaluate operational payoff of innovative tracking schemes by using real flight data in ground tests of algorithms.
- (U) $1,152 Develop sensor management technologies and innovative deployment tactics to increase air combat situational awareness, increase range, and improve high-confidence target identification.
  - (U) Ground test and evaluate algorithms which fuse all available radar data for a more comprehensive target picture.
  - (U) Evaluate sensor management technologies capable of integrating ownship sensor data and off-board data to improve situational awareness.
  - (U) Evaluate candidate technologies that allow aircraft in the same flight to share information to promote commonality of fire control functions across various platforms.
- (U) $236 Develop innovative surface strike targeting techniques using all available (on-board and off-board) threat targeting information.
  - (U) Design targeting scheme that uses off-board information to aid in development of the fire control solution passed to the weapon.
- (U) $1,911 Develop advanced automatic target recognition algorithm techniques.
  - (U) Integrate advanced feature extraction techniques to evaluate performance improvement in automatic target recognition.
  - (U) Evaluate performance of automatic target recognition using advanced thermal invariance algorithms.
  - (U) Demonstrate feasibility of multispectral infrared (IR) fusion of thermal, spatial, and motion features of threat aircraft.
- (U) $1,100 Develop advanced synthetic signature and scene generation capability to train automatic target recognition algorithms.
  - (U) Integrate advanced IR target generation with scene generation capability
  - (U) Demonstrate high-fidelity, high-speed synthetic aperture radar signature and scene prediction.
- (U) $985 Develop analytical and empirical automatic target recognition modeling techniques to determine performance boundaries of automatic target recognition.
  - (U) Use real and synthetic data to evaluate performance of automatic target recognition algorithm against multiple target types.
- (U) $1,800 Develop robust, ultra-high-range radar algorithms for both air-to-air and air-to-ground applications.
  - (U) Demonstrate advanced, robust, ultra high range radar algorithms in a laboratory environment.
- (U) $7,589 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics
PROJECT NO. AND NAME 7629 Fire Control Avionics	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,296	7,538	7,467	Cont
(U) Current Budget Submit	3,133	6,678	7,589	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increase in FY 1996 is due to incorporation of Project 06AA infrastructure funding. Horizontal increase in FY 1997 is due to increased emphasis on avionics technology development.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
7633 Passive Electronic Countermeasures

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
7633 Passive Electronic Countermeasures	2,894	6,166	7,007	7,357	7,705	8,006	8,153	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Develops passive electronic countermeasure (ECM) technologies and explores, expands, develops, and refines the most promising and cost-effective technologies. The technologies pursued support passive sensing of the entire electromagnetic spectrum in order to provide signal collection, detection, recognition, analysis, identification, location, and passive countering of enemy electronic emissions whether intentional or unintentional. Specifically, the program exploits emerging technologies to provide increased capability for: 1) radar warning, electronic warfare (EW), and electronic intelligence applications; 2) infrared detection for passive missile warning and signature exploitation; 3) laser detection for threat warning; 4) passive and combined passive/active off-board expendables (chaff, decoys, etc.); and 5) hardware and software for associated processing and system integration requirements.

(U) FY 1995 ($ in Thousands):
- (U) $724 Develop technology for generic hardware and software modules to enable low-cost block upgrades to existing operational EW receivers.
  - (U) Developed threat recognition software and integrated with signal correlation software.
  - (U) Developed hardware and software to allow normalization and transfer of threat parameters among systems.
- (U) $761 Develop all-digital EW receiver and antenna for improved reliability and flexibility in response to ever changing EW threat environment.
  - (U) Evaluated and modified the all-digital baseband receiver for application to EW.
- (U) $1,409 Develop an enhanced warning capability with advanced detector and processing technology and integrated missile warning, laser warning, and targeting sensors for an improved pilot protection capability.
  - (U) Developed models of high altitude missile infrared signature measurements for evaluation.
- (U) $2,894 Total

(U) FY 1996 ($ in Thousands):
- (U) $1,439 Develop generic hardware and software modules to enable low-cost block upgrades for existing operational EW receivers.
  - (U) Combine de-interleaving, correlation, and threat identification software modules on laboratory hardware.
  - (U) Continue hardware and software development to allow normalization and transfer of threat parameters among systems.
- (U) $1,384 Develop all-digital EW receiver and antenna for improved reliability and flexibility in response to ever changing EW threat environment.
  - (U) Investigate fundamental radio frequency hardware correlator for improved performance and reliability.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics
PROJECT NO. AND NAME 7633 Passive Electronic Countermeasures	

- (U) $2,265 Develop an enhanced warning capability with advanced detector and processing technology and integrated missile warning, laser warning, and targeting sensors for improved pilot protection.
  - (U) Complete high altitude missile infrared signature measurements and model.
  - (U) Identify focal plane array suitable for combined laser/missile detection receiver design.
  - (U) Define laser receiver specifications for countermeasures cueing for aircrew cockpit protection.
- (U) $1,078 Develop models for off-board, expendable electronic countermeasures for use in chaff and decoy dispensing programs.
  - (U) Incorporate NATO chaff flight test measurements into laboratory computer model.
- (U) $6,166 Total

(U) FY 1997 ($ in Thousands):

- (U) $2,032 Develop technology for generic hardware and software modules to enable low-cost block upgrades to existing operational electronic warfare (EW) receivers.
  - (U) Ground test combined de-interleaving, correlation, and threat identification software modules.
  - (U) Run initial concept tests for threat parameter normalization software.
- (U) $1,606 Develop all-digital EW receiver and associated antenna for improved reliability and flexibility in response to ever changing EW threat environment.
  - (U) Evaluate fundamental angle and radio frequency hardware correlator for improved performance and reliability.
  - (U) Continue to develop angle/frequency discrimination concepts to respond to new threat signals.
- (U) $1,921 Develop an enhanced warning capability with advanced detector and processing technology and integrated missile warning, laser warning, and targeting sensors for an improved pilot protection capability.
  - (U) Develop low-cost multicolor infrared filtering technique for infrared focal plane array system.
- (U) $1,448 Continue development of models for off-board, expendable electronic countermeasures for use in chaff and decoy dispensing programs.
  - (U) Determine if flight-tested "environmental chaff" is suitable for training.
  - (U) Develop breadboard for advanced, passive, expendable, off-board countermeasures.
- (U) $7,007 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
7633 Passive Electronic Countermeasures

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,043	6,960	6,894	Cont
(U) Current Budget Submit	2,894	6,166	7,007	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increase in FY 1996 is due to incorporation of Project 06AA infrastructure funding. Horizontal increase in FY 1997 is due to increased emphasis on avionics technology development.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0603270F, Electronic Combat Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
7662 Avionics Data Transmission and Reception

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
7662 Avionics Data Transmission and Reception	917	1,956	2,221	2,333	2,446	2,542	2,590	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops technology to satisfy the growing need to transmit data between aircraft with high integrity, low probability of detection, and high jam resistance. Low probability of detection communications are required to reduce aircraft physical and electromagnetic vulnerability and provide major improvements in strike effectiveness by eliminating the requirement for "no communications" operations.

(U) FY 1995 ($ in Thousands):

- (U) $289 Develop technology which improves electromagnetic interference rejection by communication systems which in turn will provide the pilot more reliable communications in the combat environment.
  - (U) Evaluated techniques to reduce radiated co-site interference for assured communications.
- (U) $71 Develop adaptive technology for medium capacity, low probability of detection, jam-resistant air-to-air exchange of time-critical threat, sensor, and cooperative operations information.
  - (U) Performed laboratory hardware experiments to evaluate deformable mirrors for laser communications.
- (U) $295 Develop technology for short-range, low probability of detection, jam-resistant capabilities for voice communication and low-data-rate information exchange to eliminate the need for "comm out" operations and to increase survivability.
  - (U) Fabricated omni-directional laser communications breadboard for highly covert, short-range communications.
- (U) $262 Develop technology for automation of cockpit communications to reduce pilot workload and increase the availability of communications during combat operations.
  - (U) Performed laboratory experiments to evaluate voice-activated expert system to control cockpit communications.
- (U) $917 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
7662 Avionics Data Transmission and Reception

(U) FY 1996 ($ in Thousands):

- (U) $645 Develop technology to improve communication system electromagnetic interference rejection which in turn will provide the pilot more reliable communications in the combat environment.
  - (U) Continue development and evaluation of low-cost techniques to reduce radiated co-site interference for assured communications.
- (U) $662 Develop technology for short-range, low probability of detection, jam-resistant capabilities for voice communication and low-data-rate information exchange to eliminate the need for "comm out" operations and to increase survivability.
  - (U) Complete development and laboratory evaluation of omni-directional laser communications breadboard for highly covert, short-range communications.
  - (U) Complete design and initiate fabrication of joint Army/Air Force ultraviolet non-line-of-site communications breadboard to enable effective communications during nap-of-the-earth flight operations.
- (U) $649 Develop technology for automation of cockpit communications to reduce pilot workload and increase the availability of communications during combat operations.
  - (U) Design voice-activated expert system brassboard that controls cockpit communications.
- (U) $1,956 Total

(U) FY 1997 ($ in Thousands):

- (U) $694 Develop technology to improve communication system electromagnetic interference rejection which in turn will provide the pilot more reliable communications in the combat environment.
  - (U) Complete development and evaluation of low-cost techniques to reduce radiated co-site interference for assured communications.
- (U) $801 Develop technology for short-range, low probability of detection, jam-resistant capabilities for voice communication and low-data-rate information exchange to eliminate the need for "comm out" operations and to increase survivability.
  - (U) Complete initial breadboard and laboratory test joint Army/Air Force ultraviolet, non-line-of-site communications concept which will enable effective communications during nap-of-the-earth flight operations.
  - (U) Develop preliminary design and assess radiated co-site interference for use of non-traditional communications capability.
- (U) $726 Develop technology for automation of cockpit communications to reduce pilot workload and increase the availability of communications during combat operations.
  - (U) Complete design and fabrication of a brassboard to demonstrate a voice-actuated expert system that will control cockpit communications.
- (U) $2,221 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602204F Aerospace Avionics

PROJECT NO. AND NAME
7662 Avionics Data Transmission and Reception

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	964	2,206	2,185	Cont
(U) Current Budget Submit	917	1,956	2,221	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increase in FY 1996 is due to incorporation of Project 06AA infrastructure funding. Horizontal increase in FY 1997 is due to increased emphasis on avionics technology development.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) PE 0602782A, Command, Control and Communications (C3) Technology.
- (U) PE 0602232N, Navy C3 Technology.
- (U) PE 060379N, Advanced Technology Demonstration Program.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.
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(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602269F Hypersonic Technology Program

PROJECT NO. AND NAME
1025 Hypersonic Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1025 Hypersonic Technology	18,496	18,448	7,471	18,477	16,685	16,665	17,831	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Applied Research program develops advanced hypersonic technologies and will provide revolutionary technology options to satisfy future Air Force needs such as future hypersonic weapons and space launch concepts. This new plan will transition the accomplishments made in hypersonic technologies by the National Aero-Space Plane (NASP) program into an applied research program to demonstrate the feasibility of hypersonic technologies. Technologies developed under this program will be dual use and applicable to both DOD and NASA requirements. Planned efforts include analyses, hypersonic materials, structures, airbreathing propulsion, hydrocarbon fuels, and integrated technology test demonstrations. All efforts in this program element contain the resources necessary, including civilian salaries, to manage, conduct, and document the technical activities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602269F Hypersonic Technology Program
PROJECT NO. AND NAME 1025 Hypersonic Technology	

(U) FY 1995 ($ in Thousands):

- (U) $7,600 Completed Hypersonic Systems Technology Program (HySTP) and National Aero-Space Plane (NASP) program terminations, final documentation, and archiving.
- (U) $4,874 Design, develop, and test propulsion components and integrated propulsion designs for advanced hypersonic propulsion concepts.
  - (U) Performed component testing of a high thrust-to-weight combined cycle engine that can be used to accelerate a vehicle from low-speed to hypersonic speeds (Mach 0-5).
  - (U) Conducted evaluation and testing of candidate scramjet engine concepts capable of demonstrating positive thrust at Mach 4-8.
  - (U) Acquired and set up for initial evaluation a foreign-built scramjet engine to leverage foreign design methodology and investment.
  - (U) Developed endothermic fuels for enhanced engine performance.
- (U) $2,080 Design, develop, and test advanced high-temperature, high-strength materials and structures for hypersonic applications.
  - (U) Selected and began characterization of high-temperature, lightweight materials and coatings for the internal sections of hypersonic propulsion engines.
  - (U) Characterized new lightweight, high temperature structures to support fabrication of flight weight engines.
- (U) $2,780 Develop technologies for instrumentation and test in realistic hypersonic conditions.
  - (U) Characterized technologies needed for hypersonic test instrumentation that can withstand and accurately sense internal flow conditions (e.g., temperature, pressure, heat flux, etc.) without disturbing airflow or engine operating conditions.
  - (U) Performed modifications of high-Mach test facilities to accommodate hydrocarbon fueled engine testing.
- (U) $350 Develop and extend analysis and computational technologies from low-speed and supersonic flight to the hypersonic environment.
  - (U) Selected and began evaluation of analytical tools available for aeromechanical, structural, propulsion, flight path dynamics, etc. to determine the necessary interactions for an integrated design methodology to create an affordable hypersonic design.
- (U) $812 Conduct feasibility studies, design trades, and simulations to integrate hypersonic technologies into advanced vehicle designs for hypersonic applications which will improve warfighting capability and satisfy the requirements of Global Reach/Global Power.
  - (U) Conducted mission analyses to characterize user requirements and technology maturity.
- (U) $18,496 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602269F Hypersonic Technology Program

PROJECT NO. AND NAME
1025 Hypersonic Technology

(U) FY 1996 ($ in Thousands):

- (U) $13,957 Design, develop, and test propulsion components, structures, and integrated propulsion designs for advanced hypersonic propulsion concepts.
  - (U) Investigate advanced fuel injection/flame holding technologies to optimize scramjet performance.
  - (U) Complete preliminary evaluation and testing of candidate scramjet combustion concepts capable of demonstrating positive thrust at Mach 4-8.
  - (U) Perform detailed design of selected scramjet engines (e.g., inlet, combustor, and nozzle) capable of demonstrating positive thrust at Mach 4-8.
  - (U) Fabricate structures designed for integration into flowpath of selected engine designs.
  - (U) Reverse engineer foreign scramjet hardware to determine foreign design methodology.
  - (U) Study endothermic fuel concepts to extend hydrocarbon-fueled scramjet capability from Mach 4-8 to Mach 10.
- (U) $2,364 Design, develop, and test advanced high-temperature, high-strength materials and structures for hypersonic applications.
  - (U) Continue characterization of high-temperature, lightweight materials and coatings for the internal sections of hypersonic propulsion engines.
  - (U) Complete initial characterization of new lightweight, high temperature structure concepts to support fabrication of flightweight engines.
- (U) $832 Develop technologies for instrumentation and test in realistic hypersonic conditions.
  - (U) Validate structural test methodology for high-temperature and lightweight hypersonic vehicle structures (e.g., fuselage sections).
  - (U) Design hypersonic test instrumentation that can withstand and accurately sense internal flow conditions (e.g., temperature, pressure, heat flux, etc.) without disturbing airflow or engine operating conditions.
- (U) $800 Develop and extend analysis and computational technologies from low-speed and supersonic flight to the hypersonic environment.
  - (U) Evaluate analytical tools available for aeromechanical, structural, propulsion, flight path dynamics, etc. to determine the necessary interactions for an integrated design methodology to create an affordable hypersonic design.
- (U) $495 Conduct feasibility studies, design trades, and simulations to integrate hypersonic technologies into advanced vehicle designs for hypersonic applications which will improve warfighting capability and satisfy the requirements of Global Reach/Global Power.
  - (U) Conduct mission analyses to characterize user requirements and technology maturity.
- (U) $18,448 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602269F Hypersonic Technology Program
PROJECT NO. AND NAME 1025 Hypersonic Technology	

(U) FY 1997 ($ in Thousands):

- (U) $5,936 Design, develop, and test propulsion components, structures, and integrated propulsion designs for advanced hypersonic propulsion concepts.
  - (U) Complete investigation of advanced injection/flameholding technologies to optimize scramjet performance.
  - (U) Complete detailed design and fabricate a scramjet engine (e.g., inlet, combustor, and nozzle) capable of demonstrating positive thrust at Mach 4-8 while withstanding the severe internal conditions.
  - (U) Determine foreign scramjet hardware performance potential through detailed analysis and test, and evaluate potential suitability to U.S. scramjets.
  - (U) Demonstrate endothermic fuel concepts to extend hydrocarbon-fueled scramjet capability from Mach 4-8 to Mach 10.
- (U) $243 Design, develop, and test advanced high-temperature, high-strength materials and structures for hypersonic applications.
  - (U) Perform detailed characterization and testing of selected high-temperature, lightweight materials for the internal sections of hypersonic propulsion engines.
- (U) $267 Develop technologies for instrumentation and test in realistic hypersonic conditions.
  - (U) Design, fabricate, and test hypersonic test instrumentation that can withstand and accurately sense internal flow conditions (e.g., temperature, pressure, heat flux, etc.) without disturbing airflow or engine operating conditions.
- (U) $480 Develop and extend computational technologies from low-speed and supersonic flight to the hypersonic environment.
  - (U) Develop initial concepts to extend interdisciplinary computational fluid dynamics and vehicle thermal management modeling for an integrated design methodology to create an affordable hypersonic design.
- (U) $545 Conduct feasibility studies, design trades, and simulations to integrate hypersonic technologies into advanced vehicle designs for hypersonic applications which will improve warfighting capability and satisfy the requirements of Global Reach/Global Power.
  - (U) Conduct mission analyses to characterize user requirements and technology maturity.
  - (U) Conduct detailed missile designs to guide technology requirements definition and development.
- (U) $7,471 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602269F Hypersonic Technology Program

PROJECT NO. AND NAME
1025 Hypersonic Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	44,760	19,900	19,901	Cont
(U) Appropriated Value	45,000	19,900		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-25,240	-694		
b. SBIR	-463	-384		
c. Omnibus/Other Above Threshold Reprogrammings		-374		
d. Below Threshold Reprogrammings	-801			
(U) Current Budget Submit	18,496	18,448	7,471	Cont

(U) Change Summary Explanation:

Funding: Development of hypersonic technologies was previously conducted under the National Aero-Space Plane (NASP) program and the Hypersonic Systems Technology Program (HySTP). In FY 1995, the Air Force canceled HySTP and refocused efforts into a hypersonic technology initiative. This required a major restructure of the program requiring Congressional approval. Vertical/horizontal decrease in FY 1997 is primarily a result of poor obligation and expenditure rates in FY 1995 because of late program initiation. Further vertical decreases are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0602102F, Materials.
- (U) PE 0602201F, Flight Dynamics.
- (U) PE 0602203F, Aerospace Propulsion
- (U) PE 0603112F, Advanced Materials for Weapon Systems.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602601F Phillips Laboratory Exploratory Development

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	154,804	131,733	121,107	125,521	134,584	143,954	150,942	Continuing	Continuing
1010 Geophysics and Weather Technology	33,815	28,223	19,287	18,244	20,957	21,548	22,143	Continuing	Continuing
1011 Rocket Propulsion Technology	35,471	36,923	30,293	30,447	31,169	32,683	34,865	Continuing	Continuing
3326 Lasers and Imaging Technology	31,678	19,316	19,244	21,919	22,406	22,193	22,501	Continuing	Continuing
5797 Advanced Weapons and Survivability Technology	17,984	16,705	16,608	16,871	17,516	18,615	19,225	Continuing	Continuing
8809 Space and Missile Technology	35,856	30,566	35,675	38,040	42,536	48,915	52,208	Continuing	Continuing

(U) Note: In FY 1995, the three Applied Research PEs at the Phillips Laboratory (PE 0602601F, Advanced Weapons; PE 0602101F, Geophysics; and PE 0602302F, Rocket Propulsion and Astronautics) were combined into this PE.

(U) **A. Mission Description and Budget Item Justification:** This is the Applied Research program for the Phillips Laboratory's mission areas of military spacecraft, launch vehicles, ballistic missiles, directed energy weapons (lasers and high power microwaves), long-range optical imaging, geophysics, weather, and rocket propulsion (space launch, orbit transfer/maneuvering, and ballistic and tactical missiles). All efforts in this program element contain the resources necessary, including civilian salaries, to manage, conduct, and document the technical activities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	158,315	124,446	121,764	
(U) Appropriated Value	159,502	136,746		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-5,486	-2,736		
b. SBIR	-1,641	-1,724		
c. Omnibus/Other Above Threshold Reprogrammings		-553		
d. Below Threshold Reprogrammings	+2,429			
(U) Current Budget Submit	154,804	131,733	121,107	

(U) Change Summary Explanation:

Funding: Vertical reductions to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. In FY 1995, Congressional actions impacted the following projects: 1010, $5 million added for the High Altitude Active Auroral Research Program; 1011, $6 million added for the Integrated High Performance Rocket Propulsion Technology; and 3326, $1.3 million added for the Advanced Electro-Optical System Spectrograph. Horizontal decreases are primarily due to a decrease in priority for Geophysics and Weather Technology.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602601F Phillips Laboratory Exploratory Development

PROJECT NO. AND NAME: 1010 Geophysics and Weather Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1010 Geophysics and Weather Technology	33,815	28,223	19,287	18,244	20,957	21,548	22,143	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops the technologies to understand, mitigate, and exploit the effects of the weather and geophysics environments on the design and operation of Air Force systems. This includes defining, modeling, and developing techniques to predict the phenomena of solar and space environments. Models are developed to specify and predict optical and infrared backgrounds and signatures of spacecraft and missiles, as well as techniques to predict when and where ionospheric disturbances will occur. Atmospheric drag effects on satellites are studied. Space debris is measured and modeled for its impact on spaceborne systems. New techniques for measuring, modeling, simulating, and predicting meteorological effects that impact the Air Force mission are researched. Additionally, seismic technology for nuclear test monitoring and test ban treaty verification is matured.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 1010 Geophysics and Weather Technology	

(U) FY 1995 ($ in Thousands):

- (U) $6,121 Develop space radiation specifications and solar hazard prediction techniques for space system design and operations.
  - (U) Formulated radiation belt model for space systems design and operations.
  - (U) Delivered space sensors for Defense Meteorological Support Program satellite, S-17.
- (U) $5,346 Develop atmospheric optical background simulations, models, and integrated codes for space system design and operation.
  - (U) Initiated transition of key optical background data from successful space shuttle and rocket-borne experiments into optical background codes for operational use.
- (U) $3,444 Develop active and passive remote sensing techniques for target signature identification and atmospheric wind profile measurements.
  - (U) Measured effluent plumes and chemical clouds using an airborne laser imaging, detection, and ranging instrument.
  - (U) Analyzed ballistic wind tests of bombs dropped from B-52s, improving bombing corrections.
- (U) $5,802 Develop global ionosphere models for satellite orbits to improve communications and space system applications.
  - (U) Continued developing a model to improve communications by simulating radio frequency propagation anywhere in the world under all ionospheric conditions.
  - (U) Transitioned Ionospheric Forecast Model for operational use.
- (U) $2,633 Measure and model the effects of local intense ionization on Air Force space systems.
  - (U) Characterized the effects of intense local ionization on Global Positioning System-like signal transmission.
- (U) $530 Develop seismic event identification techniques for nuclear test ban treaty verification.
  - (U) Delivered an improved seismic array analysis technique for monitoring foreign underground detonation.
- (U) $5,199 Develop global and theater weather analysis, simulation, and prediction techniques for combat weather system applications.
  - (U) Verified recently developed theater-scale atmospheric models using ground-based radar wind profiles.
  - (U) Completed an artificial intelligence-based theater forecast model to give 12-hour forecasts.
  - (U) Delivered a weather model that realistically and accurately depicts clouds and rain for use in tactical situations.
- (U) $4,740 Evaluate the interaction between high power, high-frequency, ground transmitted radio waves and the ionosphere.
  - (U) Conducted research to characterize the background ionosphere.
- (U) $33,815 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 1010 Geophysics and Weather Technology	

(U) FY 1996 ($ in Thousands):

- (U) $4,942 Develop space radiation specification and solar hazard prediction techniques for space system design and operations.
  - (U) Formulate and update radiation belt models that are essential for Air Force and DOD space system designs and operations.
  - (U) Develop adaptive optical techniques for improved imaging of disruptive solar events.
- (U) $4,307 Develop atmospheric optical background simulations, models, and integrated codes for space system design and operation.
  - (U) Collect data from the mid-course space experiment for use in developing stellar, on-board calibration sources for advanced space-based surveillance and tracking systems.
- (U) $2,641 Develop active and passive remote sensing techniques for target signature identification and atmospheric wind profile measurements.
  - (U) Use the Flying Infrared Signatures Technology Aircraft (FISTA) to collect infrared signatures of the F-22, other aircraft, and missiles to validate existing operational target and scenes codes.
  - (U) Test an airborne laser imaging, detection, and ranging demonstrator on the FISTA to increase the accuracy of target measurements by characterizing the optical path between the aircraft and the target.
- (U) $4,694 Develop global ionosphere models for satellite orbits to improve communications and space system applications.
  - (U) Extend the Parameterized Real-Time Ionospheric Specification Model to 22,000 kilometers and transition it to operational use.
- (U) $2,020 Measure and model the effects of local plasmas on Air Force space systems.
  - (U) Measure degradation of radio frequency transmissions passing through plasmas generated around aerospace vehicles.
- (U) $430 Develop seismic event identification techniques for nuclear test ban treaty verification.
  - (U) Deliver a physical model for guided crustal waves for applications in the Eurasian and Middle East region.
- (U) $5,000 Evaluate the interaction between high power, high-frequency, ground transmitted radio waves and the ionosphere
  - (U) Conduct research to characterize the background ionosphere.
- (U) $4,189 Develop weather analysis, simulation, and prediction techniques for use in global and theater combat weather systems.
  - (U) Deliver an advanced-parameter, global cloud analysis model to Air Force Global Weather Central.
  - (U) Complete data fusion project to integrate disparate weather data from battlefields to enhance theater weather forecasting.
- (U) $28,223 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 1010 Geophysics and Weather Technology	

(U) FY 1997 ($ in Thousands):

- (U) $4,550 Develop space radiation specification and solar hazard prediction techniques for space system design and operations.
  - (U) Design the follow-on Compact Radiation Effects Satellite payload that will analyze potentially dangerous high energy particles in space.
- (U) $4,010 Develop atmospheric optical background simulations, models, and integrated codes for space system design and operation.
  - (U) Extend the wavelength coverage of the operational atmospheric backgrounds code into the ultraviolet and millimeter wavelength regions.
- (U) $2,558 Develop active and passive remote sensing techniques for target signature identification and atmospheric wind profile measurements.
  - (U) Use Flying Infrared Signatures Technology Aircraft measurements to expand and validate the spectral in-band radiance images of target and scene codes improving the warfighter's target discrimination capabilities.
- (U) $4,276 Develop global ionosphere models for satellite orbits to improve communications and space system applications.
  - (U) Incorporate scintillation data into the operational wideband model to improve accuracy of communications disruption warnings.
- (U) $3,893 Develop global and theater weather analysis, simulation, and prediction techniques for combat weather system applications.
  - (U) Complete theater-scale analysis procedures for combat weather displays and theater weather forecast model initialization.
- (U) $19,287 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 1010 Geophysics and Weather Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	34,640	24,296	23,410	Cont
(U) Current Budget Submit	33,815	28,223	19,287	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. In FY 1996, Congressional actions added $5 million for the High Altitude Active Auroral Research Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0305160F, Defense Meteorological Satellite Program.
- (U) PE 0601102F, Defense Research Sciences.
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603410F, Space Systems Environmental Interactions Technology.
- (U) PE 0603707F, Weather Systems Advanced Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602601F Phillips Laboratory Exploratory Development

PROJECT NO. AND NAME: 1011 Rocket Propulsion Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1011 Rocket Propulsion Technology	35,471	36,923	30,293	30,447	31,169	32,683	34,865	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** The technologies developed in this project are boost and orbit transfer, satellite maneuvering, and tactical and ballistic missile rocket propulsion. This project develops exploratory technologies and provides technology options for rocket propulsion advanced demonstration, components, or subsystems. Technologies of interest are those which will improve reliability, operability, survivability, affordability, environmental compatibility, and performance of future space and missile launch sub-systems while reducing material, manufacturing, and support costs. Technology will be developed to reduce the weight and cost of components using new materials, improved designs, and improved manufacturing techniques. All efforts in this project are part of the Integrated High Payoff Rocket Propulsion Technology (IHPRPT) initiative, a joint DOD, NASA, and industry effort to focus rocket propulsion technology on national needs.

(U) FY 1995 ($ in Thousands):

- (U) $11,508 Develop advanced components necessary for the incorporation of environmentally friendly propellants into existing and future missile systems.
  - (U) Developed non-toxic, non-cryogenic, high-performance, storable liquid fuel/oxidizer ingredients.
  - (U) Analyzed propellant, explosive, and pyrotechnic waste products.
  - (U) Completed testing of high-energy chemicals that boost the performance of environmentally friendly solid rocket motor propellants.
- (U) $5,700 Develop high-energy-density materials.
  - (U) Determined the chemical and physical properties of fuel/oxidizer molecules and predicted their performance.
  - (U) Conducted synthetic and theoretical searches for new, strained-ring hydrocarbon and novel high-energy compounds for both solid and liquid propulsion.
  - (U) Analyzed potential cryogenic solid-propellant ingredients.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 1011 Rocket Propulsion Technology	

- (U) $18,263 Develop solid and liquid propulsion technology for environmentally safe and low-cost access to space.
  - (U) Developed and validated a hydrogen turbopump design incorporating advanced, fluid-film bearings that meet high-performance and system integrity requirements.
  - (U) Demonstrated fabrication techniques to reduce the cost of casting combustion chambers.
  - (U) Completed testing of hydrostatic bearing coatings in liquid hydrogen. Analyzed their improved longevity.
  - (U) Developed carbon-carbon coating methods using a plasma torch to create lightweight, high strength, high-temperature components.
  - (U) Demonstrated a new rapid densification process for carbon-carbon and ceramic nozzles that will greatly reduce manufacturing time and costs.
  - (U) Designed an integrated, increasingly reliable solid rocket motor which uses polymeric-based propellants and components to eliminate all bond lines.
  - (U) Formulated an environmentally friendly solid rocket motor propellant which has no toxic byproducts from the manufacturing and operations processes.
- (U) $35,471 Total

(U) FY 1996 ($ in Thousands):

- (U) $5,600 Develop propellants with a high-energy density.
  - (U) Determine feasibility of solid hydrogen and metallic clusters, metal atom doped cryogenic-solids, and solids with impurities as high-energy-density materials.
  - (U) Continue development of cryogenic solids, high-pressure solids, extended solids, and high-energy density material additives in cryogenic solids for future use in a solid or hybrid rocket with revolutionary performance increases.
  - (U) Test fire combustion chamber using solid oxygen as a fuel.
  - (U) Test fire the first liquid high-energy density additive (quadricyclane) in a 4,000 lb. engine. Begin increased-scale demonstrations.
  - (U) Continue search for new, higher-energy compounds for solid and liquid propellants.
  - (U) Conduct synthesis of solid, non-ozone depleting oxidizers.
  - (U) Develop scale-up capability for liquid, high-energy-density materials.
- (U) $2,900 Develop propulsion technologies for tactical missiles.
  - (U) Fabricate and begin demonstrations of components such as no-erosion, altitude-compensating nozzles used in solid rocket missiles.
  - (U) Develop lightweight insulating liners for reduced-weight solid rocket motors.
  - (U) Design a nozzle (supersonic splitline flexseal nozzle) that reduces missile weight and increases missile agility.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 1011 Rocket Propulsion Technology	

- (U) Test environmentally safe, minimum-smoke propellants for use in tactical missiles to eliminate missile vulnerability caused by exhaust plume signature tracking.

- (U) $22,276 Develop propulsion technology for reliable, safe, and low-cost boost and orbit transfers.
  - (U) Manufacture low-cost, coated carbon-carbon ceramic components and hybrid polymers for future demonstration of high temperature, non-erosive, lightweight components for solid rocket motors.
  - (U) Use advanced manufacturing and fabrication methods to produce fluid film bearings. Integrate the bearings into a breadboard turbopump to validate cost and weight savings. Begin testing hydrostatic bearings in turbopump assemblies under "real" conditions.
  - (U) Fabricate a combustion chamber to produce increased performance bearings using powder metallurgy technology.
  - (U) Design and fabricate an altitude compensating nozzle to be integrated into a liquid propellant engine.
  - (U) Develop and evaluate new injectors that are less expensive and increase engine reliability and performance over existing injectors.
  - (U) Design and develop the fabrication processes to produce a high performance, low-cost cryogenic upper stage combustion chamber for an expander cycle.
  - (U) Design and fabricate an advanced preburner engine component that uses liquid cryogenic propellants, meets high throttle requirements and does not vaporizing the propellants.
  - (U) Characterize new, lightweight components and develop the processes required to use the materials in liquid fuel rockets.
  - (U) Compile data on hybrid propulsion concepts to develop state-of-the-art hybrid rocket motor technologies.
- (U) $3,900 Develop advanced boost and orbit transfer propellants which are environmentally safe during manufacture, storage, use, and disposal.
  - (U) Characterize and evaluate the synthesized non-toxic, non-cryogenic, high-performance storable liquid fuels and oxidizers.
  - (U) Design non-toxic, non-cryogenic, high-performance storable liquid fuels and oxidizers.
  - (U) Develop lab procedures to minimize propellant, explosive, and pyrotechnic waste products. Optimize disposal procedures.
  - (U) Synthesize alternative, environmentally acceptable propellants that increase the stability and mechanical integrity of missiles.
  - (U) Test ways to improve and make more efficient the manufacturing of new environmentally-safe solid rocket fuels.
  - (U) Manufacture and evaluate laboratory quantities of new high-energy chemicals to be used in environmentally-safe propellants.
- (U) $2,247 Develop propulsion technology for satellite control and on-orbit transfer.
  - (U) Develop concepts and components for solar thermal propulsion.
  - (U) Investigate the beam divergence of a 1000-watt anode thruster (an arcjet) and evaluate methods that could reduce divergence.
- (U) $36,923 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 1011 Rocket Propulsion Technology	

(U) FY 1997 ($ in Thousands):

- (U) $4,513 Develop high-energy-density materials.
  - (U) Complete analysis of solid hydrogen and metallic clusters, metal atom doped cryogenic solids, and solids with impurities. Transition the best high-energy-density materials into the cryogenic solid properties and combustion programs. Begin testing and evaluation of downselected propellants to transition into future high-performance boost and orbit transfer propulsion systems.
  - (U) Finish exploring cryogenic solid, high-pressure solid, and extended solid properties. Determine candidates for cryogenic solid combustion programs that will show revolutionary performance increases by replacing current liquid or solid propulsion systems with cryogenic solid or hybrid-fuel rockets in future space launch missions.
  - (U) Develop techniques to accurately measure high-energy-density additive concentrations in cryogenic solids to maximize future propulsion system performance.
  - (U) Test fire cryogenic hybrid-fuel rocket using oxygen and a cryogenic hydrocarbon to demonstrate performance increases over current liquid propulsion systems.
  - (U) Perform large-scale engine tests/demonstrations with new additives (quadricyclane). Prepare for launch-size demonstrations and begin transitioning additives into system-ready applications.
  - (U) Complete strained-ring hydrocarbon high-energy compound development. Identify the best candidates for a scale-up program to replace current liquid fuels.
  - (U) Select solid, non-ozone depleting oxidizers and other synthesized, new, high-energy-density materials for development. Begin small scale demonstrations of environmentally-safe solid rocket motor fuel processing using these new ingredients.
- (U) $3,273 Develop propulsion technologies for tactical missile system applications.
  - (U) Test fabrication techniques to manufacture lightweight solid rocket engine liners.
  - (U) Complete testing and demonstration of environmentally safe, minimum-smoke propellants to eliminate vulnerability caused by exhaust plume signature tracking.
  - (U) Develop the fabrication processes for novel nozzle concepts (supersonic splitline flexseal nozzle) that reduce missile weight while increasing missile agility.
  - (U) Evaluate commercial technologies and practices for their possible incorporation into low-cost, high-performance, environmentally-safe tactical missiles.
  - (U) Analyze new propellants and components to develop a lightweight, highly-maneuverable propulsion system that will assure high kill ratios against the next generation of highly maneuverable planes.
- (U) $15,999 Develop propulsion technology to meet the needs of reliable, safe, and low-cost boost and orbit transfers.
  - (U) Demonstrate low-cost, high temperature, non-erosive, lightweight coated carbon-carbon ceramic and hybrid polymer components for use in solid rocket space launch and missile motors.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 1011 Rocket Propulsion Technology	

- (U) Demonstrate the fluid film bearing designs and verify their performance and integrity when used in liquid turbopumps on future boost and orbit transfer systems.
- (U) Design and test injectors that enable reduced cost, increased reliability, and increased engine performance in liquid boost and orbit transfer engines.
- (U) Fabricate and test a high-performance, low-cost cryogenic upper stage combustion chamber for an expander cycle application.
- (U) Fabricate and test an advanced preburner engine component that uses using liquid cryogenic propellants that meets the high throttling requirements and does not vaporizing propellants.
- (U) Continue to characterize new materials and develop processes required to apply the materials to liquid-propellant rocket production with dramatic weight reductions.
- (U) Develop design and processing techniques for high-strength, low-weight engine and motor components (metals and non-metals).

– (U) $3,793 Develop advanced boost and orbit transfer propellants which are environmentally safe during manufacture, storage, and use.

- (U) Evaluate ignition characteristics, determine combustion efficiencies, and report the results of the synthesized non-toxic, non-cryogenic, high-performance, storable liquid fuels and oxidizers to begin developing a high-performance, environmentally safe, liquid replacement for current space launch systems.
- (U) Fabricate and test non-toxic, non-cryogenic, high-performance, storable liquid additives for use with these new propellants (capable of withstanding the firing conditions created by the new propellants).
- (U) Determine alternative disposal procedures/technologies to thermolyze or breakdown propellant, explosive, and pyrotechnic wastes into their non-hazardous constituent parts.
- (U) Integrate all of the current solid propellant work being done under the high-energy-density materials program and incorporate the most promising chemicals into state-of-the-art propellants (liquid, solid, and hybrid).
- (U) Evaluate and analyze radically new methods of solid rocket motor and propellant manufacturing to develop low-cost, environmentally friendly solid rocket motors that exceed the performance of current liquid propellant rockets.
- (U) Scale-up and demonstrate the most innovative high-energy chemicals that are currently being synthesized within government and contractor laboratories. The most promising chemicals (solid or liquid) will be fed into an innovative propellants project to be used in next generation propellants for space launch systems.

– (U) $2,715 Develop satellite propulsion technology for control and on-orbit transfer.

- (U) Optimize the internal magnetic field for the 1000-watt anode thruster (arcjet).
- (U) Develop and evaluate improved designs to fabricate a pulsed plasma thruster with increased power efficiency.
- (U) Design solar thrusters and concentrators for satellite propulsion systems with longer life.

– (U) $30,293 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 1011 Rocket Propulsion Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	36,228	32,328	31,492	Cont
(U) Current Budget Submit	35,471	36,923	30,293	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. In FY 1996, Congressional actions added $6 million for Integrated High Performance Rocket Propulsion Technology Initiative.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology.
- (U) PE 0602303A, Missile Technology.
- (U) PE 0603302F, Space and Missile Launch Technology.
- (U) PE 0603311F, Ballistic Missile Technology.
- (U) PE 0603401F, Advanced Spacecraft Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 3326 Lasers and Imaging Technology	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3326 Lasers and Imaging Technology	31,678	19,316	19,244	21,919	22,406	22,193	22,501	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project examines the technical feasibility of moderate to high power lasers, associated optical components, and long-range optical imaging concepts required for Air Force missions. Technologies researched include advanced, short-wavelength laser devices for application as illuminators and imaging sources as well as advanced optical imagers for target identification and assessment. Laser technologies will be studied for their utility in aimpoint selection, target maintenance, and damage assessment. Additionally, high power laser devices, optical components, advanced beam control and atmospheric compensation technologies, techniques for laser target vulnerability assessments, and nonlinear optics processes and techniques are developed.

(U) FY 1995 ($ in Thousands):

- (U) $4,382 Develop high-energy laser devices for applications such as illuminators and for use in wavelength-specific military missions.
  - (U) Developed a compact, portable, two-watt continuous-wave, green-wavelength laser that was deployed with military users for theater operational use.
  - (U) Demonstrated power scaling for wavelength-agile lasers in the mid-infrared region, with potential application to infrared countermeasure missions.
- (U) $2,714 Develop basic laser source and target coupling technology for potentially high-payoff applications such as laser-induced, microwave-emissions phenomena.
  - (U) Developed an improved laser source for fundamental target coupling phenomena studies of laser-induced microwave emissions.
  - (U) Discovered different mechanisms for laser-induced microwave emission effects dependent on target material.
- (U) $6,038 Develop long-range optical imaging technologies that simultaneously increased resolution and data fusion to support missions such as space object identification.
  - (U) Downselected to a single concept each for active and passive imaging technologies for application to deep space (out to geosynchronous altitudes) space object identification/mission payload assessment missions.
  - (U) Initiated investigation of improved image reconstruction algorithms applicable to sparsely-filled, synthetic aperture imaging concepts (active and passive).
  - (U) Completed daytime imaging theory using adaptive optics to support optimum configuration of field experiments.
  - (U) Transitioned hyperspectral imaging technology to standoff detection applications.
  - (U) Evaluated the payoff of hyperspectral "fingerprinting" on the identification of deep space objects.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 3326 Lasers and Imaging Technology	

- (U) $2,244 Develop nonlinear optics technologies to support imaging and other applications.
  - (U) Demonstrated feasibility of using chaos control concepts with laser devices to produce wavelength agility with potential for optical countermeasure and active remote sensing applications.
  - (U) Completed evaluation of nonlinear optics concepts for scaling visible wavelength lasers to kilowatt average power.
- (U) $2,195 Investigate and develop advanced high-energy laser optical components.
  - (U) Completed fabrication and delivery of high-performance, low-cost, cooled, deformable mirror.
  - (U) Developed and scaled low-flow-cooled optics concepts to meet requirements for mirrors, aperture sharing elements, and cooled windows in full-scale laser systems.
  - (U) Continued developing and process scaling thin-film, optical coating deposition technologies.
  - (U) Completed evaluation of environmental and thermal cycling stability for high performance coating samples.
- (U) $13,000 Develop the Maui supercomputer facility.
  - (U) Increased high-speed storage capability by 20 trillion bytes.
  - (U) Provided near-real-time images to Air Force Space Command.
- (U) $1,105 Develop the advanced electro-optical system spectrograph.
- (U) $31,678 Total

(U) FY 1996 ($ in Thousands):

- (U) $2,897 Develop generic high-energy laser technologies for applications such as illuminators for use in wavelength-specific military missions.
  - (U) Demonstrate atomic-iodine laser pumped by chemically produced nitrogen-chloride (NCl(a) - an electronically excited molecule) that produces an all-gas, continuous-wave laser. This laser is potentially significantly lighter weight than a comparable chemical, oxygen-iodine laser.
  - (U) Complete semiconductor laser amplifier optimization studies of beam quality, output power, and coherence for applications such as laser communications.
  - (U) Complete development and delivery of a high power (up to one kilowatt), wavelength-agile, visible laser.
- (U) $4,493 Develop basic laser source and target coupling technology for high-payoff applications such as laser-induced microwave emissions.
  - (U) Complete initial investigation of laser-induced microwave emissions.
  - (U) Begin evaluation of laser-induced microwave effects on military system materials.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 3326 Lasers and Imaging Technology	

- (U) $5,517 Develop long-range optical imaging technologies for increased resolution and data fusion to support missions such as space object identification.
  - (U) Conduct fundamental risk reduction experiments and demonstrations for technology critical to deep space imaging concepts selected in FY 1995.
  - (U) Identify and begin focused development of key concepts and technologies for transition to high-payoff applications for optical sensing, imaging, and stand-off detection.
  - (U) Initiate effort to incorporate real-time image processing algorithms into generic, on-platform processing schemes.
- (U) $2,118 Investigate and develop nonlinear optics technologies to support imaging, communications, aircraft self-protection, and other applications.
  - (U) Show feasibility of using specially prepared, non-linear optical crystals to simultaneously produce tunable, multiple near- and mid-infrared laser emissions.
  - (U) Demonstrate all-optical technique to stabilize and extend the modulation band width of semiconductor lasers with potential applications to high data rate optical communications.
  - (U) Begin investigation of automatic, all optical phase correction techniques for optical communications across fibers and free space.
- (U) $3,035 Investigate and develop advanced high energy laser optical components.
  - (U) Initiate program to identify and develop techniques to perform in situ status and health evaluation of optical components installed in a high energy laser system.
  - (U) Identify potentially non-toxic coolants and bonding processes for use in cooled transmissive optical components such as aperture sharing elements and cooled windows for high energy lasers.
  - (U) Continued developing very low absorption, low-scatter optical thin film coatings by investigating new coating materials and coating process modifications.
- (U) $1,256 Develop the advanced electro-optical system spectrograph.
- (U) $19,316 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 3326 Lasers and Imaging Technology	

(U) FY 1997 ($ in Thousands):

- (U) $2,964 Develop generic, high-energy laser technologies for applications such as illuminators and use in wavelength-specific military missions.
  - (U) Demonstrate a multi-joule, frequency-agile laser source for remote sensing applications.
  - (U) Investigate performance parameters and scaling potential of atomic-iodine laser pumped by chemically produced, nitrogen chloride.
  - (U) Demonstrate lasing of 100 milliwatts at a wavelength of five micrometers from a diode laser.
- (U) $1,205 Develop basic laser source and target coupling technology for use in high-payoff applications such infrared countermeasures and creating laser-induced microwave effects.
  - (U) Complete experiment and analysis to assess the effectiveness of laser-induced microwave emissions in military applications.
- (U) $2,712 Develop long-range optical imaging technologies for increased resolution and data fusion to support missions such as space object identification.
  - (U) Complete initial development of experiments on key technologies for high-payoff imaging applications and transition to advanced development.
  - (U) Establish laboratory testbed for on-board image processing concept.
- (U) $2,282 Investigate and develop nonlinear optics technologies to support imaging and other applications.
  - (U) Demonstrate, in the laboratory, an automatic all-optical phase correction technique for an optical communications link across free-space using a modulated fiber laser source and collector.
  - (U) Demonstrate an efficient non-linear optical method for producing moderate-power, multiple-wavelength, frequency-agile lasers.
- (U) $2,261 Investigate and develop of advanced, high energy laser optical components.
  - (U) Continue to develop and evaluate techniques to evaluate optical components installed in an operational high-energy laser system.
  - (U) Complete testing and accept delivery of a cooled, transmissive optical element.
  - (U) Continue developing very low absorption, low-scatter optical, thin-film coatings. Transfer technology to industry for scaling.
- (U) $4,000 Develop laser radar for space surveillance and remote sensing applications.
  - (U) Demonstrate capabilities to collect range, range rate, and doppler images against unaugmented low-earth orbit satellite.
  - (U) Evaluate the system's capabilities for long-range (up to 75 kilometers) remote sensing within the atmosphere.
- (U) $3,820 Develop high power laser diode arrays at alternate wavelengths that will be transitioned to many military applications.
  - (U) Demonstrate lasing of a five watt average power laser diode at 2.1 micrometers wavelength
  - (U) Demonstrate 5 watss peak output power from an optically-pumped semi-conductor structure at 4 micrometers wavelength
- (U) $19,244 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 3326 Lasers and Imaging Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	32,457	18,752	17,276	Cont
(U) Current Budget Submit	31,678	19,316	19,244	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Vertical increases are a result of increased emphasis on remote sensing applications. In FY 1996, Congress added $1.3 million for the advanced electro-optical system spectrograph. Apparent horizontal decreases are due to Congressional adds in FY 1995.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602101N, Directed Energy Weapons.
- (U) PE 0602307A, Laser Weapon Technology.
- (U) PE 0603314A, High Energy Laser and Directed Energy Components.
- (U) PE 0603319F, Airborne Laser Demonstrator.
- (U) PE 0603605F, Advanced Weapons Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602601F Phillips Laboratory Exploratory Development

PROJECT NO. AND NAME: 5797 Advanced Weapons and Survivability Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
5797 Advanced Weapons and Survivability Technology	17,984	16,705	16,608	16,871	17,516	18,615	19,225	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** High power microwave and other unconventional weapon concepts using innovative technologies such as compact toroids are explored in this project. Technologies that support a wide range of Air Force missions such as space control, command and control warfare, and counter-air warfare are developed. This project provides for vulnerability assessments of representative U.S. strategic and tactical systems to directed energy weapons, directed energy weapon technology assessment for specific Air Force missions, and directed energy weapon lethality assessments against foreign targets. In addition to directed energy weapon threats, this project conducts assessments of specific space environmental (natural and man-made) effects on space systems and develops hardening technologies and methodologies.

(U) FY 1995 ($ in Thousands):

- (U) $3,621 Develop generic advanced weapon technologies that support many Air Force applications.
  - (U) Developed alternative directed energy weapon sources that will destroy advanced, future enemy integrated air defense systems.
  - (U) Continued to develop advanced pulse power technologies that will power new high power microwave source designs.
  - (U) Continued development of solid-liner plasma-driven hypervelocity projectiles.
- (U) $1,476 Assess effects/lethality of directed energy weapons technologies against representative air and ground military systems.
  - (U) Completed fixed-site design for high power microwave effects hardening testing for command and control warfare applications.
  - (U) Completed communications network response experiments to identify network susceptibilities to high power microwaves.
- (U) $5,505 Develop high power microwave technologies that will support applications such as suppression of enemy air defenses, counter-air, command and control warfare, and aircraft self-protection.
  - (U) Completed investigation into high power microwave weapons concepts for command and control warfare mission.
- (U) $3,619 Develop high power microwave technologies, including susceptibility and effects experiments and modeling and data base development, to support space control applications.
  - (U) Performed tests of advanced focal plane arrays to assess their susceptibility to electromagnetic emissions.
  - (U) Examined multi-threat, directed energy weapon warning/reporting/protection technology development efforts.
  - (U) Delivered integrated multi-subsystem survivability/vulnerability modeling software.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 5797 Advanced Weapons and Survivability Technology	

- (U) $3,763 Assess the vulnerability of various space assets to natural and man-made threats such as solar radiation, space debris, and directed energy weapons.
  - (U) Developed satellite directed energy weapon lethality and assessment models for five assets.
  - (U) Developed multi-threat survivability/vulnerability assessment software.
  - (U) Continued space payload assessment and environmental interaction experiments. Quantified ultraviolet, visible, and infrared satellite signatures.
- (U) $17,984 Total

(U) FY 1996 ($ in Thousands):

- (U) $6,619 Develop generic advanced weapon technologies that support many Air Force applications.
  - (U) Develop advanced, pulse-power technologies that will power new, high power microwave source designs.
  - (U) Continue development of narrowband and ultra-wideband high power microwave sources and antennas for command and control warfare efforts.
  - (U) Develop high-performance computer codes to support plasma and pulsed power research.
  - (U) Investigate ability of high power microwaves to neutralize biological weapons.
  - (U) Transition ultra-wideband antenna to PE 0603605F.
- (U) $2,895 Assess effects/lethality of directed energy weapon technologies against representative air and ground military systems.
  - (U) Develop computer modeling codes that predict high power microwave coupling into aircraft. Complete B-2 shielding survey.
  - (U) Develop technologies to harden military assets against high power microwave damage and effects.
  - (U) Continue characterization of high power microwave upset of various system's hardware, including command and control network equipment.
  - (U) Develop specifications and standards, and hardness maintenance technologies for systems such as the F-16, Hawk missile, and F-22.
  - (U) Complete counter-air effectiveness analyses of high power microwave weapons.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 5797 Advanced Weapons and Survivability Technology	

- (U) $3,399 Develop high power microwave technologies that will support applications such as suppression of enemy air defenses, counter-air, command and control warfare, and aircraft self-protection.
  - (U) Complete high power microwave weapons concept exploration for command and control warfare.
  - (U) Continue theoretical analysis of predicted high power microwave weapons' effectiveness for suppression of enemy air defense and command and control warfare.
  - (U) Downselect wideband, high power microwave source which provides aircraft self-protection.
  - (U) Develop downselected narrowband source technology for application in suppression of enemy air defenses.
  - (U) Complete high power microwave weapons application analysis for use in counter-air applications.
- (U) $1,769 Develop high power microwave technologies, including susceptibility and effects experiments and modeling and data base development, to support space control applications.
  - (U) Continue development of multi-threat warning/protection technologies.
  - (U) Develop hardened space sensor.
  - (U) Develop high power microwave weapon applications concept designs.
- (U) $2,023 Assess the vulnerability of various space assets to threats such as solar radiation, space debris, and directed energy weapons.
  - (U) Develop satellite lethality and assessment models for four assets.
  - (U) Provide advanced sensor design and assessments for multi-spectral, multi-sensor data analysis workstation.
  - (U) Complete space payload assessment and environmental interaction experiments.
- (U) $16,705 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 5797 Advanced Weapons and Survivability Technology	

(U) FY 1997 ($ in Thousands):

- (U) $5,671 Develop generic advanced weapon technologies that support many Air Force applications.
  - (U) Develop advanced pulse-power, microwave and radio-frequency technologies for offensive and defensive weapon systems.
  - (U) Develop high-performance computer codes to support plasma and pulsed power research.
  - (U) Continue to investigate ability of high power microwave technologies to neutralize biological weapons.
  - (U) Continue to develop narrowband and wideband sources and antennas and complete compact toroid effort.
- (U) $2,713 Assess effects/lethality of directed energy weapon technologies against representative air and ground military systems.
  - (U) Develop computer modeling codes that predict high power microwave coupling into advanced technology aircraft. Complete F-22 coupling experiments.
  - (U) Develop fratricide protection technology for advanced technology fighter aircraft.
  - (U) Complete command and control warfare effectiveness analyses using high power microwaves.
  - (U) Transition specifications and standards and high power microwave hardness technologies to F-16 and F-22 program offices.
  - (U) Continue directed energy weapon lethality/survivability enhancements and characterization of equipment upset of various foreign and U.S. systems.
  - (U) Develop high power microwave protection criteria for large aircraft, such as cargo-transport, air-refueling, and bomber aircraft.
- (U) $3,671 Develop high power microwave technologies that will support applications such as suppression of enemy air defenses, command and control warfare, and aircraft self-protection.
  - (U) Continue in situ experimentation with installed systems for command and control warfare using high power microwaves.
  - (U) Begin in situ demonstrations of selected high power microwave sources that provide aircraft self-protection.
  - (U) Refine computer models of weapon effectiveness for all weapon applications.
  - (U) Perform experiment using downselected narrowband source for suppression of enemy air defenses.
- (U) $2,453 Develop high power microwave technologies, including susceptibility and effects experiments and modeling and data base development, to support space control applications.
  - (U) Select one high power microwave weapon concept for space control and application.
  - (U) Continue concept studies of high power microwaves for space control applications.
- (U) $2,100 Assess the vulnerability of various space assets to threats such as solar radiation, space debris, and directed energy weapons.
  - (U) Develop directed energy weapon lethality and assessment models for five satellites.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 5797 Advanced Weapons and Survivability Technology	

- (U) Transition satellite survivability/vulnerability/lethality assessments to the ground-based laser technology program.
- (U) Transition advanced data fusion techniques to the multi-spectral, multi-sensor data analysis workstation.

- (U) $16,608 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	18,368	17,340	16,972	Cont
(U) Current Budget Submit	17,984	16,705	16,608	Cont

(U) Change Summary Explanation:

Funding: Horizontal/vertical reductions to this project are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602120A, Electronic Survivability and Fuzing Technology.
- (U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology.
- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0603605F, Advanced Weapons Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 8809 Space and Missile Technology	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
8809 Space and Missile Technology	35,856	30,566	35,675	38,040	42,536	48,915	52,208	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** In FY 1995, all Air Force spacecraft, launch vehicle, and ballistic missile Applied Research efforts from several prior program elements and projects were consolidated into this project. This project focuses on five major space and missile technology areas: spacecraft platform technologies (e.g., structures, controls, power, and thermal management); space-based payload technologies (e.g., sensors, satellite communications, and survivable electronics); satellite control technologies (e.g., spacecraft software); ballistic missile/launch vehicle specific technologies (e.g., astrodynamics and guidance, navigation, and control avionics); and integrated experiments of advanced technologies for transition to planned systems (e.g., payload/platform/launch vehicle merging).

(U) FY 1995 ($ in Thousands):

- (U) $14,053 Develop technologies for space platform subsystems such as cryocoolers, space vehicle thermal management, compact solar power cells, lightweight batteries, and innovative power generation concepts.
  - (U) Designed and fabricated flex-array deployment mechanisms, increasing overall efficiency of solar to electric energy conversion by 15 percent.
  - (U) Assembled solid state primary battery for future space and missile launch vehicle applications.
  - (U) Developed alkali metal thermal to electric conversion power subsystem components.
  - (U) Completed bimodal solar thermal propulsion and power conceptual design study.
  - (U) Continued former Ballistic Missile Defense Organization 35-80 degrees Kelvin cryocooler development work.
- (U) $6,669 Develop technologies for space platform structures such as spacecraft structural controls for vibration suppression and lightweight composite satellite and launch vehicle structures.
  - (U) Completed first experiments on adaptive neural controls for spacecraft structural vibration suppression.
  - (U) Completed carbon-carbon radiator structure fabrication.
  - (U) Defined system requirements for the launch vibration isolation technology development program.
  - (U) Completed preliminary concept design for the multi-functional structures technology program.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 8809 Space and Missile Technology	

- (U) $5,710 Develop technologies for space-based payload subsystems such as hardened sensors and satellite communications.
  - (U) Examined improvements to long wavelength, mercury cadmium telluride infrared detectors under low light background conditions.
  - (U) Developed and characterized low-noise, high-performance quantum well infrared photodetectors.
  - (U) Evaluated and characterized radio frequency and laser communication modem and modem controller components.
  - (U) Developed integrated computer models of space-based surveillance systems' performance that quantify the trade offs in using various satellite components.
  - (U) Completed space-based surveillance antenna architecture surveys and studies of antenna usage trade offs.
- (U) $3,900 Develop technologies for space-based payload components such as hardened electronics and memories.
  - (U) Investigated effects of space radiation on advanced electronics materials including silicon-on-diamond components.
  - (U) Investigated potential for orders of magnitude increases in radiation tolerance of commercial space devices through processing improvements.
- (U) $1,424 Develop technologies for satellite control such as standardized, reusable software for astrodynamics and modeling/simulation.
  - (U) Enhanced the MAGIC system to provide intelligent assistance to satellite operators in resolution of satellite anomalies.
  - (U) Demonstrated integration of high-accuracy laser measurements for orbit determination into astrodynamics routines.
  - (U) Developed software algorithms that improve the accuracy of space-based observation systems using existing observation resources.
  - (U) Developed algorithms to improve current operational orbit accuracy of satellites by several orders of magnitude.
- (U) $3,000 Develop ground and small satellite integration technologies for space and near-space experiments.
  - (U) Refurbished existing satellite vehicle and integrated four experimental payloads for the MightySat technology evaluation program, providing frequent access to space for Applied Research space technology component demonstrations.
  - (U) Developed standard telemetry interface and control program for balloon, sounding rocket, and small satellite control.
  - (U) Evaluated balloon, sounding rocket, and small satellite integration techniques and concepts.
- (U) $1,100 Develop technologies such as guidance, navigation, and control avionics to improve flights of launch vehicles and ballistic missiles.
  - (U) Designed and fabricated advanced navigational instruments for ballistic missiles.
  - (U) Designed solid state, next generation thrust axis accelerometer for ballistic missiles.
- (U) $35,856 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 8809 Space and Missile Technology	

(U) FY 1996 ($ in Thousands):

- (U) $6,261 Develop technologies for space platform subsystems such as cryocoolers, space vehicle thermal management, compact solar power cells, lightweight batteries, and improved power generation concepts.
  - (U) Fabricate and test solar cell flex array deployment and solar to electric energy conversion efficiency.
  - (U) Fabricate and evaluate solid state primary battery for space and missile launch vehicles.
  - (U) Characterize and evaluate lightweight thermal bus components for future space vehicle thermal management subsystems.
- (U) $5,780 Develop technologies for space platform structures such as spacecraft structural controls for vibration suppression and lightweight composite satellite and launch vehicle structures.
  - (U) Initiate advanced 'mechanisms' technology development program to replace current generation pin pullers, tie down bolts, reaction wheels, etc.
  - (U) Complete non-pyrotechnic release device technology development.
  - (U) Complete preliminary design for the launch vibration isolation program.
  - (U) Complete multi-functional structures technology program.
- (U) $5,780 Develop technologies for space-based payload subsystems such as hardened sensors and satellite communications.
  - (U) Continue improvements to long-wavelength mercury cadmium telluride detectors under low background radiation conditions.
  - (U) Develop optimized low-noise, high-performance quantum well infrared photodetectors in the mid-, long-, and very long-wavelength spectral regions.
  - (U) Design radio frequency communications modems, modem controllers, and associated high-speed network components for evaluation.
  - (U) Continue development of integrated space-based surveillance models that address background clutter, target cross section, and propagation losses. Develop software algorithms that improve the accuracy of space-based observation systems using existing observation resources.
  - (U) Evaluate component technologies for large aperture space-based surveillance antennas.
- (U $4,069 Develop technologies for space-based payload components such as hardened electronics and computer memories.
  - (U) Design and evaluate advanced packaging technology whose goal is the reduction of size/volume/weight by a factor of ten.
  - (U) Fabricate standard space-based surveillance signal processing module.
- (U) $3,013 Develop technologies for satellite control such as standardized, reusable software for astrodynamics, and command and control.
  - (U) Design and develop common satellite control software.
  - (U) Develop astrodynamics parallel processing code for propagation and differentiation correction program.
  - (U) Construct algorithms for integrated space technology product development.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 8809 Space and Missile Technology	

- (U) $4,843 Develop ground and small satellite integration technologies for space and near-space experiments.
  - (U) Complete the integration of components onto and checkout of MightySat-I satellite.
  - (U) Design and fabricate the MightySat-II.1 satellite that will demonstrate hyperspectral imaging technologies and experiments that will lead to a better understanding of the space environment.
- (U) $820 Develop technologies supporting launch vehicles and ballistic missile such as guidance, navigation, and control avionics.
  - (U) Design solid state micro-mechanical guidance instruments for future Air Force ballistic missile environments.
  - (U) Fabricate next generation thrust axis accelerometer which could provide low life cycle cost Minuteman III guidance upgrade.
- (U) $30,566 Total

(U) FY 1997 ($ in Thousands):

- (U) $5,947 Develop technologies for space platform subsystems such as cryocoolers, space vehicle thermal management, compact solar power cells, lightweight batteries, and innovative power generation concepts.
  - (U) Complete solar cell flex array technology development effort.
  - (U) Complete solid state primary battery for space and missile launch vehicle applications.
  - (U) Develop ten degrees Kelvin cryocoolers for evaluation and characterization.
- (U) $5,478 Develop technologies for space platform structures such as spacecraft structural controls for vibration suppression and lightweight composite satellite and launch vehicle structures.
  - (U) Initiate the advanced adaptive structures technology development program.
  - (U) Conduct proof-of-concept experiments for the launch vehicle vibration isolation program.
  - (U) Initiate the advanced launch vehicle structures technology development program.
- (U) $5,267 Develop technologies for space-based payload subsystems such as hardened sensors and satellite communications.
  - (U) Continue improvement of long-wavelength mercury cadmium telluride detectors and optimize for large focal plane arrays.
  - (U) Develop large format quantum well infrared photodetector focal plane arrays.
  - (U) Continue to evaluate and characterize radio frequency communications modem, modem controllers and network components.
  - (U) Integrate space-based surveillance models into wargaming simulations for immediate performance feedback.
  - (U) Integrate and test space-based surveillance antenna component technologies to support system level design concepts.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 8809 Space and Missile Technology	

- (U) $3,901 Develop technologies for space-based payload components such as hardened electronics and memories.
  - (U) Evaluate and fabricate advanced packaging technology whose goal is a ten times size/volume/weight reduction.
  - (U) Construct a standard space-based surveillance signal processing module.
- (U) $3,823 Develop technologies for satellite control such as standardized, reusable software for astrodynamics.
  - (U) Develop satellite control software for applications such as multi-mission advanced ground intelligent control (MAGIC).
  - (U) Assemble next generation gravitational astrodynamics model, permitting non-maintainable orbits analysis.
  - (U) Write software routines for integrated space technology product development.
- (U) $9,388 Develop ground and small satellite integration technologies for space and near-space experiments.
  - (U) Launch MightySat-1 satellite from Space Shuttle #STS-81 that will validate space Applied Research technologies having operational user interest. Technologies to be validated on MightySat-1 include: experimental composite structures that are inexpensive, lightweight, and which decrease structure production time; increased efficiency solar cells; shape memory alloy non-pyrotechnic release device that improves the release of antennas and solar cells; and miniaturization technologies to prove the utility of smaller devices such as accelerometers on smaller satellites.
  - (U) Assemble and integrate exploratory ground, hardware-in-the-loop, and small satellite technologies, techniques, and concepts onto flight platforms.
  - (U) Integrate hyperspectral imaging payload onto MightySat-II satellite technology demonstrator for planned FY 1998 launch.
  - (U) Develop near-space capabilities for experiments requiring high altitudes, long durations, and guided recovery systems.
- (U) $1,871 Develop technologies such as guidance, navigation, and control avionics to support launch vehicles and ballistic missile flights.
  - (U) Fabricate solid state micro-mechanical guidance instruments for future ballistic missile environments.
  - (U) Evaluate and test next generation thrust axis accelerometer.
  - (U) Develop improved techniques to determine accurate gravity field values, a major source of error in space inertial navigation systems.
- (U) $35,675 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exploratory Development
PROJECT NO. AND NAME 8809 Space and Missile Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	36,622	31,730	32,614	Cont
(U) Current Budget Submit	35,856	30,566	35,675	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Vertical/horizontal increase in FY 1997 reflects increased Air Force emphasis on ground and small satellite integration technologies for space and near-space experiments.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0602102F, Materials.
- (U) PE 0603302F, Space and Missile Rocket Propulsion.
- (U) PE 0603311F, Ballistic Missile Technology.
- (U) PE 0603401F, Advanced Spacecraft Technology.
- (U) PE 0603410F, Space Systems Environmental Interactions.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	41,504	43,276	42,573	46,244	47,625	48,921	50,560	Continuing	Continuing
06AL Armament Directorate Operations	15,003	0	0	0	0	0	0	Continuing	Continuing
2068 Advanced Guidance Technology	8,101	16,832	14,901	16,186	16,669	17,125	17,698	Continuing	Continuing
2502 Ordnance Technology	12,790	20,632	21,712	23,584	24,288	24,948	25,784	Continuing	Continuing
2543 Weapons Effectiveness Methodology	2,244	5,812	5,960	6,474	6,668	6,848	7,078	Continuing	Continuing
2567 Aeromechanics Technology	3,366	0	0	0	0	0	0	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Applied Research program develops and establishes the feasibility of advanced technologies for air-to-air and air-to-surface conventional weapons to support non-nuclear Air Force missions. Project 2567 funding for Weapon Airframe and Carriage Technology for FY 1996 and out is included in Project 2502. Project 2567 funding for midcourse guidance technology for advanced guided munitions for FY 1996 and out is included in Project 2068. Starting in FY 1996, Project 06AL was terminated. The funds in Project 06AL were put in Projects 2068, 2502, and 2543 to support technical efforts. All projects in this program element now contain the resources necessary, including civilian salaries, to manage, conduct, and document the technical activities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	43,627	44,954	43,830	Cont
(U) Appropriated Value	44,685	44,954		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-2,256	-897		
b. SBIR	-452	-529		
c. Omnibus/Other Above Threshold Reprogrammings	-473	-252		
d. Below Threshold Reprogrammings				
(U) Current Budget Submit	41,504	43,276	42,573	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

PROJECT NO. AND NAME: 06AL Armament Directorate Operations

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
06AL Armament Directorate Operations	15,003	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project supports and complements all other projects in the Program Element and provides for management, support, and operation of the Wright Laboratory Armament Directorate, Eglin AFB, FL. It provides civilian salaries, transportation, rents, maintenance, communications, supplies and equipment, and facilities maintenance. Starting in FY 1996, Project 06AL funding will be included in Projects 2068, 2502, and 2543.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	16,769	0	0	Cont
(U) Current Budget Submit	15,003	0	0	Cont

(U) Change Summary Explanation:

Funding: Changes due to consolidation of Project 06AL into the technical projects.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

PROJECT NO. AND NAME: 2068 Advanced Guidance Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2068 Advanced Guidance Technology	8,101	16,832	14,901	16,186	16,669	17,125	17,698	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops precision terminal guidance technologies for air-launched conventional weapons and technologies for midcourse guidance for advanced munitions. Project payoffs include: adverse-weather and "launch and leave" precision guidance capability; increased number of kills per sortie; increased aircraft survivability; improved reliability and affordability; reduced test costs; shorter development programs; and improved survivability and effectiveness of conventional air-to-air and air-to-surface weapons.

(U) FY 1995 ($ in Thousands):

- (U) $4,728 Develop and demonstrate guidance component technology for low-cost precision adverse-weather, autonomous seekers.
  - (U) Flight tested an optical correlator integrated with a video camera to investigate passive autonomous target recognition in a severe clutter environment.
  - (U) Integrated an optical correlator with a laser radar to investigate target identification in a severe clutter environment.
  - (U) Designed an adverse-weather, wide field-of-view, high resolution, passive, millimeter wave sensor for use in future covert seekers.
  - (U) Demonstrated initial operating capability for a unique research and evaluation seeker emulation radar to investigate next generation passive and active millimeter wave seeker concepts.
- (U) $292 Develop and demonstrate advanced weapons seeker simulation capability.
  - (U) Completed the improved infrared modeling program which will spatially correlate active and passive, infrared, and millimeter-wave scenes.
- (U) $3,081 Develop and demonstrate instrumentation for weapons guidance development and test.
  - (U) Developed weapon/bomb damage assessment instrumentation and hard target smart fuze technology.
  - (U) Conducted study using holographic data reduction to provide improved warhead hydrocode test data.
  - (U) Completed high-speed charge-coupled device imager development to provide sensor for weapons development and test.
  - (U) Fabricated and flight tested subminiature telemetry units for improved development/test of munitions and submunitions.
- (U) $8,101 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT NO. AND NAME 2068 Advanced Guidance Technology	

(U) FY 1996 ($ in Thousands):

- (U) $8,918 Develop and demonstrate guidance component technology for low-cost precision adverse-weather, autonomous seekers.
  - (U) Flight test an optical correlator with a laser radar to investigate target identification in a severe clutter environment.
  - (U) Conduct in-house experiments on an adverse-weather, wide field-of-view, high resolution, passive, millimeter wave sensor for use in future covert seekers.
  - (U) Complete design of an electronic processor using image algebra for use in future missile systems.
  - (U) Complete the conformal antenna design for an air superiority missile to enable the design of a smaller diameter missile.
- (U) $4,810 Develop and demonstrate advanced navigation/control technologies for weapon airframes.
  - (U) Conduct initial design of a smaller, lighter, less expensive Global Position System/Inertial Navigation System that provides an improvement in accuracy over current technology to achieve an affordable future weapon designs.
  - (U) Complete design for an improved tactical-grade inertial measurement unit to investigate micro machined inertial sensor technology.
  - (U) Fabricate an inertial sensor utilizing silicon chip micro machining technology to allow for small and inexpensive inertial measurement units (IMUs) without sacrificing performance.
- (U) $3,104 Develop and demonstrate instrumentation for weapon guidance development and test.
  - (U) Conduct telemetry signal processing experiments to enhance transmission range and provide weapon in-flight time-space-position information.
  - (U) Complete telemetry instrumentation development system to provide expert system programming capability to weapons development and test community users of subminiature telemetry.
- (U) $16,832 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT NO. AND NAME 2068 Advanced Guidance Technology	

(U) FY 1997 ($ in Thousands):

- (U) $8,625 Develop and demonstrate guidance component technology for low-cost precision adverse-weather, autonomous seekers.
  - (U) Complete experiments on an adverse-weather, wide field-of-view, high resolution, passive, millimeter wave sensor for use in future covert seekers.
  - (U) Demonstrate/ground test a conformal antenna design for an air superiority missile that provides an instantaneous addressable wide field-of-regard.
  - (U) Complete construction of multichannel laser radar (LADAR) breadboard; utilize completed breadboard to continue technology base development to enhance capability of solid state LADAR (i.e., increase operating range, assess rapid scanning techniques, develop multichannel receiver capability, and develop longer wavelength technology).
  - (U) Complete filter development for LADAR sensors; continue development of optical correlator technologies (i.e., high-speed, high resolution, multiple state-capable correlator hardware).
  - (U) Continue development of technologies to support advanced imaging longwave infrared (IR) sensors: complete requirements for multicolor large format focal planes and polarization sensitive detectors.
  - (U) Complete construction of breadboard scene projector for solid state LADAR seekers.
- (U) $4,591 Develop and demonstrate advanced navigation/control technologies for advanced air-to-ground munitions and highly agile air-to-air missiles.
  - (U) Complete breadboard assembly and laboratory testing, and initiate preliminary design for an advanced jam resistant Global Position System/Inertial Navigational System that is 40 percent of the size and cost of FY 1995 technology.
  - (U) Complete fabrication of micro-machined inertial sensor and begin fabrication of a breadboard inertial measurement unit.
- (U) $1,685 Develop and demonstrate instrumentation for weapons guidance development and evaluation.
  - (U) Develop new subminiature telemetry chip-set functions and new packaging concepts for high-g usage.
  - (U) Develop and demonstrate spectrally efficient modulation and coding methods for telemetering wideband test data.
- (U) $14,901 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT NO. AND NAME 2068 Advanced Guidance Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	8,299	17,485	16,818	Cont
(U) Current Budget Submit	8,101	16,832	14,901	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. FY 1996 horizontal increase due to incorporation of mid-course guidance technology for advanced guided munitions from Project 2567, higher priority given to developing affordable precision guidance technologies, and incorporation of Project 06AL. FY 1997 horizontal decrease due to restructuring of the program for applied research of conventional weapons technology to meet warfighter needs.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603601F, Conventional Weapons Technology.
- (U) PE 0604314F, Advanced Medium Range Air-to-Air Missile.
- (U) PE 0604940D, Central Test and Evaluation Improvement Program.
- (U) PE 0604604F, Submunitions Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

PROJECT NO. AND NAME: 2502 Ordnance Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2502 Ordnance Technology	12,790	20,632	21,712	23,584	24,288	24,948	25,784	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops technologies for advanced weapon dispensers, submunitions, safe and arm devices, fuzes, explosives, and warheads for air-to-surface and air-to-air conventional weapons, instrumentation technology and techniques, and weapon airframe and carriage technology. The payoffs include: improved storage capability and transportation safety of fully assembled weapons; improved non-nuclear warhead and fuze effectiveness; improved submunition dispensing; selectable multimode kill capability; low-cost airframe/subsystem components and structures; and reduced aircraft/weapons drag and radar signature.

(U) FY 1995 ($ in Thousands):

- (U) $2,824 Develop and demonstrate fuze technology to reduce cost and increase supportability, safety, and performance.
  - (U) Completed warhead detonation algorithm and breadboard of an active hard target smart fuze.
  - (U) Integrated fuze simulation into a six degree-of-freedom missile simulation to provide system-level evaluation and design.
- (U) $2,547 Develop and demonstrate affordable explosives for higher performance and lower sensitivity.
  - (U) Conducted explosive sensitivity and performance evaluations to provide enhanced weapon effectiveness for penetrating warheads.
  - (U) Characterized tailorable blast explosives to increase weapon effectiveness with minimal collateral damage.
  - (U) Developed reactive fills for warheads which provide a greater impulse than high explosives for a given volume.
- (U) $1,667 Develop and demonstrate advanced analytical tools for calculating weapons effects to reduce development time and cost.
  - (U) Developed models and verified code for the antimaterial multimode warhead to optimize its lethality against multiple target sets.
  - (U) Developed target/warhead interaction simulation development to provide improved understanding of weapon kill mechanisms.
- (U) $5,752 Develop and demonstrate advanced warhead development technologies.
  - (U) Demonstrated primary and secondary kill mechanisms for agent defeat of biological and chemical weapons.
  - (U) Developed concepts for dense cased warheads (i.e., thick wall steel and heavy metal warheads for improved hard target penetration).
- (U) $12,790 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT NO. AND NAME 2502 Ordnance Technology	

(U) FY 1996 ($ in Thousands):

- (U) $4,411 Develop fuze technology to reduce cost and increase supportability, safety, and performance.
  - (U) Design and initiate fabrication of ground penetrating radar fuze for interrogation of target prior to penetration to improve weapon burst point selection and increased weapon effectiveness.
  - (U) Conduct trade studies to determine feasibility of fuze systems for a dual role missile capable of defeating air-to-air and air-to-surface targets which will provide ordnance packages for improving effectiveness for defeating air targets and selected ground targets.
- (U) $396 Develop and demonstrate affordable explosives for higher performance and lower sensitivity.
  - (U) Install explosive demilitarization equipment for technology evaluation and demonstration to provide low-cost, environmentally compatible methods for disposal, conversion, or recycling of explosives.
  - (U) Conduct sensitivity experiments of advanced penetrator explosive formulations to provide insensitive explosive fills which survive penetration while increasing blast performance.
- (U) $2,463 Develop and demonstrate advanced analytical tools for calculating weapons effects to reduce development time and cost.
  - (U) Complete study to verify optimum nose shape for penetrating weapons to increase penetration capability.
  - (U) Verify detonation shock dynamics methodology for tracking an explosive detonation as it propagates through weapon payload.
  - (U) Verify target/warhead interaction simulation to provide improved understanding of weapon kill mechanisms.
- (U) $476 Develop aeroballistic analysis tools to enhance and reduce the cost/schedule of weapons testing/certification.
  - (U) Develop and install a high resolution, solid state, digital camera system to record flight data for the Aeroballistic Research Facility to maintain high experimentation rates while greatly decreasing cost.
  - (U) Study applications of advanced flow field visualization instrumentation for collection of quantitative density information around a projectile in free flight to greatly enhance design process of new munitions.
- (U) $2,256 Develop advanced weapon airframe and carriage technology.
  - (U) Study designs of affordable methods of external weapon carriage for future fighter aircraft.
  - (U) Investigate designs of compressed weapons to reduce the size of stores to improve weapon payload capability on aircraft.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT NO. AND NAME 2502 Ordnance Technology	

- (U) $9,164 Develop and demonstrate advanced warhead development technologies and advanced kill mechanisms for materiel target defeat.
  - (U) Characterize candidate high strength penetrator warhead materials which will provide greater penetration capability/warhead survivability.
  - (U) Perform reactive material explosive cratering experiments to increase warhead effectiveness without increasing weapon size for small payload volume penetrators.
  - (U) Conduct theoretical investigations into new warhead technology involving magnetically formed warheads which will provide additional kill methods for enhancing weapons effectiveness.
  - (U) Conduct design trades for an all-up general purpose bomb to reduce test costs and design period required to develop advanced weapons.
- (U) $1,466 Develop and demonstrate instrumentation for weapon test and evaluation.
  - (U) Integrate high-speed electronic imaging components and validate through laboratory tests.
  - (U) Develop techniques for holographic data reduction to provide improved warhead hydrocode test data.
- (U) $20,632 Total

(U) FY 1997 ($ in Thousands):

- (U) $3,568 Develop and demonstrate fuze technology to reduce cost and increase supportability, safety, and performance.
  - (U) Fabricate and evaluate a proximity sensor for general purpose bomb fuzes; investigate implementations of high/low drag sensing methods.
  - (U) Conduct preliminary design studies of a hard target penetrating radar fuze to optimize burst point selection.
  - (U) Complete trade studies on an integrated ordnance package capable of defeating future air targets and surface-to-air missiles.
- (U) $3,201 Develop and demonstrate affordable explosives for higher performance and lower sensitivity.
  - (U) Conduct explosive experiments to provide low cost technologies for demilitarization of weapon explosives.
  - (U) Continue sensitivity experiments of insensitive explosive fills which survive hard target penetration while increasing blast performance.
- (U) $1,477 Develop and demonstrate advanced analytical tools for calculating weapons effects to reduce development time and cost.
  - (U) Convert weapon design methods to allow operation on a massively parallel computer to reduce computer-aided weapon design time by an order of magnitude.
  - (U) Initiate incorporation of unstructured grid methods into penetrator weapon design tools.
  - (U) Initiate development of next generation weapon design methods for hard target warheads incorporating heavy metals.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT NO. AND NAME 2502 Ordnance Technology	

- (U) $4,169 Develop and demonstrate advanced weapon airframe and carriage technology for advanced air-to-ground munitions and highly agile air-to-air missiles.
  - (U) Develop flight control software and simulations for a highly maneuverable air combat missile incorporating hybrid reaction jet/aerodynamic flight controls.
  - (U) Continue development of initial system integration/design of a rapid response weapon for effectively engaging time-critical targets.
  - (U) Complete fabrication of selected fin folding and deployment mechanisms for compressed carriage.
  - (U) Continue installation of high resolution solid state, digital shadowgraph system to allow for quick and less expensive data collection, processing, and analysis to reduce time to evaluate projectile configurations.
- (U) $7,011 Develop and demonstrate advanced warhead development technologies and advanced kill mechanisms for target defeat.
  - (U) Conduct large-scale testing of agent defeat payload for neutralizing weapons of mass destruction production and storage facilities.
  - (U) Conduct in-house experiments to support design of multimode warhead initiator system and supporting electronics.
- (U) $2,286 Develop and demonstrate instrumentation for weapon test and evaluation.
  - (U) Complete weapons effects holography program; transition technology to munition development facilities.
  - (U) Fabricate and test brassboard automated holographic data reduction system to provide improved warhead hydrocode test data.
  - (U) Integrate and laboratory test high-speed, high resolution electronic imager.
- (U) $21,712 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT NO. AND NAME 2502 Ordnance Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	12,699	21,431	20,627	Cont
(U) Current Budget Submit	12,790	20,632	21,712	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. FY 1996 horizontal increase due to incorporation of Project 06AL funding, movement of Weapon Airframe and Carriage Technology from Project 2567, and increased emphasis on numerous armament technology efforts. FY 1997 horizontal increase due to restructuring of the program for applied research of conventional weapons technology to meet warfighter needs.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0604314F, Advanced Medium Range Air-to-Air Missile
- (U) PE 0604602F, Armament Ordnance Development
- (U) PE 0604604F, Submunitions Development
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

PROJECT NO. AND NAME: 2543 Weapons Effectiveness Methodology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2543 Weapons Effectiveness Methodology	2,244	5,812	5,960	6,474	6,668	6,848	7,078	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project assesses the lethality and effectiveness of current and planned air-to-surface and air-to-air conventional weapons technology programs, and assesses the vulnerability of targets against which conventional weapons are designed. Project payoffs include more thoroughly tested weapon systems.

(U) FY 1995 ($ in Thousands):

- (U) $1,456 Extend effectiveness vulnerability assessment (EVA) code to increase prediction accuracy of deeply buried hardened target facilities.
  - (U) Conducted EVA code configuration management activities to ensure software changes are authorized, validated, documented, and distributed to user community.
  - (U) Analyzed rebar reinforced concrete penetration data base and updated existing penetration algorithm.
  - (U) Conducted embedded detonation experiments to quantify the effects of detonating munitions in burster slabs and thick walls.
  - (U) Implemented plans to enhance existing blast algorithms and quantify vulnerabilities of mission critical equipment to enable development of component fragility algorithms for predicting functional damage to targets.
- (U) $788 Develop and demonstrate analytical methods of predicting the coupling of destructive energy into the target.
  - (U) Modified existing source, transport, and diffusion codes to develop methodology for assessing weapon effectiveness against weapons of mass destruction storage, production, and logistic facilities.
  - (U) Planned development of systems level lethality/vulnerability assessment codes to predict the effectiveness of emerging munition technologies and inventory weapons against tunnels, buildings, and linear targets such as runways, bridges, railroads, etc.
  - (U) Developed predictive effectiveness algorithms for high velocity penetration and advanced munition case technologies.
- (U) $2,244 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT NO. AND NAME 2543 Weapons Effectiveness Methodology	

(U) FY 1996 ($ in Thousands):

- (U) $3,269 Extend modular effectiveness vulnerability assessment code (MEVA) to increase accuracy of weapon effectiveness predictions against fixed hardened targets.
  - (U) Conduct MEVA code configuration management activities to ensure software changes are authorized, validated, documented, and distributed to user community.
  - (U) Analyze embedded detonation data base and update existing blast damage algorithms for detonations in burster slabs and thick walls.
  - (U) Conduct component vulnerability experiments, develop first set of fragility algorithms for integration into MEVA code, and conduct code validation experiments.
  - (U) Integrate modified source, transport, and diffusion codes to build a systems-level network for assessing weapon effectiveness against weapons of mass destruction storage, production, and logistic facilities and to predict potential for collateral damage.
- (U) $1,709 Develop and demonstrate analytical methods of predicting weapon effectiveness and the coupling of destructive energy into the target.
  - (U) Integrate high velocity penetration and advanced munitions case technology algorithms into systems-level weapon assessment codes.
  - (U) Develop weapon assessment methodologies to significantly reduce requirements for expensive lethality/vulnerability data collection experiments.
- (U) $834 Develop and demonstrate advanced weapons simulation capability.
  - (U) Adapt and extend existing analytical tools to enable efficient, one-time development of complex munition simulations.
  - (U) Develop a modular munition simulation taxonomy for interconnecting munition subsystem models.
  - (U) Develop munition-specific models which allow component trades to be conducted for anti-jam Global Positioning System (GPS) technologies.
  - (U) Conduct technology trade studies for antimateriel submunitions.
- (U) $5,812 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT NO. AND NAME 2543 Weapons Effectiveness Methodology	

(U) FY 1997 ($ in Thousands):

- (U) $2,246 Extend modular effectiveness vulnerability assessment code (MEVA) to increase accuracy of weapon effectiveness predictions against fixed hardened targets.
  - (U) Continue MEVA code configuration management activities to ensure software changes are authorized, validated, documented, and distributed to user community.
  - (U) Continue component vulnerability experiments, develop first set of fragility algorithms for integration in MEVA code, and complete code validation experiments.
  - (U) Develop algorithms and new functional modules for integration into MEVA to accurately predict the effectiveness of advanced munitions technology concepts.
  - (U) Complete development/integration of systems level lethality/vulnerability assessment methodologies into MEVA for buried/hardened targets, above ground structures, tunnels, linear targets, and weapons of mass destruction.
- (U) $2,245 Develop and demonstrate analytical methods of predicting weapon effectiveness and the coupling of destructive energy into the target, and the means to translate that information into advanced analytical methods for predicting weapon effectiveness.
  - (U) Complete development of weapon assessment methodologies that significantly reduce requirements for expensive lethality/vulnerability data collection experiments.
  - (U) Conduct phenomenology and weapon effects experiments to provide data for code deficiencies with respect to advanced munition concepts.
  - (U) Conduct experiments and analyses to investigate phenomena such as synergistic effects from blast and fragments, simultaneous detonations, and penetration dynamics through rock, rubble, and geological material of various hardness.
- (U) $690 Develop and demonstrate advanced weapons analytical methodologies.
  - (U) Validate antimateriel submunition analyses versus actual warhead arena and flight test data.
  - (U) Enhance and develop codes for hard target penetration and weapons of mass destruction munition technologies.
  - (U) Develop joint compatible models to allow evaluation of synthetic aperture radar seeker technology and infrared seeker technology in support of munition tools to make evaluation of munition performance with new technology a much faster, cheaper and more effective process.
- (U) $779 Develop and demonstrate advanced munitions seeker analyses capability.
  - (U) Continue to validate 4-channel pixel-registered active/passive infrared/millimeter wave (IR/MMW) synthetic scene generation code against measured data.
  - (U) Complete development of 6-channel pixel-registered active/passive IR/MMW, visible, ultraviolet synthetic scene generation code.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT NO. AND NAME 2543 Weapons Effectiveness Methodology	

- (U) $5,960 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,311	6,038	6,385	Cont
(U) Current Budget Submit	2,244	5,812	5,960	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. FY 1996 horizontal increase due to incorporation of Project 06AL and program to reduce weapons testing costs by better analytical prediction methods.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0604602F, Armament Ordnance Development
- (U) PE 0604604F, Submunitions Development
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602602F Conventional Munitions

PROJECT NO. AND NAME: 2567 Aeromechanics Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2567 Aeromechanics Technology	3,366	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops technologies to improve the aerodynamic performance, survivability, and effectiveness of conventional air-to-surface weapons and air-to-air weapons. These technologies provide advanced midcourse guidance equipment for advanced guided munitions.

(U) FY 1995 ($ in Thousands):

- (U) 1,729 Develop and demonstrate advanced navigation/control technologies for weapon airframes.
  - (U) Completed testing anti-jam, low-cost, tactical Global Positioning System/inertial navigation brassboard using simulated satellite and jamming signals.
  - (U) Completed fabrication and testing of an interferometric fiber optic gyroscope to improve reliability and lower cost.
- (U) 1,318 Develop and demonstrate computational fluid dynamics store separation codes and aeroballistic analysis to enhance weapon design and reduce the cost/schedule of weapons testing/certification.
  - (U) Fabricated and installed an electronic shadowgraph camera system in the aeroballistic research facility.
- (U) $319 Develop and demonstrate advanced weapon airframe and carriage technology.
  - (U) Performed feasibility studies of affordable methods of external weapon carriage to preserve near "clean" aircraft performance.
- (U) $3,366 Total

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602602F Conventional Munitions
PROJECT NO. AND NAME 2567 Aeromechanics Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,549	0	0	Cont
(U) Current Budget Submit	3,366	0	0	Cont

(U) Change Summary Explanation:

Funding: Project 2567 mid-course guidance technology for advanced guided munitions for FY 1996 and out transferred to Project 2068; Project 2567 weapon airframe and carriage technology for FY 1996 an out transferred to Project 2502.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0604602F, Armament Ordnance Development
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	90,650	93,056	96,615	98,847	99,115	101,931	107,472	Continuing	Continuing
06RA C3 Laboratory Operations	39,155	0	0	0	0	0	0	Continuing	Continuing
2338 Reliability Sciences Technology	5,238	10,751	11,221	11,527	12,064	12,693	13,430	Continuing	Continuing
4506 Surveillance Technology	9,787	16,737	17,382	17,529	17,627	17,855	18,483	Continuing	Continuing
4519 Communications Technology	7,731	11,886	13,100	13,470	13,373	13,326	14,730	Continuing	Continuing
4594 Information Technology	8,077	12,281	14,278	15,134	15,063	15,210	15,634	Continuing	Continuing
4600 Electromagnetic Technology	11,501	24,661	23,263	23,702	23,657	24,787	26,739	Continuing	Continuing
5581 Command and Control (C2) Technology	9,161	16,740	17,371	17,485	17,331	18,060	18,456	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Applied Research program is the primary source of new concepts, feasibility demonstrations, and advanced technology for Air Force C3. Current developments include: increased operational availability of C3 systems through improving reliability, diagnostic capability, and electromagnetic environmental performance; improving effectiveness and survivability through secure communications; improving surveillance range and detection capabilities against low-observable threats and enemy electronic countermeasures; and improving the timeliness and quality of data acquisition for decision making. The program addresses six technology areas: reliability sciences; surveillance; communications; information; electromagnetic; and command and control. Starting in FY 1996, separate infrastructure projects have been eliminated. This technology directly supports the Joint Chiefs of Staff Future Joint Warfighting Capability: "To maintain near perfect real-time knowledge of the enemy and communicate that to all forces in near-real-time." The C3 Laboratory Operations Project that had previously provided infrastructure support has been eliminated. The associated funding was incorporated into the laboratories technical projects.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	91,563	98,477	95,578	Cont
(U) Appropriated Value	95,444	96,477		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-6,453	-1,956		
b. SBIR	-950	-1,094		
c. Omnibus/Other Above Threshold Reprogrammings	-1,011	-371		
d. Below Threshold Reprogrammings	+3,620			
(U) Current Budget Submit	90,650	93,056	96,615	Cont

(U) Change Summary Explanation:

Funding: Horizontal increases from FY 1995 to FY 1996 to FY 1997 are to address added emphasis on C3 technology user-identified deficiencies. Vertical increase in this Program Element since the previous President's Budget is due to added emphasis on C3 technology. Vertical decreases are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

2 - Applied Research | **0602702F Command,Control, and Communication (C3)**

PROJECT NO. AND NAME
06RA C3 Laboratory Operations

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
06RA C3 Laboratory Operations	39,155	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project provides for management, support, and operation of Rome Laboratory, Griffiss AFB, NY, and another directorate of Rome Laboratory at Hanscom AFB, MA. It provides: the pay and related cost of civilian scientists, engineers, and support personnel; transportation of equipment; rents; communications and utilities costs; reproduction services; and procurement of supplies, equipment, and contractor support services for these facilities. Funds support and complement other projects within the PE.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	41,225	0	0	Cont
(U) Current Budget Submit	39,155	0	0	Cont

(U) Change Summary Explanation:

Funding: Changes due to incorporation of personnel and laboratory support costs into the technical projects.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

PROJECT NO. AND NAME
2338 Reliability Sciences Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2338 Reliability Sciences Technology	5,238	10,751	11,221	11,527	12,064	12,693	13,430	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** The Air Force requires technology which increases reliability and diagnostic capability for electronic devices and systems while assessing electromagnetic environmental performance. Payoffs are increased system availability and lower life cycle costs. This effort focuses on technology to identify and eliminate design and fabrication characteristics that result in poor reliability. It develops equipment and system reliability and diagnostic techniques to be applied in development of military systems with improved operational readiness and supportability. Areas of emphasis include electronic technology reliability assessment, diagnostic development and integration, design for reliability, and system design and operational assurance.

(U) FY 1995 ($ in Thousands):

- (U) $1,398 Develop electronic reliability techniques to evaluate new devices in an operational environment and recommended corrective action.
  - (U) Improved reliability of high-power monolithic microwave integrated circuits by determining limiting factors which affect overall reliability.
  - (U) Developed measurement and modeling techniques to evaluate electromagnetic effects on electronic systems.
- (U) $1,760 Develop diagnostics technologies and integrated them into existing tools and techniques to address high-priority user requirements.
  - (U) Developed techniques for modeling analog and mixed mode circuits to predict manufacturing and operational fielding failures.
  - (U) Defined an operating environment and computational tools to provide the ability to model system faults and assess performance degradation; developed a design methodology which permits system-level fault injection and simulation.
- (U) $2,080 Develop reliability system design process enhancements to create tools, techniques, and guidelines to improve C3 devices.
  - (U) Developed techniques to monitor, in real-time, transient electromagnetic events occurring during mission operations; correlated these events with disruption and/or failure of system/subsystems to provide improved repair and maintenance.
  - (U) Developed techniques to assess and estimate the reliability/readiness of commercial equipment intended for use in military environments.
  - (U) Developed reliability assurance and control methods to improve product quality, process (design, manufacture, test, etc.) improvement, and control of combined hardware/software systems.
  - (U) Developed a computer-aided design technique for the prediction of multi-chip module integrated circuit device performance which decreased development costs for new designs.
- (U) $5,238 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 2338 Reliability Sciences Technology	

(U) FY 1996 ($ in Thousands):

- (U) $3,588 Develop electronic reliability techniques to evaluate new devices/systems in an operational environment and recommend corrective action.
  - (U) Develop prediction, modeling, analysis, and tracking techniques to assess the reliability of electronic devices and systems operating in severe electrical, thermal, and dynamic environments throughout all phases of the system life cycle.
  - (U) Assess the effects of metal oxide semiconductor degradation in deep sub-micron main operating system transistors to improve the reliability of ultra-large scale integrated circuits.
- (U) $3,558 Develop diagnostics technologies and integrate them into existing tools and techniques to address high-priority user requirements.
  - (U) Develop, evaluate, and demonstrate non-destructive injection and fault sampling techniques for digital systems.
  - (U) Develop test automation and internal diagnostic techniques for microcircuit devices that are tested algorithmically.
  - (U) Develop electromagnetic simulation, analysis, and measurement tools to predict susceptibility thresholds and radio frequency performance in operational environments.
- (U) $3,605 Develop reliability system design process enhancements to create tools, techniques, and guidelines to improve C3 devices.
  - (U) Improve design techniques for solid state monolithic microwave integrated circuit high-power amplifiers to meet high-power, low-cost, reliable, and energy efficient system requirements.
  - (U) Develop techniques for building reliability into the design of ultra-high density memory devices by evaluating the effects of decisions made early in the design process on reliability.
- (U) $10,751 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 2338 Reliability Sciences Technology	

(U) FY 1997 ($ in Thousands):

- (U) $3,827 Develop electronic reliability techniques to evaluate new devices in an operational environment and recommend corrective action.
  - (U) Assess the quality, reliability, and electromagnetic effects performance of advanced electronic packaging concepts.
  - (U) Define performance of advanced microelectronics devices and measure their potential for system applications.
  - (U) Assess electromagnetic performance and reliability of microwave/millimeter-wave and optoelectronic devices for future systems.
- (U) $3,536 Develop diagnostics technologies and integrate them into existing tools and techniques to address high-priority user requirements.
  - (U) Develop design techniques that integrate computer-aided design with insertion of established built-in test modules.
  - (U) Develop electromagnetic analysis and measurement tools to predict susceptibility thresholds and radio frequency performance in operational environments.
- (U) $3,858 Develop reliability system design process enhancements to create tools, techniques, and guidelines to improve C3 devices.
  - (U) Improve systems reliability by characterizing the electrical, electromagnetic, and mechanical stress-inducing parameters of the aerospace operational environment.
  - (U) Develop computer-based reliability and maintainability tools and techniques for design of electronic circuits, devices, and systems.
- (U) $11,221 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

PROJECT NO. AND NAME
2338 Reliability Sciences Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,120	11,370	11,186	Cont
(U) Current Budget Submit	5,238	10,751	11,221	Cont

(U) Change Summary Explanation:

Funding: Horizontal increase from FY 1995 to FY 1996 reflects the incorporation of infrastructure costs within the project and are to address added emphasis on C3 technology user-identified deficiencies. Horizontal increase from FY 1996 to FY 1997 is to provide additional support costs which will be incurred as the laboratory assumes its stand-alone posture as directed by the 1993 Base Closure and Realignment Commission. Vertical increases in this project since the previous President's Budget are due to increased emphasis on meeting systems reliability user-needs. Vertical decrease is due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603617F, C3 Applications.
- (U) PE 0603726F, C3 Subsystems Integration.
- (U) PE 0603728F, Advanced Computer Technology.
- (U) PE 0603789F, C3 Advanced Development.
- (U) PE 0604609F, Reliability and Maintainability Technology Insertion Program.
- (U) PE 0708026F, Producibility, Reliability, Availability, and Maintainability.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

PROJECT NO. AND NAME
4506 Surveillance Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4506 Surveillance Technology	9,787	16,737	17,382	17,529	17,627	17,855	18,483	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** The Air Force requires advanced surveillance technologies to improve the performance and reduce the cost of Air Force surveillance systems. Major Applied Research programs include: low-observable surveillance; passive surveillance; and advanced processing technologies. Technologies being developed include: advanced passive bistatic radar; spatial coordinate and time processing techniques; sensor and data fusion; signal generation; and advanced array antennas.

(U) FY 1995 ($ in Thousands):

- (U) $4,867 Develop, test, and demonstrate processing technologies and algorithms to enhance small target detection in a complex electromagnetic background.
  - (U) Completed measurement and analysis of monostatic data from the airborne data collection experiment including performance evaluation of spatial coordinate and time adaptive processing techniques.
  - (U) Completed bistatic multichannel airborne radar measurements data collection experiment and analysis.
  - (U) Fabricated a breadboard wafer scale signal processor multichip module delivering five billion floating point operations per second.
- (U) $2,534 Develop enabling technologies and concepts for passive surveillance with emphasis on electronic support measures and bistatics for enhanced detection, track, and classification in severe clutter and jamming environments.
  - (U) Conducted design assessment of combining non-cooperative bistatic synthetic aperture radar techniques with electronic support measures and advanced parallel processing computer technology for high confidence target identification.
  - (U) Successfully suppressed background clutter to improve bistatic target detection and tracking of low-cross section targets.
- (U) $1,191 Develop, test, and demonstrate advanced multispectral/multisensor fusion techniques for enhanced target detection and tracking.
  - (U) Demonstrated adaptive threshold control for enhanced detection and tracking of low-cross section targets.
  - (U) Implemented measures of performance and conducted preliminary evaluation of diverse multisensor tracking algorithms.
- (U) $1,195 Design, develop, and test ultra-high fidelity microwave electronics for radar applications.
  - (U) Completed development of wideband receiver modules for employment in bistatic radar system testbed.
- (U) $9,787 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4506 Surveillance Technology	

(U) FY 1996 ($ in Thousands):

- (U) $8,086 Develop, test, and demonstrate processing technologies and algorithms to enhance small target detection in a complex electromagnetic background.
  - (U) Complete Phase 1 fabrication of multi-chip module wafer scale signal processor with a capability to perform five billion operations per second.
  - (U) Complete real-time, airborne spatial coordinate and time processing experiments using an embedded parallel processing computer.
  - (U) Demonstrate applicability of expert system constant false alarm rate technology in an operational airborne radar system.
  - (U) Analyze and evaluate space-time processing algorithms using the multichannel airborne radar measurements test bed.
- (U) $4,273 Develop technologies and concepts for passive surveillance with emphasis on electronic support measures and bistatics for enhanced detection, track, and classification in severe clutter and jamming environments.
  - (U) Perform studies in support of the advanced airborne radar and bistatic fusion processing technology demonstrations. This will lead to the preliminary system design for the real-time, airborne, bistatic capability demonstration.
  - (U) Develop advanced airborne bistatic radar software; complete integration of 64 channel antenna/receiver into static wing testbed; provide baseline test data for transition to the bistatic test integration experiment and the advanced airborne radar technology demonstration.
  - (U) Complete assessment of combining non-cooperative bistatic synthetic aperture radar techniques with electronic support measures and advanced parallel processing computer technology for high confident target identification. Integrate fusion algorithms into airborne sensor processor to provide enhanced detection capability.
- (U) $2,203 Develop, test, and demonstrate advanced multispectral/multisensor fusion techniques for enhanced target detection and tracking.
  - (U) Exploit fusion and artificial intelligence (AI) technologies to develop an "AI fusion black box" for enhanced target detection and tracking.
  - (U) Develop algorithms for a sensor level AI approach to multispectral, multisensor fusion.
- (U) $2,175 Design, develop, and test ultrahigh fidelity microwave electronics for radar applications.
  - (U) Develop wideband pre-selector technology for bistatic radar systems.
  - (U) Develop optically-based increased dynamic range radar array emulation hardware for test and evaluation of microwave components.
- (U) $16,737 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4506 Surveillance Technology	

(U) FY 1997 ($ in Thousands):

- (U) $8,541 Develop, test, and demonstrate processing technologies and algorithms to enhance small target detection in a complex electromagnetic background.
  - (U) Develop knowledge-based adaptive processing for bistatic ground-to-air radar applications.
  - (U) Complete Phase 2 of the multi-chip module wafer scale signal processor with a capability to perform twenty billion operations per second.
  - (U) Evaluate embedded parallel processing architecture for integrating wafer scale signal processor chips for a real-time signal processor enhancement demonstration.
- (U) $4,654 Develop technologies and concepts for passive surveillance with emphasis on electronic support measures and bistatics for enhanced detection, track, and classification in severe clutter and jamming environments.
  - (U) Conduct a design evaluation of the advanced airborne radar technology demonstration.
  - (U) Complete data collection, hardware integration, and software development for the static wing testbed; conduct ground-based field test.
  - (U) Conduct extensive field tests and demonstrations using integrated electronic support measures and bistatic passive surveillance and imaging technology on board a small aircraft; enhance integrated passive surveillance and imaging technology capabilities through an airborne demonstration with a very broad frequency bandwidth controlled phase array.
- (U) $2,162 Develop, test, and demonstrate advanced multispectral/multisensor fusion techniques for enhanced target detection and tracking.
  - (U) Develop Phase 1 special purpose artificial intelligence machines for both "expert" and 'blackboard" systems.
  - (U) Develop and demonstrate graphical user interface software and platform-based displays; analyze, test, and demonstrate integrated knowledge-based fusion concepts.
- (U) $2,025 Design, develop, and test ultrahigh fidelity microwave electronics for radar applications.
  - (U) Demonstrate optically-based increased dynamic range radar array emulation hardware for test and evaluation of microwave components.
  - (U) Develop high fidelity power conditioning system for active radar apertures.
  - (U) Incorporate digital preprocessing in the development of transmit and receive module technology for ground-to-air radar.
- (U) $17,382 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

PROJECT NO. AND NAME
4506 Surveillance Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	9,568	17,704	17,261	Cont
(U) Current Budget Submit	9,787	16,737	17,382	Cont

(U) Change Summary Explanation:

Funding: Horizontal increase from FY 1995 to FY 1996 reflects the incorporation of infrastructure costs within the project and are to address added emphasis on C3 technology user-identified deficiencies. Horizontal increase from FY 1996 to FY 1997 is to provide additional support costs which will be incurred as the laboratory assumes its stand-alone posture as directed by the 1993 Base Closure and Realignment Commission. Vertical increases in this project since the previous President's Budget are due to increased emphasis on surveillance technology user-needs. Vertical decrease is due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0603726F, C3 Subsystems Integration.
- (U) PE 0603789F, C3 Advanced Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

PROJECT NO. AND NAME
4519 Communications Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4519 Communications Technology	7,731	11,886	13,100	13,470	13,373	13,326	14,730	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** The Air Force requires technologies which will provide worldwide communications. The rapid application of air power via assured connectivity for timely, reliable, responsive, affordable transfer of information using all available communications media is essential to support rapid build-up of U.S. presence abroad. This program provides the technologies for: multi-level, secure, seamless networks; advanced communications processors; anti-jam and low probability of intercept techniques, such as spread spectrum and adaptive null steering; lightweight antennas and phased array antennas; and modular, programmable, low-cost radios and C3 across the electromagnetic and optical spectrums. It includes technologies for advanced processors and devices, advanced network protocols, artificial intelligent communications management and control, advanced algorithms, and enabling processing techniques.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4519 Communications Technology	

(U) FY 1995 ($ in Thousands):

- (U) $2,809 Develop critical communications technologies employing programmable devices, enabling processing technologies, and monolithic microwave integrated circuits to provide survivable radios and transceivers.
  - (U) Defined commercially compatible switching concepts for worldwide military communications, focusing on the interface of existing low data rate communications equipment to asynchronous switches.
  - (U) Analyzed the relationship between radio multiple access data links technology and secure, survivable communications networking.
  - (U) Analyzed state-of-the-art data compression techniques for their utility in an ultra high frequency (UHF) communications environment.
  - (U) Designed, built, and demonstrated an initial wideband wireless communication extension and remoting capability using commercial off-the-shelf equipment.
- (U) $2,679 Develop technologies for improved security, survivability, timeliness, and reconstruction of communications networks.
  - (U) Defined smart networking strategies for emerging military tactical multiband multifunction radios and commercial communications equipment.
  - (U) Determined required capacity in a multiband, multifunction radio suitable for providing commercially compatible radio links to support a distributed computing environment in the battlefield.
  - (U) Designed an information system that effectively utilizes the underlying commercially available asynchronous communications infrastructure.
  - (U) Developed intelligent, survivable network management concepts which leverage current work in management of distributed command and control applications to provide system-wide optimization of resource usage, down to the user service level.
- (U) $2,243 Develop advanced electronic and photonic processors, advanced network protocols, advanced algorithms, and enabling processing technologies essential for survivable communications.
  - (U) Developed smart and adaptive communications signal processing concepts and techniques applicable to enhancing the capability of multiband multifunction radios to sense and adapt to their link environment and demands for service; investigated the applicability of time-frequency analysis and adaptive filtering techniques to diagnose and mitigate various types of interference.
  - (U) Applied enhanced computer-aided design, modeling, and analysis tool-sets to support the development of smart radio technology.
  - (U) Developed new high bandwidth, efficient, anti-jam/low probability of intercept waveforms; investigated new signal modulation and transformation.
- (U) $7,731 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

PROJECT NO. AND NAME
4519 Communications Technology

(U) FY 1996 ($ in Thousands):

- (U) $3,518 Develop critical communications technologies employing programmable devices, processing technologies, and monolithic microwave integrated circuits to provide survivable radios and transceivers.
  - (U) Demonstrate commercially compatible switching concepts for ultra high frequency (UHF) communications to aircraft and other systems.
  - (U) Develop modifications of state-of-the-art data compression techniques to emphasis their utility in a UHF communications environment.
  - Upgrade the wideband communications extension and remoting capability for multimedia integrated services demonstration.
  - (U) Assess supporting operations involving remote local area networks, voice, and slow scan/compressed video within the wide band communications for distributed computing environments.
- (U) $6,031 Develop technologies for improved security, survivability, timeliness, and reconstruction of communications networks.
  - (U) Assess secure, survivable communications networking, multiple accessing, and radio networking to enhance implementation planning.
  - (U) Analyze evolving components within the asynchronous switching infrastructure to support a distributed information system.
  - (U) Design and implement a peer-to-peer management interface for intelligent, survivable network management.
- (U) $2,337 Develop advanced electronic and photonic processors, advanced network protocols, advanced algorithms, and processing technologies essential for survivable communications.
  - (U) Demonstrate new "smart" adaptive communications signal processing techniques and wave forms.
  - (U) Develop communications and control technologies applicable to of smart radios, including the use of spatial processing and adaptive antenna, parallel processors, field programmable gate arrays, and other high performance digital signal processors and devices.
- (U) $11,886 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4519 Communications Technology	

(U) FY 1997 ($ in Thousands):

- (U) $4,000 Develop critical communications technologies employing programmable devices, processing technologies, and monolithic microwave integrated circuits to provide survivable radios and transceivers.
  - (U) Complete ultra high frequency (UHF) communications demonstration and extend the commercially compatible switching concepts techniques to super high frequency (SHF) environment for communications to aircraft and other systems.
  - (U) Develop and demonstrate data compression techniques for use in a UHF and SHF communications environment.
  - (U) Investigate supporting a distributed air operations center, lower echelon theater air control system, and theater missile defense operations centers with wideband access to a distributed command and control network.
- (U) $6,464 Develop technologies for improved security, survivability, timeliness, and reconstruction of communications networks.
  - (U) Demonstrate selected multiple access and asynchronous switching protocols for theater applications.
  - (U) Complete demonstration of standards-based, interactive, secure user services which optimally employ the underlying commercially compatible communications network.
  - (U) Demonstrate intelligent, survivable network management that provides secure, system-wide optimization of resource usage.
- (U) $2,636 Develop advanced electronic and photonic processors, advanced network protocol, advanced algorithms, and enabling processing technologies essential for survivable communications.
  - (U) Develop specifications for the next generation smart radio, incorporating proven smart adaptive signal processing technologies.
  - (U) Develop and demonstrate potentially high payoff communications signal processing technologies applicable to future smart radio systems.
- (U) $13,100 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4519 Communications Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	7,557	12,570	12,352	Cont
(U) Current Budget Submit	7,731	11,866	13,100	Cont

(U) Change Summary Explanation:

Funding: Horizontal increase from FY 1995 to FY 1996 reflects the incorporation of infrastructure costs within the project and are to address added emphasis on C3 technology user-identified deficiencies. Horizontal increase from FY 1996 to FY 1997 is to provide additional support costs which will be incurred as the laboratory assumes its stand-alone posture as directed by the 1993 Base Closure and Realignment Commission. Vertical increases in this project since the previous President's Budget are due to increased emphasis on meeting communications technology user-needs. Vertical decrease is due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603726F, C3 Subsystems Integration.
- (U) PE 0603728F, Advanced Computer Technology.
- (U) PE 0603789F, C3 Advanced Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

PROJECT NO. AND NAME
4594 Information Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4594 Information Technology	8,077	12,281	14,278	15,134	15,063	15,210	15,634	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** The Air Force requires technologies which improve and automate capabilities to process, manage, generate, fuse, exploit, interpret, and disseminate information in a timely manner. This project: improves recording, storage, and retrieval of high data-rate, large volume data; pursues speech processing technologies for signal exploitation, information deception, and exploiting unintentional emissions; develops technology for correlation and fusion of multisource data; develops natural language capabilities that can read text and extract data of interest; develops tools and techniques to build and manage a scaleable client server environment; provides advanced processing techniques for receipt, correlation analysis, and display of target reports from advanced sensor systems; supports advanced weapon systems through the exploration of multispectral, multisource imagery; and provides advanced techniques for mapping, charting, and geodesy data processing.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4594 Information Technology	

(U) FY 1995 ($ in Thousands):

- (U) $3,319 Develop processing technologies responsive to operational deficiencies by improving information timeliness, reliability, and accessibility.
  - (U) Completed design/fabrication of compact, breadboard, three-dimensional, read-only-memory system using a two photon absorption concept.
  - (U) Successfully field tested platform identification technology which differentiates military helicopters based on audio acoustics.
  - (U) Developed channel normalization technology which significantly improves the automatic sorting and routing of communications.
  - (U) Developed modeling and integration technology for application to theater-level models.
- (U) $2,362 Develop information data handling techniques to automatically extract event data and update databases for prediction purposes.
  - (U) Transitioned the exercise timeline analysis system at user sites to provide the tools to graphically build exercises on timelines and maps.
  - (U) Integrated and tested the transition of 28 information and surveillance migration systems to the client server environment.
  - (U) Developed and installed data handling system software at operational sites, providing enhanced message handling, situational assessment, database, client server, and imagery management technologies.
  - (U) Developed, tested, and installed the client server environment system to provide common computing, uniform system administration tools, and common support applications.
- (U) $2,396 Develop sensor exploitation techniques for faster and more efficient imaging to support targeting, planning, and mission execution.
  - (U) Developed an imagery/information server, image exploitation tool kit, and continued migration towards and object-oriented environment for the imagery testbed facility.
  - (U) Demonstrated the rapid application of air power tool utility to the warfighter at several national and international exercises.
  - (U) Integrated the mapping application-client/server software as a mapping server for theater battle management.
- (U) $8,077 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4594 Information Technology	

(U) FY 1996 ($ in Thousands):

- (U) $5,155 Develop processing technologies responsive to operational deficiencies by improving information timeliness, reliability, and accessibility.
  - (U) Develop three-dimensional holographic read-only-memory optical disk to provide higher capacity, faster throughput, and decreased access time in storage devices.
  - (U) Develop processing techniques to analyze background sound to determine aircraft status and configuration.
  - (U) Develop techniques to support the release of beyond-visual-range weapons against high confidence air targets.
  - (U) Develop techniques for electronic imagery fusion and analysis.
- (U) $3,434 Develop information data handling techniques to automatically extract event data and update databases for prediction purposes.
  - (U) Develop techniques to rapidly assess situations and warn decision makers and warfighters.
  - (U) Develop message processing techniques which extract only pertinent information from free text and multimedia sources so decision makers and war planners have the most recent information available and on-line.
  - (U) Develop Phase 1 techniques to configure and manage a scaleable distributed information computing environment.
- (U)$3,692 Develop sensor exploitation techniques for faster and more efficient imaging to support targeting, planning, and mission execution.
  - (U) Develop Phase 1 techniques to manage, query, and exploit digital imagery databases.
  - (U) Develop techniques to apply artificial neural networks to problems associated with finding objects in aerial imagery.
  - (U) Investigate applications of modeling technology to provide battle damage assessment.
- (U) $12,281 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4594 Information Technology	

(U) FY 1997 ($ in Thousands):

- (U) $5,904 Develop processing technologies responsive to operational deficiencies by improving information timeliness, reliability, and accessibility.
  - (U) Integrate three-dimensional holographic read-only-memory optical disk technology into enhanced storage and retrieval devices with reduced size, weight, power requirements, and lower cost.
  - (U) Develop processing algorithms to automatically sort and route large volumes of communication signals to assist information analysts.
  - (U) Incorporate techniques that correlate active radar signals with processing of non-cooperative signal emanations to support the release of beyond-visual-range weapons against high confidence air targets.
  - (U) Integrate detection and analysis techniques with the electronic imagery fusion to provide enhanced electronic imagery.
- (U) $4,062 Develop information data handling techniques to automatically extract event data and update databases for prediction purposes.
  - (U) Develop techniques to build intelligent, single point, multimedia databases to provide the warfighter global awareness.
  - (U) Develop analytical tools which exploit message processing techniques to extract multimedia information for concise, efficient display to the warfighter.
  - (U) Develop Phase 2 techniques to configure and manage a scaleable distributed information computing environment.
- (U) $4,312 Develop sensor exploitation techniques for faster and more efficient imaging to support targeting, planning, and mission execution.
  - (U) Develop Phase 2 techniques to improve the methodology required to manage and query imagery databases.
  - (U) Develop information currency techniques and data consistency techniques to support combat imagery/information systems.
  - (U) Apply modeling techniques which exploit aircraft mission video data to satisfy battle damage assessment requirements.
- (U) $14,278 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4594 Information Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	7,896	13,042	12,722	Cont
(U) Current Budget Submit	8,077	12,281	14,278	Cont

(U) Change Summary Explanation:

Funding: Horizontal increase from FY 1995 to FY 1996 reflects the incorporation of infrastructure costs within the project and are to address added emphasis on C3 technology user-identified deficiencies. Horizontal increase from FY 1996 to FY 1997 is to provide additional support costs which will be incurred as the laboratory assumes its stand-alone posture as directed by the 1993 Base Closure and Realignment Commission. Vertical increases in this project since the previous President's Budget are due to increased emphasis on meeting information technology user-needs. Vertical decrease is due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603726F, C3 Subsystems Integration.
- (U) PE 0603789F, C3 Advanced Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

PROJECT NO. AND NAME
4600 Electromagnetic Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4600 Electromagnetic Technology	11,501	24,661	23,263	23,702	23,657	24,787	26,739	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project consists of three subset technologies: electromagnetics; solid state sciences; and photonics. Future surveillance, communications, and imagery/information processing systems will require improved technology for the generation, control, processing, and radiation of electromagnetic and optical energy to reduce system cost, improve system sensitivity, and increase processing rates. Promising technologies for improving C3 systems are electromagnetic propagation and scattering (from targets and clutter), and monolithic microwave and millimeter wave integrated components and antennas. This project develops: a technology base for electronic and photonic devices and device materials for C3 systems; optical technology for electronic data processing and storage; real-time target recognition and high-speed fiber optic interconnects; control techniques for large phased array antennas; and characterizes phenomena for low-observable surveillance.

(U) FY 1995 ($ in Thousands):

- (U) $3,730 Develop electromagnetic technologies for advanced surveillance and communications systems applications.
  - (U) Developed clutter and target radar cross section models for adaptive surveillance simulations; optimized high temperature superconductor phased array feeds; improved array packaging with innovative, multi-layer radio frequency connections.
  - (U) Finalized algorithms and developed hardware for small target motion discrimination.
- (U) $2,840 Develop advanced materials and components capable of higher processing speeds at reduced power levels for telecommunications and survivable server applications.
  - (U) Determined how hydrogen impurities affect the concentration of electrons in semiconducting indium phosphide for millimeter wave and photonic component hardware development for infrared spectral imagery.
  - (U) Produced advanced high temperature superconductive films suitable for phased array high frequency antennas.
  - (U) Developed advanced processing techniques for the deposition of high temperature superconductive films on substrates.
- (U) $4,931 Defined concept design approaches exploiting photonic components and related materials for insertion into core C3 programs.
- (U) $11,501 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4600 Electromagnetic Technology	

(U) FY 1996 ($ in Thousands):

- (U) $7,498 Develop electromagnetic technologies for advanced surveillance and communications systems applications.
  - (U) Develop parallel processing algorithms for digital beamforming for antenna testbed; formulate new models of complex scattering mechanisms to improve radar cross-section codes.
  - (U) Develop "ducted" mode high frequency communications for super-long distance, covert links.
  - (U) Evaluate and refine hardware for infrared small target motion discriminator, and initiate hardware development for infrared spectral imager.
  - (U) Demonstrate concept of a semiconductor wideband short-pulsed source element array (spectrum shaping) for target tracking and recognition.
- (U) $6,156 Develop advanced materials and components capable of higher processing speeds at reduced power levels for telecommunications and survivable server applications.
  - (U) Design, build, and test monolithic transmit chip with integrated amplifier and phase shifter; integrate phase shifter and antenna feed network.
  - (U) Fabricate brassboard high temperature superconductor films suitable for antenna components; develop new crystal growth methods.
- (U) $11,007 Develop photonic components and related materials for insertion into core C3 programs.
  - (U) Demonstrate feasibility of spectrum shaping technology for target tracking; analyze optoelectronic integration on indium phosphide.
  - (U) Fabricate and test multi-chip module interconnect technology in cooperation with commercial vendor.
  - (U) Develop design concepts for an ultra-high-speed multiple access testbed with specialized components for unique switching architecture, radar processors, and communications protocols.
  - (U) Develop design concepts for unique photonic signal processor brassboards to demonstrate optical logic and optical neural networks.
- (U) $24,661 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4600 Electromagnetic Technology	

(U) FY 1997 ($ in Thousands):

- (U) $6,874 Develop electromagnetic technologies for advanced surveillance and communications systems applications.
  - (U) Conduct experimental assessment of techniques to improve bistatic signal-to-clutter ratios for low radar cross section target detection.
  - (U) Finalize algorithm and initiate hardware development for infrared small target spectral discriminator.
- (U) $5,812 Develop advanced materials and components capable of higher processing speeds at reduced power levels for telecommunications and survivable server applications.
  - (U) Design and fabricate brassboard, high-temperature transmit array; design, fabricate, and test monolithic low noise amplifier.
  - (U) Fabricate brassboard aluminum/gallium nitride substrates using new crystal growth methods.
- (U) $10,577 Develop photonic components and related materials for insertion into core C3 programs.
  - (U) Demonstrate next level spectrum shaping for high range resolution target recognition based on optoelectric integration.
  - (U) Conduct Phase 1 development of the ultra-high-speed multiple access testbed and associated components for unique switching architecture, radar processors and communications protocols.
  - (U) Conduct Phase 1 development of unique photonic signal processor brassboards to demonstrate optical logic and optical neural networks.
  - (U) Demonstrate radio frequency optical beamforming and anti-jamming processors for radar and communication systems.
- (U) $23,263 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 4600 Electromagnetic Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	11,243	26,085	25,155	Cont
(U) Current Budget Submit	11,501	24,661	23,263	Cont

(U) Change Summary Explanation:

Funding: Horizontal increase from FY 1995 to FY 1996 reflects the incorporation of infrastructure costs within the project and are to address added emphasis on C3 technology user-identified deficiencies. Horizontal decrease from FY 1996 to FY 1997 is due to budget constraints. Vertical changes in this project since the previous President's Budget are due to balancing budget constraints against priorities within the Sciences and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603617F, C3 Applications.
- (U) PE 0603726F, C3 Subsystems Integration.
- (U) PE 0603789F, C3 Advanced Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

PROJECT NO. AND NAME
5581 Command and Control (C2) Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
5581 Command and Control (C2) Technology	9,161	16,740	17,371	17,485	17,331	18,060	18,456	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: Air Force C2 requires technologies which provide next generation battlefield commanders with improved processing and presentation of information for real-time battle management. Technologies being developed in this project will increase capability, quality, and reliability while reducing the cost of computer resources in C2 systems. Work in this project is focused on developing advanced C 2 computer software systems capable of providing vast improvements in military decision making. It also develops software engineering analysis tools, software development methodologies, and software quality specification and assessment techniques. It develops: technology for distributed systems, data bases, and fault tolerance mechanisms; and knowledge-based technologies, systems, and data bases.

(U) FY 1995 ($ in Thousands):

- (U) $4,115 Develop information technologies for real-time battle management and command and control for time-critical air operations.
  - (U) Completed demonstrations of rational capture, multi-agent distributed planning, plan characterization, and planning framework.
  - (U) Developed a multi-initiative scheduling tool using autonomous software agents.
  - (U) Completed techniques for fault tolerance and software visualization for an enhanced knowledge-based-software-assistant capability.
- (U) $2,968 Develop software technologies to provide increased capability, quality, and reliability while reducing support cost.
  - (U) Developed certification methods for reusable software components; defined process controls and security for system engineering environments.
  - (U) Defined system specifications needed to expand the requirements engineering language technology to deal with system level functions of hardware and software, including a capability for parallel systems.
  - (U) Developed software for heterogeneous parallel computers including benchmarks for parallel software, a concept of operations for a virtual machine, and optimization of computing versus communication in a parallel architecture.
  - (U) Completed techniques for fault tolerance and software visualization for an enhanced knowledge-based-software-assistant capability.
- (U) $2,078 Develop enabling technology for distributed computing and database technology using cluster technique to allow secure processing and management of multimedia information by commanders at all echelons.
  - (U) Demonstrated feasibility of distributed shared memory within a distributed computing environment.
  - (U) Completed preliminary design for a high resolution interactive "datawall" to display digital and video data to the warfighter.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 5581 Command and Control (C2) Technology	

- (U) Extended object-oriented database model to accommodate time dependent multimedia data objects.

- (U) $9,161 Total

(U) FY 1996 ($ in Thousands):

- (U) $6,213 Develop intelligent information technologies for real-time battle management and command and control for time-critical air operations.
  - (U) Develop concept design approaches for initiative planning and approximate planning.
  - (U) Complete demonstration of dynamic backscattering search for generative planning.
- (U) $5,326 Develop software technologies to provide increased capability, quality, and reliability while reducing support cost.
  - (U) Complete enhancement of process controls and security for computer environments and the certification of reusable software components.
  - (U) Provide automated scenario generation for requirements engineering analysis environments.
  - (U) Develop benchmarks and specifications for parallel processing software usage on high speed computers.
  - (U) Complete technology efforts to support learning and define architectural improvements for the knowledge-based-software-assistant.
- (U) $5,201 Develop enabling technology for distributed computing and database technology using cluster techniques to allow secure processing and management of multimedia information by commanders at all echelons.
  - (U) Demonstrate feasibility of shared collaborative context workspace across a distributed computing environment.
  - (U) Complete feasibility demonstration of interactive datawall with non-tethered, interactive input devices.
  - (U) Complete feasibility demonstration of synthetic visualization environment to command center applications.
- (U) $16,740 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)

PROJECT NO. AND NAME
5581 Command and Control (C2) Technology

(U) FY 1997 ($ in Thousands):

- (U) $6,410 Develop intelligent information technologies for real-time battle management and command and control for time-critical air operations.
  - (U) Demonstrate integration of planning technology using autonomous software agents and mixed initiative scheduling toolbox.
  - (U) Develop and demonstrate dialog-based, man-machine integration planning task.
  - (U) Develop and demonstrate evaluation criteria for intelligent information systems.
- (U) $5,324 Develop software technologies to provide increased capability, quality, and reliability while reducing support cost.
  - (U) Develop Phase 1 of the high level requirements engineering language with scenario generation for the requirements engineering environment.
  - (U) Evaluate concept design approaches and visualization techniques for parallel processing systems, parallel object-oriented programming methods, and advanced techniques for real-time parallel processing analyses.
  - (U) Complete development of benchmarks for parallel processing software.
- (U) $5,637 Develop enabling technology for distributed computing and database technology using cluster techniques to allow secure processing and management of multimedia information by commanders at all echelons.
  - (U) Demonstrate asynchronous switching technology as a local interconnect mechanism for shared collaborative context workspace across a distributed computing environment.
  - (U) Demonstrate feasibility of an optical storage and retrieval mechanism for multimedia database management brassboard.
  - (U) Demonstrate feasibility application-based reconfiguration of multiple distributed computing clusters.
- (U) $17,371 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
2 - Applied Research	0602702F Command,Control, and Communication (C3)
PROJECT NO. AND NAME 5581 Command and Control (C2) Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	8,954	17,706	16,902	
(U) Current Budget Submit	9,161	16,740	17,371	

(U) Change Summary Explanation:

Funding: Horizontal increase from FY 1995 to FY 1996 reflects the incorporation of infrastructure costs within the project and is to address added emphasis on C3 technology user-identified deficiencies. Horizontal increase from FY 1996 to FY 1997 is to provide additional support costs which will be incurred as the laboratory assumes it stand-alone posture as directed by the 1993 Base Closure and Realignment Commission. Vertical increases in this project since the previous President's Budget are due to increased emphasis on meeting command and control technology user-needs. Vertical decrease is due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603617F, C3 Applications.
- (U) PE 0603728F, Advanced Computer Technology.
- (U) PE 0603789F, C3 Advanced Development.
- (U) PE 0303401F, Communications-Computer Systems (C-CS) Security RDT&E.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Development

PE NUMBER AND TITLE: 0305176F Combat Survivor/Evader Locator (CSEL)

PROJECT NO. AND NAME: 4522 Combat Survivor/Evader Locator (CSEL)

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4522 Combat Survivor/Evader Locator (CSEL)	0	0	9,596	4,865	0	0	0	0	14,461

Note: Congressionally approved reprogramming of $13.5M in FY95 funds used in FY96 RDT&E efforts for new start.

(U) A. Mission Description and Budget Item Justification

(U) The Combat Survivor/Evader Locator is a new start joint program, with the Air Force as lead Service, which will provide enhanced Combat Search and Rescue (CSAR) capability by replacing antiquated survivor radios (PRC-90/112) with current and emerging technologies in a new hand-held radio. This radio will be used by all the Services and DoD, and potentially non-DoD government agencies. CSEL features will include two-way, secure, over-the-horizon (OTH) messaging and line-of-sight (LOS) voice, near real-time geopositioning, verification of evader identity and condition, low probability of intercept/detection (LPI/LPD), anti-jam, and the integration of commercial satellite systems capabilities. This program is in Budget Activity (BA) 3 because it is advanced development of communication and navigation technologies. The Air Force intends to transition the program to BA 5, Engineering and Manufacturing Development (EMD), in future submissions since a new start for EMD has been approved..

(U) FY 1995

- (U) $0 Not Applicable

(U) FY 1996 **(Congressionally approved reprogramming of $13.5M in FY95 funds used in FY96 RDT&E efforts as a new start for CSEL.)**

- (U) CSEL Engineering and Manufacturing Development ($9,320)
- (U) COBRA Base Station Development ($2,000)
- (U) Other Government Support ($2,180)
- (U) $0 Total ($13,500)

(U) FY 1997

- (U) $5,410 CSEL Engineering and Manufacturing Development
- (U) $2,000 COBRA Base Station Development
- (U) $2,186 Other Government Support
- (U) $9,596 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Development	PE NUMBER AND TITLE 0305176F Combat Survivor/Evader Locator (CSEL)
PROJECT NO. AND NAME 4522 Combat Survivor/Evader Locator (CSEL)	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget		0	0	Continuing
(U) Appropriated Value				
(U) Adjustments to Appropriated Value				
a. Cong Gen Reductions				
b. SBIR				
c. Omnibus and Other Above Threshold Reprogram		*0		
d. Below Threshold Reprogramming				
(U) Adjustments to Budget Years since FY 96 PB			**9,596	
(U) Current Budget Submit/President's Budget		0	9,596	Continuing

(U) Change Summary Explanation:

Funding: * Congressionally approved reprogramming actions for FY96 not yet reflected in the database. ($13,500)

** Not requested in FY96 President's Budget. $10,000 in RDT&E added by OSD for program new start in FY96 approved by Congress. $404 reduction due to inflation rate adjustment.

Schedule: N/A

Technical: N/A

(U) **C. Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Other Procurement, Air Force	0	0	3,000	6,000	15,000	16,000	16,000	Continue	Continue

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Development

PE NUMBER AND TITLE: 0305176F Combat Survivor/Evader Locator (CSEL)

PROJECT NO. AND NAME: 4522 Combat Survivor/Evader Locator (CSEL)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

Related RDT&E:

(U) PE # 35164F Navstar GPS User Equipment

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) RFP Release					X							
(U) Contract Award						X						
(U) Initial Design Review							X					
(U) Final Design Review								X				
(U) Government DT/OA									X			
(U) Production Options Proposal											X	
(U) Production Option 1 Award												X

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Development

PE NUMBER AND TITLE: 0305176F Combat Survivor/Evader Locator (CSEL)

PROJECT NO. AND NAME: 4522 Combat Survivor/Evader Locator (CSEL)

(U) A. **Project Cost Breakdown ($0 in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) CSEL Engineering and Manufacturing Development		9,320	5,410
(U) COBRA Base Station Development		2,000	2,000
(U) Other Government Support		2,180	2,186
(U) Adjustments not reflected in Data Base		*-13,500*	
(U) Total		0	9,596

(U) B. **Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Total Program
Product Development Organizations									
Rockwell-Autonetics	CPAF	23 Feb 96	TBD	TBD	0	0	9,320	5,410	Cont
SMC (COBRA)	Multiple	Multiple	TBD	TBD	0	0	2,000	2,000	Cont
Support and Management Organizations									
Program Support					0	0	2,077	1,779	Cont
Test and Evaluation Organizations									
AFOTEC					0	0	103	407	Cont
Government Furnished Property: Not Applicable.									
Subtotal Product Development					0	0	11,320	7,410	Cont

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)				DATE March 1996		
BUDGET ACTIVITY 3 - Advanced Development			PE NUMBER AND TITLE 0305176F Combat Survivor/Evader Locator (CSEL)			
PROJECT NO. AND NAME 4522 Combat Survivor/Evader Locator (CSEL)						
Subtotal Support and Management	0	0	2,077	1,779	Cont	Cont
Subtotal Test and Evaluation	0	0	103	407	Cont	Cont
Adjustments not reflected in Data Base			*-13,500*			
Total Project	0	0	0	9,596	Cont	Cont

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603106F Logistics Systems Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	14,195	17,252	18,254	18,279	20,629	22,294	23,363	Continuing	Continuing
2745 Logistics for Contingency Operations and Weapon Systems Support	4,527	4,858	5,960	6,041	6,888	7,444	7,801	Continuing	Continuing
2940 Technology for Design and Maintenance	5,679	6,186	6,111	6,159	6,836	7,391	7,747	Continuing	Continuing
2950 Improved Logistics and Maintenance Performance	3,989	6,208	6,183	6,079	6,905	7,459	7,815	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates cost-effective technologies to improve the design, acquisition, and supportability of current and future weapon systems. This program will incorporate maintenance and support considerations into the weapon systems design process and will make engineering, product support, and maintenance data electronically available throughout weapon systems' life cycles. It will: provide more realistic logistics planning and combat capability assessment tools; provide critical risk reduction technology; and include test and diagnostics technologies, flight line and deployment support, critical aircraft battle/accident damage assessment and repair technology, military aircraft fire suppression agents, and other logistics technologies.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603106F Logistics Systems Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	14,715	17,960	19,465	Cont
(U) Appropriated Value	15,000	17,960		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-689	-348		
b. SBIR	-279	-360		
c. Omnibus/Other Above Threshold Reprogrammings	-159			
d. Below Threshold Reprogrammings	+322			
(U) Current Budget Submit	14,195	17,252	18,254	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase in FY 1996/1997 supports initiatives to improve reliability/maintainability of existing and future weapon systems.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603106F Logistics Systems Technology

PROJECT NO. AND NAME: 2745 Logistics for Contingency Operations and Weapon Systems Support

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2745 Logistics for Contingency Operations and Weapon Systems Support	4,527	4,858	5,960	6,041	6,888	7,444	7,801	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops, demonstrates, and transitions technology to improve the performance and supportability of Air Force weapon systems in peacetime and deployed wartime environments. This project will develop and demonstrate the technologies needed for more reliable aircraft support equipment, enhance our capability to rapidly return battle damaged aircraft to a combat ready status, and support rapid and flexible deployments.

(U) FY 1995 ($ in Thousands):

- (U) $2,716 Develop and demonstrate fire suppression/extinguishing technologies.
  - (U) Completed Phase III testing and finalized Halon alternative design equations for aircraft.
  - (U) Validated alternative fire suppression chemical for auxiliary ground power units.
- (U) $1,811 Develop and demonstrate repair techniques for battle damaged/accident damaged aircraft.
  - (U) Developed technologies for repairing battle damaged low-observable structures.
  - (U) Developed technologies for repairing battle damaged composite structures.
- (U) $4,527 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603106F Logistics Systems Technology
PROJECT NO. AND NAME 2745 Logistics for Contingency Operations and Weapon Systems Support	

(U) FY 1996 ($ in Thousands):

- (U) $1,654 Develop and demonstrate fire suppression/extinguishing technologies.
  - (U) Develop and flight test gas generator extinguisher technology for aircraft.
  - (U) Develop inflatable bag fire extinguisher technology for aircraft fire suppression.
- (U) $1,767 Develop and demonstrate repair techniques for battle/accident damaged aircraft.
  - (U) Develop and evaluate technologies for repairing and electrically measuring battle damaged low-observable structures.
  - (U) Develop technologies for repairing battle damaged composite structures.
  - (U) Determine technology needs and select concepts for repairing battle damaged turbine engines.
- (U) $395 Develop needs assessment and technology for multi-purpose, easily deployable support equipment.
- (U) $1,042 Identify processes, models, technologies, and equipment to enhance contingency operations while decreasing the logistics footprint.
  - (U) Define and evaluate configuration options for multi-function and modular aerospace ground equipment that reduce support costs and deployment footprint.
- (U) $4,858 Total

(U) FY 1997 ($ in Thousands):

- (U) $959 Develop and demonstrate fire suppression/extinguishing technologies.
  - (U) Complete testing on the gas generator technology for aircraft fire suppression systems and make available for transition.
  - (U) Further develop and flight test the inflatable bag extinguisher technology for aircraft fire suppression.
- (U) $1,923 Develop and demonstrate repair techniques for battle damaged/accident damaged aircraft.
  - (U) Field demonstrate and verify concepts for repairing and measuring battle damaged low-observable structures.
  - (U) Evaluate technologies for repairing battle damaged composite structures.
  - (U) Develop and evaluate technologies and tools for repairing battle damaged turbine engines.
- (U) $3,078 Develop processes, models, technologies, and equipment to enhance contingency operations while decreasing the logistics footprint.
  - (U) Design and evaluate technologies for multi-function modular aerospace ground equipment that reduce support costs and deployment footprint.
  - (U) Design and evaluate technologies for improved supportability and operational efficiency of support equipment and materiel handling equipment.
- (U) $5,960 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603106F Logistics Systems Technology
PROJECT NO. AND NAME 2745 Logistics for Contingency Operations and Weapon Systems Support	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,095	5,057	6,355	Cont
(U) Current Budget	4,527	4,858	5,960	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase in FY 1996/1997 supports initiatives to improve reliability/maintainability of existing and future weapon systems.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0603721N, Integrated Diagnostic Support.
- (U) PE 0605801A, Pollution Prevention Research and Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603106F Logistics Systems Technology

PROJECT NO. AND NAME: 2940 Technology for Design and Maintenance

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2940 Technology for Design and Maintenance	5,679	6,186	6,111	6,159	6,836	7,391	7,747	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops and demonstrates new technologies to enable design, procurement, repair, and modification of more supportable and affordable weapon systems. These technologies permit integration of design trade off decisions among survivability, producibility, and supportability, including development and use of analyses to assess impacts on system supportability while initiatives are still in the concept design stage.

(U) FY 1995 ($ in Thousands):

- (U) $4,260 Develop and demonstrate engineering design and analysis methods and tools to improve Air Force maintenance and address requirements for improved reliability/maintainability of Air Force systems.
  - (U) Developed and integrated an improved human hand model with a virtual reality hand control device for use by systems designers and human factors/logistics support engineers.
  - (U) Developed a distributed, virtual reality interface for human engineering analysis tools.
- (U) $1,419 Develop and demonstrate analysis tools to identify and meet Air Force logistics needs and improve aircraft repair/support methods and equipment effectiveness.
  - (U) Demonstrated Program Depot Maintenance (PDM) information modeling support tools for Air Force maintenance operations.
- (U) $5,679 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603106F Logistics Systems Technology
PROJECT NO. AND NAME 2940 Technology for Design and Maintenance	

(U) FY 1996 ($ in Thousands):

- (U) $2,454 Develop engineering design and analysis methods and technologies to improve Air Force maintenance and address requirements for improved system reliability/maintainability.
  - (U) Develop technology to assess multiple maintenance tasks for improved maintainer interfaces early in the design cycle, including environmental conditions in a simulated work cell.
- (U) $2,702 Develop analysis tools to identify needs and improve aircraft repair/support methods and equipment effectiveness.
  - (U) Develop variable deployment readiness assessment methods, criteria, and metrics.
  - (U) Develop and verify methods to help Air Force logisticians more effectively support the analysis process.
- (U) $1,030 Develop and demonstrate engineering design trade off methods to make acquisition/support of Air Force systems more affordable.
  - (U) Develop analytic trade off methods to allow designers and users to assess affordability versus performance, support cost, risk, etc., in early development.
  - (U) Develop decision analysis criteria and metrics for affordability integration.
- (U) $6,186 Total

(U) FY 1997 ($ in Thousands):

- (U) $3,302 Develop engineering design, analysis methods, and technologies to improve Air Force maintenance and address requirements for improved reliability/maintainability.
  - (U) Create and validate methods for documenting maintenance technician performance requirements for automatic insertion in the Logistics Support Analysis Record.
  - (U) Develop criteria/metrics for design engineering assessment of system deployment footprint, supportability, airlift/transportation requirements, and on-site support. Demonstrate methods on new support equipment concepts.
- (U) $1,259 Develop and demonstrate analysis mehtods to identify and meet Air Force logistics needs; improving aircraft repair/support methods.
  - (U) Build and demonstrate data collection and decision support technologies for operational logistics requirements.
  - (U) Test the flexibility and accuracy of this multi-user technology with commercial analytical methods.
- (U) $1,550 Develop engineering design trade off methods to make acquisition/support of Air Force systems more affordable.
  - (U) Develop and/or modify existing technologies to capture relevant data during technical development. Demonstrate these technologies have for assessing system affordability early in development.
  - (U) Build methods to define affordability metrics and exit criteria during technology design and development.
- (U) $6,111 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603106F Logistics Systems Technology
PROJECT NO. AND NAME 2940 Technology for Design and Maintenance	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,865	6,440	6,516	Cont
(U) Current Budget Submit	5,679	6,186	6,111	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizonal changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0604740F, Computer Resource Management Technology.
- (U) PE 0708011F, Manufacturing Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603106F Logistics Systems Technology

PROJECT NO. AND NAME: 2950 Improved Logistics and Maintenance Performance

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2950 Improved Logistics and Maintenance Performance	3,989	6,208	6,183	6,079	6,905	7,459	7,815	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project develops and demonstrates technologies that will improve logistics and maintenance support including: development and demonstration of technology essential to field and depot maintenance operations; implementation of near-term logistics technology to shorten the time between user requirement definition and usable product delivery; and development and demonstration of technologies for flightline and Air Logistics Center maintenance technicians.

(U) FY 1995 ($ in Thousands):

- (U) $1,476 Complete Integrated Maintenance Information System (IMIS) demonstration program.
  - (U) Completed IMIS field demonstrations.
  - (U) Transitioned the hardware, software, and specifications to the Integrated Maintenance Data System Program Office.
- (U) $2,513 Develop and demonstrate methodologies to evaluate the benefits of electronic technical data for planning and implementing various types of field and depot maintenance.
  - (U) Completed information model development for the integrated technical information program.
  - (U) Completed integrated technical information program architecture and draft system specifications.
- (U) $3,989 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603106F Logistics Systems Technology
PROJECT NO. AND NAME 2950 Improved Logistics and Maintenance Performance	

(U) FY 1996 ($ in Thousands):

- (U) $3,370 Develop and demonstrate methodologies and technologies to evaluate the benefits of electronic technical data for planning and implementing various types of field and depot maintenance.
  - (U) Evaluate various software technology systems to automatically convert aircraft drawings and technical orders into electronic formats.
  - (U) Complete requirements analysis for the Aircraft Battle Damage Repair (ABDR) combat maintenance environment.
  - (U) Evaluate various logistical technology designs for development, demonstration and evaluation at user field sites.
- (U) $2,838 Develop and demonstrate technologies for improved logistics planning and deployed maintenance operations.
  - (U) Demonstrate advanced logistics planning technologies.
  - (U) Develop software technology tools for wing level logistics planners.
- (U) $6,208 Total

(U) FY 1997 ($ in Thousands):

- (U) $4,441 Develop and demonstrate methodologies and technologies to evaluate the benefits of electronic technical data for planning and implementing various types of field and depot maintenance.
  - (U) Continue evaluation and demonstrate designs for application of electronic technical data to logistical systems at user field sites.
  - (U) Complete the system design for the automatic conversion of aircraft drawings and technical orders into electronic format.
- (U) $1,742 Develop and demonstrate technologies for improved logistics planning and deployed maintenance operations.
  - (U) Complete information analysis required to develop technologies to improve wing level logistics planning environment.
- (U) $6,183 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603106F Logistics Systems Technology
PROJECT NO. AND NAME 2950 Improved Logistics and Maintenance Performance	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,755	6,463	6,594	Cont
(U) Current Budget Submit	3,989	6,208	6,183	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0207219F, Advanced Tactical Fighter.
- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0603721N, Integrated Diagnostic System.
- (U) PE 0604708F, Generic Integrated Maintenance Diagnostics Systems.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Development

PE NUMBER AND TITLE: 0603108F Integrated Data Systems (IDS)

PROJECT NO. AND NAME: 4427 Integrated Maintenance Data Systems (IMDS)

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4427 Integrated Maintenance Data Systems (IMDS)	8,340	14,404	18,232	20,433	22,073	23,020	20,782	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification

The IMDS program was established in FY 95 based on Congressional direction and funding. FY 96 funds were also Congressionally directed. FY 97 and outyear funding provided in FY 97 POM also per Congressional direction. This program element integrates information systems supporting Air Force maintenance activities into a single open architecture, modern decision support system. This enhanced decision support system will increase operational production capability and support system efficiency, while decreasing our mobility footprint and cost of operations. This PE contains only the RDT&E portion of IMDS. Procurement and production funds are located within PE 0708611F. This program is in budget activity 3, Advanced Development, because the System Decision Memorandum (SDM) approval for Milestone 0 was received on 3 Jan 96.

(U) FY 1995

- (U) 2,600 Concept studies and demonstration.
- (U) 2,000 Testbed development.
- (U) 1,000 Demonstration support.
- (U) 1,100 System engineering.
- (U) 400 Preliminary Functional Economic Analysis (PFEA).
- (U) 1,240 Program office operations.
- (U) 8,340 Total

(U) FY 1996

- (U) 2,985 Testbed/operational program development.
- (U) 6,000 IMDS System contract - Increment 1.
- (U) 1,300 System engineering
- (U) 736 Cost/Functional Economic Analysis (FEA)
- (U) 3,383 Program office operations.
- (U) 14,404 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Development	PE NUMBER AND TITLE 0603108F Integrated Data Systems (IDS)
PROJECT NO. AND NAME 4427 Integrated Maintenance Data Systems (IMDS)	

(U) FY 1997

- (U) 12,532 IMDS system contract - Increment 2.
- (U) 1,000 Testbed development.
- (U) 1,700 System engineering.
- (U) 3,000 Program office operations.
- (U) 18,232 Total.

(U) B. Program Change Summary ($ in Thousands)

	FY 96	FY 97	Total Cost
(U) Previous President's Budget	0	19,000	Cont
(U) Appropriated Value	15,200		
(U) Adjustments to Appropriated Value			
a. Small Business Innovative Research (SBIR)	-330		
b. Congressional General Reductions	-317		
c. Omnibus and Other Above Threshold Reprogrammings	-149		
(U) Adjustments to Budget Years		-768	
(U) Current Budget Submit/President's Budget	14,404	18,232	Cont

(U) Change Summary Explanation:

Funding: FY 95 and FY 96 funding was established as a result of Congressional direction. FY 97 and outyear funding provided via FY 97 POM also per Congressional direction.

Schedule: Not Applicable.

Technical: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Development

PE NUMBER AND TITLE: 0603108F Integrated Data Systems (IDS)

PROJECT NO. AND NAME: 4427 Integrated Maintenance Data Systems (IMDS)

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	To Compl	Total Cost
(U) O&M (IMDS)*			977	973	1,933	1,918	Cont	Cont
(U) Other Proc (IMDS)*			2,888	2,853	2,836	2,814	Cont	Cont

* O&M and procurement funds located within PE 0708611F, IMDS.

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Concept studies and demonstration.			X	----	----	X						
(U) Begin testbed development				X								
(U) Testbed development	X	----	----	----	Ongoing	----	----	----	----	----	----	>
(U) Demonstration support.		X	----	----	Ongoing	----	----	----	----	----	----	>
(U) System engineering.	X	----	----	----	Ongoing	----	----	----	----	----	----	>
(U) Preliminary Functional Economic Analysis (PFEA).		X	----	----	X							
(U) Functional Economic Analysis				X	----	----	----	----	X			
(U) Program office operations.	X	----	----	----	Ongoing	----	----	----	----	----	----	>
(U) Award IMDS system contract.								X				

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603112F Advanced Materials for Weapon Systems

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	18,827	21,864	23,803	23,932	24,809	25,662	26,748	Continuing	Continuing
2100 Laser Hardened Materials	9,394	10,078	9,859	10,247	10,233	10,620	11,110	Continuing	Continuing
3153 Non-Destructive Inspection Development	3,792	5,332	5,638	5,496	5,964	6,189	6,477	Continuing	Continuing
3946 Materials Transition	5,641	6,454	8,306	8,189	8,612	8,853	9,161	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program demonstrates materials technology options for application into Air Force weapon systems. Developing materials technologies for the broadband laser protection of aircrews and sensors from a variety of threats is a high priority of the Air Force. The Non-Destructive Inspection/Evaluation (NDI/E) techniques for fighter, bomber, and transport aircraft are critical to the logistics centers as well as the operational fleet as the service lives of these systems increase. This program provides critical data for prospective users to make engineering decisions on lightweight structural, electronic, optical, and non-structural materials for air and space. Reducing risk in materials technology improves the affordability, supportability, reliability, survivability, and operational performance of current and future warfighting systems.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603112F Advanced Materials for Weapon Systems

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	19,972	23,283	24,018	Cont
(U) Appropriated Value	20,400	30,283		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-978	-587		
b. SBIR	-379	-632		
c. Omnibus/Other Above Threshold Reprogrammings	-216	-7,200		
(U) Current Budget Submit	18,827	21,864	23,803	Cont

(U) Change Summary Explanation:

Funding: Vertical decreases to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology program. Horizontal increases are due to additional emphasis on improved materials and sustainment of aging aircraft.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603112F Advanced Materials for Weapon Systems

PROJECT NO. AND NAME: 2100 Laser Hardened Materials

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2100 Laser Hardened Materials	9,394	10,078	9,859	10,247	10,233	10,620	11,110	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops new materials and concepts for protecting Air Force assets such as aircrews, munitions, sensors, transparencies, and structures against laser radiation. The goal is to ensure mission capability before, during, and after laser exposure. The world laser market is rapidly expanding with easy export to any nation. Survivability solutions must account for a variety of lasers facing a mission. Current protection schemes are activated by intensity or color and are only capable of countering a specific portion of the laser threat. To harden systems against all potential lasers, a combination of approaches is required. Concepts are demonstrated to provide hardening options for transition to Air Force systems.

(U) FY 1995 ($ in Thousands):

- (U) $1,111 Develop advanced materials technologies that enhance laser hardening for Air Force aircraft structures.
  - (U) Completed the laser hardening design portion of the Mission Integrated Transparency System (MITS) program for the next generation canopy.
  - (U) Identified laser hardening approaches for special structural materials.
- (U) $4,373 Develop advanced materials technologies that enhance laser hardening for Air Force aircrews.
  - (U) Demonstrated an interim statistical laser eye protection using advanced coating (rugate) technology.
  - (U) Demonstrated visor hardcoats and dyes for fixed laser wavelength threats.
- (U) $3,910 Develop advanced materials technologies that enhance laser hardening for sensors, avionics, and components.
  - (U) Identified optimum laser hardening approaches for existing Air Force sensor systems.
  - (U) Demonstrated the feasibility of hybrid switch approach to protect sensors from a wide variety of wavelengths and pulse widths.
- (U) $9,394 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603112F Advanced Materials for Weapon Systems
PROJECT NO. AND NAME 2100 Laser Hardened Materials	

(U) FY 1996 ($ in Thousands):

- (U) $1,474 Develop advanced materials technologies that enhance laser hardening for Air Force aircraft structures.
  - (U) Evaluate canopy protection technologies in preparation for hardened transparency demonstration.
  - (U) Investigate applicability of laser hardening technologies for missile and aircraft radomes.
- (U) $4,328 Develop advanced materials technologies that enhance laser hardening for Air Force aircrews.
  - (U) Complete program to provide laser eye protection for Military Airlift Command aircrews at night.
  - (U) Complete effort to develop holographic technologies for aircrew laser eye protection.
- (U) $4,276 Develop advanced materials technologies that enhance laser hardening for sensors, avionics, and components.
  - (U) Complete program to provide laser protection technologies for laser radars.
  - (U) Complete survivable, high performance optical sensor program.
- (U) $10,078 Total

(U) FY 1997 ($ in Thousands):

- (U) $1,492 Develop advanced materials technologies that enhance laser hardening for Air Force aircraft structures.
  - (U) Complete evaluation of structural materials laser susceptibility under various mission profiles.
  - (U) Fabricate sub-scale canopy for demonstration of canopy laser protection technologies.
- (U) $4,284 Develop advanced materials technologies that enhance laser hardening for Air Force aircrews.
  - (U) Evaluate demonstrated laser hardening approaches for application in Helmet-Mounted Displays.
  - (U) Investigate the use of advanced protection coatings in night vision goggles.
- (U) $4,083 Develop advanced materials technologies that enhance laser hardening for sensors, avionics, and components.
  - (U) Complete hardened Forward Looking Infrared (FLIR) system demonstration.
  - (U) Develop technologies to protect low light level television systems.
- (U) $9,859 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603112F Advanced Materials for Weapon Systems
PROJECT NO. AND NAME 2100 Laser Hardened Materials	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	9,937	10,574	10,736	Cont
(U) Current Budget Submit	9,394	10,078	9,859	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal changes are due to additional emphasis on improved materials and sustainment of aging aircraft.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0604706F, Life Support System.
- (U) Coordinated through the Tri-Service Laser Hardening Materials and Structures Working Group and the Joint Service Agile Laser Eye Protection Program.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603112F Advanced Materials for Weapon Systems

PROJECT NO. AND NAME: 3153 Non-Destructive Inspection Development

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3153 Non-Destructive Inspection Development	3,792	5,332	5,638	5,496	5,964	6,189	6,477	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Develops and demonstrates advanced Non-Destructive Inspection/Evaluation (NDI/E) methods and procedures to monitor performance integrity and to detect failure causing conditions in weapon system components and materials. NDI/E capabilities greatly influence and/or limit many designs, manufacturing, and maintenance practices. Reduction in the number of fighter wings and the need for rapid sortie generation demand an ability to perform real-time NDI/Es faster than current capability. This project provides technology to satisfy critical Air Force requirements to extend lifetimes of current systems through increased reliability and cost-effectiveness at field and depot maintenance levels, as well as assuring manufacturing quality, integrity, and safety requirements.

(U) FY 1995 ($ in Thousands):

- (U) $1,994 Develop advanced technologies for improved capabilities in materials corrosion testing, monitoring, and inspection of aging aircraft.
  - (U) Demonstrated corrosion non-destructive evaluation data fusion to simplify inspection of aircraft structures.
- (U) $1,798 Develop advanced electromagnetic radiation (i.e., x-ray, gamma-ray, and laser) NDI/E technologies for improved capabilities in materials testing, monitoring, inspection, and maintenance.
  - (U) Identified advanced non-destructive evaluation techniques for turbine engine components.
  - (U) Demonstrated demonstration of high resolution three-dimensional computed tomography for complex aircraft structures.
- (U) $3,792 Total

(U) FY 1996 ($ in Thousands):

- (U) $2,883 Develop advanced technologies for improved capabilities in materials corrosion testing, monitoring, and inspection of aging aircraft.
  - (U) Continue to evaluate corrosion non-destructive evaluation data fusion to simplify inspection of aircraft structures.
  - (U) Develop corrosion detection systems for passive detection of aircraft structural corrosion.
- (U) $2,449 Develop advanced electromagnetic radiation (i.e., x-ray, gamma-ray, and laser) NDI/E technologies for improved capabilities in materials testing, monitoring, inspection, and maintenance.
  - (U) Develop high resolution, real-time radioscopy for digitized (filmless) inspection of aircraft structures.
  - (U) Develop man portable large area composite inspection technologies for inspection of aircraft wing and fuselage sections.
- (U) $5,332 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603112F Advanced Materials for Weapon Systems
PROJECT NO. AND NAME 3153 Non-Destructive Inspection Development	

(U) FY 1997 ($ in Thousands):

- (U) $3,959 Develop advanced technologies for improved capabilities in materials corrosion testing, monitoring, and inspection of aging aircraft.
  - (U) Continue to develop corrosion detection systems for passive detection of aircraft structural corrosion.
  - (U) Develop technologies for detection of hidden flaws in complex aircraft structures.
- (U) $1,679 Develop advanced electromagnetic radiation (i.e., x-ray, gamma-ray, and laser) Non-Destructive Inspection/Evaluation (NDI/E) technologies for improved capabilities in materials testing, monitoring, inspection, and maintenance.
  - (U) Evaluate the use of computed tomography for failure analysis of complex structures.
  - (U) Develop remote inspection microwave non-destructive evaluation techniques for aircraft structures.
- (U) $5,638 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,034	5,840	6,139	Cont
(U) Current Budget Submit	3,792	5,332	5,638	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increases are due to additional emphasis on improved materials and sustainment of aging aircraft.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603112F Advanced Materials for Weapon Systems
PROJECT NO. AND NAME 3153 Non-Destructive Inspection Development	

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603112F Advanced Materials for Weapon Systems

PROJECT NO. AND NAME: 3946 Materials Transition

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3946 Materials Transition	5,641	6,454	8,306	8,189	8,612	8,853	9,161	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops scale-up data on new defense-related materials to achieve their acceptance by designers, to shorten transition time into applications, and to provide the initial incentive for their industrial development.

(U) FY 1995 ($ in Thousands):

- (U) $2,313 Develop defense-related materials technologies and data bases to facilitate timely transition of advanced structures, propulsion, and subsystems materials to warfighters, industry, and academia.
  - (U) Demonstrated ceramic composites in advanced engine exhaust nozzle components.
  - (U) Characterized thermoplastics composites for application in load bearing aircraft doors.
- (U) $1,635 Develop technologies and data bases to facilitate timely transition of advanced electronics, optics, and survivability materials to warfighters, industry, and academia.
  - (U) Identified candidate high durability infrared window materials and coatings for use in extreme environments.
- (U) $1,693 Develop technologies and data bases to facilitate timely transition of advanced materials for improved systems support and operational support to warfighters, industry, and academia.
  - (U) Characterized the physical properties of advanced structural materials and provided design allowable data to designers.
- (U) $5,641 Total

(U) FY 1996 ($ in Thousands):

- (U) $2,630 Develop defense-related materials technologies and data bases to facilitate timely transition of advanced structures, propulsion, and subsystems materials to warfighters, industry, and academia.
  - (U) Complete transition of high temperature organic matrix composite material to aircraft aft fuselage sections.
  - (U) Demonstrate affordable permanent mold casting technology for titanium.
- (U) $3,250 Develop technologies and data bases to facilitate timely transition of advanced electronics, optics, and survivability materials to warfighters, industry, and academia.
  - (U) Develop infrared (IR) countermeasures materials which will provide lasers with the capability to counter a variety of IR threat munitions.
  - (U) Develop high performance, very long wavelength IR detector materials for for space applications.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603112F Advanced Materials for Weapon Systems
PROJECT NO. AND NAME 3946 Materials Transition	

- (U) $574 Develop technologies and data bases to facilitate timely transition of advanced materials for improved systems support and operational support to warfighters, industry, and academia.
  - (U) Continue to characterize the physical properties of advanced structural materials and provide design allowable data to designers.
  - (U) Evaluate improved materials and materials processes for potential use in aircraft systems.
- (U) $6,454 Total

(U) FY 1997 ($ in Thousands):

- (U) $3,116 Develop defense-related materials technologies and data bases to facilitate timely transition of advanced structures, propulsion, and subsystems materials to warfighters, industry, and academia.
  - (U) Scale up and evaluate improved IR signature reduction coatings for aircraft.
  - (U) Develop new wrought gamma titanium processes for application in advanced turbine engines.
- (U) $2,851 Develop technologies and data bases to facilitate timely transition of advanced electronics, optics, and survivability materials to warfighters, industry, and academia.
  - (U) Complete demonstration of durable infrared window materials and coatings for high temperature and debris environments.
  - (U) Develop thermal control coatings for space applications.
- (U) $591 Develop technologies and data bases to facilitate timely transition of advanced materials for improved systems support and operational support to warfighters, industry, and academia.
  - (U) Continuue to characterize the physical properties of advanced structural materials and provide design allowable data to designers.
  - (U) Continue to evaluate improved materials and materials processes for potential use in aircraft systems.
- (U) $1,748 Develop and demonstrate engineering design trade off methods to allow designers and users to assess affordability versus performance, support cost, risk, etc., in early development.
- (U) $8,306 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603112F Advanced Materials for Weapon Systems
PROJECT NO. AND NAME 3946 Materials Transition	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	6,001	6,869	7,143	Cont
(U) Current Budget Submit	5,641	6,454	8,306	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal increases to this project since the previous President's Budget are due to additional emphasis on improved materials and sustainment of aging aircraft. Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0603211F, Aerospace Structures.
- (U) PE 0603202F, Aerospace Propulsion Subsystem Integration.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603216F, Aerospace Propulsion and Power Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603202F Aerospace Propulsion Subsystem Integration

PROJECT NO. AND NAME: 668A Aircraft Propulsion Subsystem Integration

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
668A Aircraft Propulsion Subsystem Integration	27,654	28,294	28,318	28,905	29,923	30,719	31,891	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates gas turbine propulsion system technologies applicable to a broad range of aircraft. The Aircraft Propulsion Subsystem Integration (APSI) program has three distinct tasks. Task I develops affordable and durable system component technology such as low pressure fans and low pressure turbines (LPT), engine controls, and nozzles. Task II includes demonstrator engines such as the Joint Technology Demonstrator Engine (JTDE) for manned systems and the Joint Expendable Turbine Engine Concept (JETEC) for cruise missile applications. These demonstrator engines apply the core technology developed under the Advanced Turbine Engine Gas Generator (ATEGG) program. Task III focuses on the system integration aspects of inlets, nozzles, engine/airframe compatibility, and low-observable technologies. This program will provide aircraft with: 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 resulting in increased mission effectiveness. The APSI program supports the demonstration of performance, cost, and durability goals of the Integrated High Performance Turbine Engine Technology (IHPTET) program. IHPTET is a three phase, totally integrated DOD, ARPA, NASA, and industry initiative focused on doubling turbine engine propulsion capabilities while reducing cost of ownership. The IHPTET program structure provides continuous technology transition for military turbine engine upgrades and derivatives and has the added benefit of enhancing the U.S. turbine engine industry's international competitiveness.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603202F Aerospace Propulsion Subsystem Integration
PROJECT NO. AND NAME 668A Aircraft Propulsion Subsystem Integration	

(U) FY 1995 ($ in Thousands):

- (U) $4,082 Design, fabricate, and demonstrate fans, low pressure turbines, engine controls, exhaust nozzles, and integration technology for turbofan/turbojet engines for current and future Air Force aircraft.
  - (U) Fabricated low signature, lightweight axisymmetric nozzle.
  - (U) Rig tested an advanced concepts fan incorporating two-stage swept aero fan technology.
  - (U) Evaluated, via engine test, the high cycle fatigue characteristics of hollow fan blade technology.
- (U) $19,609 Design, fabricate, and test technology demonstration engines for turbofan/turbojet engines for fighters, attack aircraft, bombers, and transports.
  - (U) Fabricated a swept aerodynamic fan with hollow metal matrix composite blades.
  - (U) Fabricated and demonstrated advanced, high throughflow fan and high stability fan casing treatment technologies.
  - (U) Fabricated advanced low pressure turbine cooling technology.
  - (U) Designed forward swept fan technology.
  - (U) Designed Castcool and Internal Convective Enhancement (ICE) turbines.
  - (U) Designed integration technologies including metal matrix composite shafts, hybrid ceramic bearings, and counterrotating vaneless turbine.
  - (U) Designed variable cycle engine with fixed geometry, fluidic area control, and fluidic thrust vectoring exhaust nozzle technologies.
- (U) $3,963 Design, fabricate, and test technology demonstration engines for expendable engines for missile applications.
  - (U) Designed carbon/silicon carbide (C/SiC) exhaust nozzle and high throughflow combustor.
  - (U) Designed efficient, lightweight lamilloy hot section, including first use of MA754 sheet material for turbine nozzle.
- (U) $27,654 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603202F Aerospace Propulsion Subsystem Integration
PROJECT NO. AND NAME 668A Aircraft Propulsion Subsystem Integration	

(U) FY 1996 ($ in Thousands):

- (U) $4,192 Design, fabricate, and demonstrate fans, low pressure turbines, engine controls, exhaust nozzles, and integration technology for turbofan/turbojet engines for current and future Air Force aircraft.
  - (U) Demonstrate low signature, lightweight axisymmetric nozzle.
  - (U) Design and fabricate distributed and model-based engine controls.
  - (U) Design and fabricate ceramic composite components for exhaust nozzles.
- (U) $20,033 Design, fabricate, and test technology demonstration engines for turbofan/turbojet engines for fighters, attack aircraft, bombers, and transports.
  - (U) Demonstrate a swept aerodynamic fan with hollow metal matrix composite blades.
  - (U) Demonstrate advanced low pressure turbine cooling technology.
  - (U) Design and fabricate forward swept fan technology.
  - (U) Design and fabricate Castcool and Internal Convective Enhancement (ICE) turbines.
  - (U) Design and fabricate integration technologies including metal matrix composite shafts, hybrid ceramic bearings, and counterrotating vaneless turbine.
  - (U) Design and fabricate variable cycle engine with fixed geometry, fluidic area control, and fluidic thrust vectoring exhaust nozzles.
- (U) $4,069 Design, fabricate, and test technology demonstration engines for expendable engines for missile applications.
  - (U) Demonstrate mixed flow turbine and ceramic matrix composite (CMC) turbine shroud on a very low fuel consumption propfan engine.
  - (U) Fabricate high pressure ratio, forward swept compressor stage.
  - (U) Fabricate efficient, lightweight lamilloy hot section with first use of high temperature capable MA754 sheet material for turbine nozzle.
  - (U) Fabricate low-cost, uncooled ceramic hot sections.
- (U) $28,294 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603202F Aerospace Propulsion Subsystem Integration
PROJECT NO. AND NAME 668A Aircraft Propulsion Subsystem Integration	

(U) FY 1997 ($ in Thousands):

- (U) $4,054 Design, fabricate, and demonstrate fans, low pressure turbines, engine controls, exhaust nozzles, and integration technology for turbofan/turbojet engines for current and future Air Force aircraft.
  - (U) Complete fabrication and demonstrate distributed and model-based engine controls.
  - (U) Demonstrate ceramic composite components for exhaust nozzles.
- (U) $20,317 Design, fabricate, and test technology demonstration engines for turbofan/turbojet engines for fighters, attack aircraft, bombers, and transports.
  - (U) Complete fabrication and demonstrate forward swept fan technology.
  - (U) Complete fabrication and demonstrate Castcool and Internal Convective Enhancement (ICE) turbines.
  - (U) Complete fabrication and demonstrate integration technologies including metal matrix composite shafts, hybrid ceramic bearings, and counterrotating vaneless turbine.
  - (U) Complete fabrication and demonstrate variable cycle engine with fixed geometry, fluidic area control, and fluidic thrust vectoring exhaust technologies.
- (U) $3,947 Design, fabricate, and test technology demonstration engines for expendable engines for missile applications.
  - (U) Demonstrate high pressure ratio, forward swept compressor stage.
  - (U) Demonstrate efficient, lightweight lamilloy hot section with first use of high temperature capable MA754 sheet material.
  - (U) Demonstrate low-cost, uncooled ceramic hot section.
- (U) $28,318 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603202F Aerospace Propulsion Subsystem Integration
PROJECT NO. AND NAME 668A Aircraft Propulsion Subsystem Integration	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	29,408	29,818	29,149	Cont
(U) Appropriated Value	29,941	29,818		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-1,340	-577		
b. SBIR	-558	-654		
c. Omnibus/Other Above Threshold Reprogrammings	-317	-293		
d. Below Threshhold Reprogrammings	-72			
(U) Current Budget Submit	27,654	28,294	28,318	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities with the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0603112F, Advanced Materials for Weapon Systems.
- (U) PE 0603216F, Aerospace Propulsion and Power Technology.
- (U) PE 0602122N, Aircraft Technology.
- (U) PE 0603217N, Air Systems Advanced Technology Demonstration.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603203F Advanced Avionics for Aerospace Vehicles

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	26,329	30,577	28,691	29,944	31,753	31,818	33,390	Continuing	Continuing
665A Airborne Sensors Technology	14,833	13,826	11,833	13,243	14,047	14,079	14,776	Continuing	Continuing
69CK Advanced Electronics	3,501	3,363	3,515	3,414	3,613	3,614	3,790	Continuing	Continuing
69DF Target Attack and Recognition Technology	7,995	13,388	13,343	13,287	14,093	14,125	14,824	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification**: This Advanced Technology Development program provides technology to enable continued avionics superiority. Military force structures must contain combat aircraft that can defeat increasingly sophisticated active and passive countermeasures, destroy a wide variety of targets with precision, and reliably perform complex missions with less logistics support in a world of proliferating threats. This program responds to these needs by developing and demonstrating technologies and techniques for advanced radio frequency sensors (i.e., radar) and active and passive electro-optical sensors for airborne and ground targeting including: electronic counter-countermeasures; advanced electronics technologies for improvements in cost, weight, and reliability; and fire control/weapon delivery; target identification and recognition technologies; and techniques for precision air and ground target kills. Emphasis is on detecting, locating, and targeting airborne fixed and mobile time-critical ground threat targets and providing the capability to adapt to changes in target signatures and background environments. These advanced avionics capabilities will provide for flexible, multi-function/multi-mission combat aircraft that can safely penetrate threat areas, destroy multiple ground targets per pass, perform air combat with positive, beyond visual range detection and identification within a complex mix of look-alike friendly, neutral, and enemy aircraft, and return to fight again.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles

(U) **B. Program Change Summary ($ in Thousands)**:

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	27,983	32,131	31,013	Cont
(U) Appropriated Value	28,500	32,131		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-1,285	-636		
b. SBIR	-531	-616		
c. Omnibus/Other Above Threshold Reprogrammings	-302	-302		
c. Below Threshold Reprogrammings	-53			
(U) Current Budget Submit	26,329	30,577	28,691	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes to this Program Element since the previous President's Budget are due budget contraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary**: Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603203F Advanced Avionics for Aerospace Vehicles

PROJECT NO. AND NAME: 665A Airborne Sensors Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
665A Airborne Sensors Technology	14,833	13,826	11,833	13,243	14,047	14,079	14,776	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops and demonstrates airborne sensor technologies, including electro-optical sensors, radars, and electronic counter-countermeasures (ECCM) for radars. This project provides the warfighter with the capability to precisely detect and target both airborne targets (conventional and low radar cross section) and ground-based, high-value, time-critical targets. Work includes developing both complete sensor capabilities as well as components. The desired warfighting capability includes the ability to detect and target in difficult background conditions, with emphasis on countering improvements in camouflage, concealment, and deception techniques that limit current detection and tracking capability for threats obscured by these means. Adaptive radar processing and ECCM techniques are developed for transition to operational and new systems and provide for continued sensor performance in harsh electromagnetic interference environment that can include both intentional and unintentional clutter and interference. Electro-optical sensors include passive, active, and integrated passive and active technologies. Passive sensors have the advantage of allowing the warfighter to detect, target, and strike both airborne and ground targets while remaining covert. Active sensors provide for high confidence target recognition capability at long-ranges. Active sensors also provide for wind sensing capabilities which enable precision weapon deployment and air cargo drop. These technologies will provide operational users with the capability for electro-optical target engagement systems that will maintain the combat advantage.

(U) FY 1995 ($ in Thousands):

- (U) $1,971 Develop a conformal, low-observable infrared search and track (IRST) window capable of meeting long-range detection requirements while minimizing adverse impacts to the aircraft platform. Integrate sensor, algorithm, and infrared phenomenology models into an IRST end-to-end simulation to evaluate sensor performance. Evaluate concepts for improving look-down performance and reducing IRST size, weight, and cost.
  - (U) Completed testing of IRST window components.
  - (U) Completed sensor performance prediction model.
  - (U) Evaluated sensor performance through sensor performance simulations.
- (U) $922 Develop affordable air-to-air electro-optical sensor concepts for target detection and tracking in high clutter with interface for real-time automated target declaration processing.
  - (U) Designed sensor and evaluated for performance and affordability.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 665A Airborne Sensors Technology	

– (U) $1,249	Develop advanced air-to-ground electro-optical sensors for target detection and tracking in high clutter environments with interface for real-time automated target recognition processing. – (U) Collected multi-spectral tower data. – (U) Evaluated multi-spectral sensor for the detection of ground-based targets in open or obscured environments.
– (U) $2,308	Develop technologies for a wind profiling capability for precision first shot, for precision air drop, and to detect, target, and identify high-value, ground-based, time-critical targets. – (U) Flight demonstrated airborne brassboard wind profiler. – (U) Developed eye-safe, flight worthy, high-power, high reliability laser transceiver for wind profiling system.
– (U) $3,566	Develop and demonstrate radar electronic counter-countermeasure (ECCM) techniques for negating air intercept and synthetic aperture radar (for air-to-surface) electronic countermeasure (ECM) threats. Evaluate operational sensor susceptibility to validated ECM threats. – (U) Collected synthetic aperture radar data against multiple jammers for use in developing potential system upgrades to weapon systems such as the APG-70 and the APE-164. – (U) Developed adaptive processing algorithms to counter synthetic aperture radar jammers. – (U) Developed ECCM techniques to negate the effects of digital radio frequency memory technologies.
– (U) $816	Develop adaptive processing techniques to negate clutter and electromagnetic interference, both intentional and unintentional, for uninterrupted sensor performance and increased detection and targeting performance against sophisticated and low radar cross section targets. – (U) Developed adaptive processing algorithms and evaluated against raw radar data. – (U) Performed electronic protection vulnerability assessment using APG-68 and APG-70 radar data.
– (U) $1,815	Develop and demonstrate, through a multi-Service program, the sensor and algorithm technology required to detect, identify, and target high-value, time-critical targets obscured by foliage or concealed through deceptive techniques. – (U) Collected instrumented airborne data and evaluated target detection algorithms for ground-based threats. – (U) Developed real-time signal processing capability, with low false alarm rates, to detect concealed time-critical targets.
– (U) $1,785	Develop critical components required to achieve a low-cost radar architecture that will lower weapon system life cycle cost. – (U) Developed fighter aircraft aperture technology concepts to meet operational requirements.
– (U) $401	Develop and demonstrate, through a multi-Service program, the radar sensor technology required for a two-dimensional image of airborne high-value threats. This technology will aid in real-time, high confidence target detection. – (U) Collected and analyzed airborne data of fighter aircraft signatures for characteristics conducive to identification of airborne targets.
– (U) $14,833	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 665A Airborne Sensors Technology	

(U) FY 1996 ($ in Thousands):

- (U) $1,585 — Develop a conformal, low-observable infrared search and track (IRST) window capable of meeting long-range detection requirements while minimizing adverse impacts to the aircraft platform. Integrate sensor, algorithm, and infrared phenomenology models into an IRST end-to-end simulation to evaluate sensor performance. Evaluate concepts for improving look-down performance and reducing IRST size, weight, and cost.
  - (U) Complete evaluation of aero-optical effects in a supersonic wind tunnel.
- (U) $1,566 — Develop affordable air-to-air electro-optical sensor technology for long-range target detection and tracking to further reduce complexity, size, and cost of electro-optical sensors.
  - (U) Complete design of compact, affordable sensor for airborne weapon systems which require long-range passive target detection.
- (U) $1,434 — Develop airborne, air-to-ground, wind profiling technologies to enhance first shot hit capability of gunships and improve precision air drops from cargo aircraft. Technology will decrease loiter time and increase operational altitude, thus, improving survivability.
  - (U) Demonstrate gunship performance enhancement with airborne wind profiler.
  - (U) Flight test wind profiling technologies with Warner Robins Air Logistics Command for application to gunship platforms.
  - (U) Complete fabrication of flight worthy, high-power, reliable laser transceiver for evaluation of wind profiling sensor system.
- (U) $928 — Develop and demonstrate, through a multi-Service program, the electro-optical multi-spectral sensor and algorithm technology required to passively search large areas, detect, and target ground-based threats in an open or obscured environment. This is a cooperative effort between the Army, Navy, and Air Force. Passive search allows the user to remain covert.
  - (U) Perform multi-spectral imaging data collections to enable design of airborne sensor for generic reconnaissance platforms.
  - (U) Demonstrate passive targeting of ground-based targets at extended weapon stand-off ranges (>20 km from target).
- (U) $1,043 — Develop, demonstrate, and evaluate advanced laser technologies that provide pilots with positive, timely, and reliable identification. The identification information is compatible with existing identification/Identify friend or foe techniques. This technology will be packaged for existing electro-optical systems and provides the multi-mission capability of supporting air-to-air missile launch at 60 km and air-to-ground weapon launch at 15-25 km.
  - (U) Demonstrate sensor capability at operationally useful ranges.
  - (U) Evaluate three-dimensional imaging technologies in simulations using tower data and compare to conventional imaging and range-only techniques.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 665A Airborne Sensors Technology	

– (U) $1,523	Develop and demonstrate radar electronic counter-countermeasure (ECCM) techniques capable of negating air intercept and synthetic aperture radar electronic countermeasure (ECM) threats. – (U) Develop, train, and test neural net algorithms to improve identification of possible jamming sources. – (U) Develop advanced synthetic aperture radar techniques and test to evaluate susceptibility to jamming. – (U) Develop and evaluate digital radio frequency memory ECCM techniques to negate airborne ECM.
– (U) $1,428	Develop adaptive processing techniques to negate clutter and electromagnetic interference, both intentional and unintentional, for uninterrupted sensor performance and increased detection and targeting performance against sophisticated and low radar cross section targets. – (U) Develop and evaluate algorithms to reduce effects of terrain scattering and radome reflections/clutter and to improve target detection range. – (U) Define data collection requirements and data analysis plan for selection of algorithms and techniques for airborne radar systems. – (U) Perform data collection and data reduction/processing for adaptive processing algorithms.
– (U) $2,209	Develop and demonstrate, through an Air Force/Navy/Advanced Research Projects Agency (ARPA) program, the sensor and algorithm technology required to detect, identify, and target high-value, time-critical targets obscured by foliage or concealed through deceptive techniques. – (U) Continue to collect data for algorithm development and selection. – (U) Develop real-time, concealed target detection algorithms.
– (U) $2,110	Develop technology required to achieve improved life cycle cost for current and future airborne radar apertures and systems. – (U) Design radar subsystem interface improvements for affordability and reliability. – (U) Evaluate low-cost synthetic aperture radar motion compensation techniques derived from Global Positioning System technology.
– (U) $13,826	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 665A Airborne Sensors Technology	

(U) FY 1997 ($ in Thousands):

- (U) $218 Develop affordable multi-function electro-optical sensor technology for long-range target detection and track/missile warning. This effort will combine the offensive and defensive functions into a single electro-optical sensor, reducing volume and cost of the overall system.
  - (U) Define multi-function sensor technologies for an integrated offensive and defensive sensor system.
- (U) $873 Develop airborne, air-to-ground, wind profiling technologies to enhance first shot hit capability of gunships and greater precision air drops from cargo aircraft. Technology will decrease loiter time and increase operational altitude, thus, improving survivability.
  - (U) Complete evaluation and transition wind profiling system in cooperation with Warner Robins Air Logistics Command.
  - (U) Investigate technology issues related to improving cargo drop performance on aircraft utilizing wind profiling.
- (U) $873 Develop and demonstrate, through a tri-Service program, the multi-spectral electro-optical sensor and algorithm technology required to passively search large areas, detect, and target ground-based targets in the open and under cover. Passive search allows the user to remain covert.
  - (U) Verify multi-spectral targeting sensor performance using tower data for joint United Kingdom/France/U.S. Air Force/U.S. Navy fire control system development.
- (U) $2,255 Develop, demonstrate, and evaluate advanced laser technologies that provide pilots with positive, timely, and reliable identification (ID) information that is compatible with existing reliable identification/identify friend or foe techniques. This technology will be packaged for existing electro-optical systems and provide for the capability for air-to-air missile launch at 60 km and air-to-ground weapon launch at 15-25 km.
  - (U) Demonstrate three-dimensional imaging capability in a field test.
- (U) $1,703 Develop and demonstrate radar electronic counter-countermeasure (ECCM) techniques to negate air intercept and synthetic aperture radar electronic countermeasure threats.
  - (U) Evaluate synthetic aperture radar ECCM techniques which allow all-weather targeting of high-value ground targets while under severe jamming.
  - (U) Perform laboratory and roofhouse demonstrations of electronic protection techniques for transition to front-line fighters and bombers operating in harsh electronic countermeasure environments.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 665A Airborne Sensors Technology	

- (U) $1,703 Develop adaptive processing techniques to negate clutter and electromagnetic interference, both intentional and intentional, for uninterrupted sensor performance and increased detection and targeting performance against sophisticated and low radar cross section targets.
  - (U) Continue to develop innovative concepts to eliminate clutter and interference from other sensors on board and enable the maximum possible target detection and tracking range.
  - (U) Use airborne radar data to perform cost/performance trade studies of advanced clutter /interference mitigation techniques.
- (U) $1,932 Develop and demonstrate, through an Air Force/Navy/Advanced Research Projects Agency program, the radio frequency sensor and algorithm technology required to detect, identify, and target high-value, time-critical targets obscured by foliage or concealed through deceptive techniques.
  - (U) Perform ground demonstration of real-time, automatic detection of concealed/camouflaged, high-value, time-critical targets.
  - (U) Develop sensor specification for an airborne, all-weather, concealed target detection sensor.
- (U) $2,276 Develop critical components required to lower life cycle cost of radar apertures for operational and future radar systems.
  - (U) Fabricate low-cost antenna aperture for improved performance of electronic scanned arrays.
  - (U) Perform experiments to evaluate aperture technology for performance and reliability under laboratory conditions and harsh operating environments.
  - (U) Develop radar aperture technology with life cycle cost reduction goal of 20-40%.
- (U) $11,833 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 665A Airborne Sensors Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	15,793	14,528	13,779	Cont
(U) Current Budget Submit	14,833	13,826	11,833	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603205F, Flight Vehicle Component and Subsystem Technology.
- (U) PE 0603707F, Weather Systems Advanced Development.
- (U) PE 062111N, Weapons Technology.
- (U) PE 062232N, Space and Electronic Warfare (SEW) Technology.
- (U) PE 0604249F, LANTIRN Night Precision Attack.
- (U) PE 0603270F, Electronic Combat Technology.
- (U) A memorandum of agreement has been established between the Air Force Wright Laboratory and the Advanced Research Projects Agency (ARPA) to jointly develop the technology required to detect high-value, time-critical targets in a variety of environments including deception, camouflage, concealment, and deep hide. This technology also has significant application in the civil sector, and the ARPA/Air Force program will collaborate with civil agencies where appropriate.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 665A Airborne Sensors Technology	

(U) **D.** **Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603203F Advanced Avionics for Aerospace Vehicles

PROJECT NO. AND NAME: 69CK Advanced Electronics

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
69CK Advanced Electronics	3,501	3,363	3,515	3,414	3,613	3,614	3,790	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops and demonstrates devices, tools, and components that improve performance, reliability, and affordability of radar, communication, and electronic counter-countermeasure systems for both retrofit and new system applications. This includes monolithic solid state transmit/receive modules for airborne radar, high-speed analog-to-digital converters, advanced memory/logic for electronic countermeasures, high reliability electronics power distribution, microwave/microelectronics packaging and interconnect techniques, and integrated electro-optical detector arrays.

(U) FY 1995 ($ in Thousands):

- (U) $1,725 Develop advanced microelectronics component, power distribution, packaging, and interconnect technologies to provide for reduction in power consumption, cost, weight, and volume of target detection electronics.
  - (U) Completed Phase I development of inorganic coatings for the encapsulation of integrated circuits in multichip assemblies for significant cost reduction of target detection electronic systems.
- (U) $1,061 Develop advanced component technologies to integrate multi-function microwave and millimeter wave circuits for reduced airborne sensor cost, weight, and volume, and improved reliability of radar and targeting electronics.
  - (U) Built first wideband klystron that meets Airborne Warning and Control System (AWACS) specifications and provides replacement option for two existing narrowband devices.
- (U) $715 Develop advanced multi-function sensor electronics, including integrated analog/digital elements (both radio frequency and electro-optical), to increase reliability, improve performance, and decrease cost, weight, and volume in integrated airborne avionics.
  - (U) Designed multiplexers for receivers in transmit/receive modules for multi-mode phased array radar systems.
- (U) $3,501 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 69CK Advanced Electronics	

(U) FY 1996 ($ in Thousands):

- (U) $1,652 Develop advanced microelectronics component, power distribution, packaging, and interconnect technologies to provide for ten times reduction in power consumption, cost, weight, and volume of target detection electronics.
  - (U) Develop Phase II multichip assemblies under the integrated circuit encapsulation program.
  - (U) Develop new power architectures and active devices for multi-function phased array systems containing both analog and digital subsystems.
  - (U) Complete a functional design of a custom integrated circuit which can execute the algorithm for radar signature prediction.
  - (U) Build a graphics generator chip which will result in reduced pilot workload.
- (U) $875 Develop advanced component technologies to integrate multi-function microwave and millimeter wave circuits for reduced airborne sensor cost, weight, and volume, and improved reliability of radar and targeting electronics.
  - (U) Demonstrate the reproducibility and manufacturability of an advanced wide band klystron for applications such as the Airborne Warning and Control System (AWACS).
  - (U) Develop low band millimeter wave power module for interrogator, transponder, communications, and navigation applications.
- (U) $836 Develop advanced multi-function sensor electronics, including integrated analog/digital elements (both radio frequency and electro-optical), to increase reliability, improve performance, and decrease cost, weight, and volume in integrated airborne avionics.
  - (U) Fabricate and test advanced multiplexers for transmit/receive module receivers for generic avionics applications.
  - (U) Complete initial component and circuit designs for highly integrated analog/digital microwave receivers which will move the digital interface closer to the antenna to reduce cost and improve performance.
- (U) $3,363 Total

(U) FY 1997 ($ in Thousands):

- (U) $1,715 Develop advanced microelectronics component, power distribution, packaging, and interconnect technologies to provide for reduction in power consumption, cost, weight, and volume of target detection electronics.
  - (U) Demonstrate reliability of inorganic chip seal process which reduces size and cost of packaging for target detection electronics.
  - (U) Fabricate and test advanced power modules for improved efficiency and reliability in phased array radar systems.
- (U) $1,065 Develop advanced component technologies to integrate multi-function microwave and millimeter wave circuits for reduced airborne sensor cost, weight, and volume, and improved reliability of radar and targeting electronics.
  - (U) Demonstrate initial driver and booster amplifier designs; complete final design of low-band microwave power module.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 69CK Advanced Electronics	

- (U) $735 Develop advanced multi-function sensor electronics, including integrated analog/digital elements (both radio frequency and electro-optical), to increase reliability, improve performance, and decrease cost, weight, and volume in integrated airborne avionics.
  - (U) Select optimal analog/digital microwave receiver designs which offer greatest overall improvement in cost and performance and initiate development.
- (U) $3,515 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,712	3,534	3,411	Cont
(U) Current Budget Submit	3,501	3,363	3,515	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes to this project since the previous President's Budget are due to budget contraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603270F, Electronic Combat Technology.
- (U) PE 0603739E, Electronic Manufacturing Technology.
- (U) PE 0603706E, Microwave/Millimeter Wave Integrated Circuits.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 69DF Target Attack and Recognition Technology	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
69DF Target Attack and Recognition Technology	7,995	13,388	13,343	13,287	14,093	14,125	14,824	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops and demonstrates advanced technologies to provide for attack management, fire control, and target identification and recognition capabilities. The objective of this project includes developing and demonstrating integrated fire control techniques to provide for a capability of adverse-weather air-to-surface precision strike against multiple targets-per-pass and air-to-air engagement at maximum weapon launch range with cooperative launch deployment flexibility. Specific fire control technologies include attack management, sensor fusion, automated decision aids, advanced tracking for low radar cross section threats, and targeting using both on-board and off-board sensor information. These fire control developments will provide force multiplication and a reduction of exposure to hostile fire. The objective of this project also includes developing and demonstrating technologies to provide for positive, high confidence cueing, recognition, and identification of both airborne and ground-based, high-value, time-critical targets at ranges compatible with tactical air-to-air and air-to-surface weapons in bad weather, day or night, and in high-threat multiple target battle areas. Model-based vision algorithms and target signature development techniques are key to the identification and recognition solution and are pursed in this project in partnership with the Advanced Research Projects Agency. The techniques developed are evaluated to support the Theater Missile Defense efforts in surveillance and attack. The fire control and recognition technologies developed and demonstrated in this project are high leverage in that they provide for significant advancements in operational capabilities largely through software improvements which can be readily transitioned to new and existing systems.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 69DF Target Attack and Recognition Technology	

(U) FY 1995 ($ in Thousands):

- (U) $1,283 Develop synthetic signature capability for ground targets to train automatic target recognition algorithms.
  - (U) Baselined synthetic signature validation methodology using tactical targets.
  - (U) Developed first set of target signatures for incorporation into ground-based target recognition systems.
- (U) $2,139 Evaluate automatic target recognition algorithms, including model-based vision algorithms, for moving and stationary target acquisition and recognition, for consideration of Theater Missile Defense surveillance and attack efforts.
  - (U) Evaluated automatic radar air-to-ground target acquisition algorithms using measured and synthetic signature data.
- (U) $1,414 Develop advanced hostile target identification technologies to provide a capability for beyond visual range, all aspect, high confidence classification and identification of airborne targets.
  - (U) Evaluated synthetic airborne target signatures with sufficient fidelity to support hostile target identification program.
- (U) $252 Develop advanced air-to-air engagement and weapon delivery technologies to provide for beyond visual range detection, targeting, and weapon deployment against sophisticated and reduced observable airborne threats.
  - (U) Completed concept evaluation for cooperative air-to-air engagement techniques.
- (U) $113 Develop advanced information fusion technologies to increase air engagement situation awareness and lethality through: longer range, high confidence identification; integration of offensive and defensive sensor technology; and exploitation of off-board targeting information.
  - (U) Completed architecture design and multispectral radar signal fusion algorithm development to increase confidence and opportunity for identification of airborne threats.
- (U) $217 Develop advanced tracking algorithms to increase detection range of conventional threats and maintain detection range against low cross section threats. This effort will also increase identification range of airborne threats.
  - (U) Demonstrated tracking algorithm in roof-top test to validate laboratory results of greater than 50% increase in target detection range.
- (U) $1,163 Develop technologies for targeting both stationary and moving ground-based threats with precision, utilizing both on-board and off-board targeting information. These technologies provide the targeting solution required to deploy air-to-surface weapons.
  - (U) Used flight data from an F-15 aircraft to evaluate potential to target ground-based threats using off-board sources.
  - (U) Evaluated through in-laboratory simulation the ability to target in real-time using off-board information.
- (U) $1,414 Develop the technology for an Advanced Anti-Radiation Guided Missile.
  - (U) Evaluated potential for Advanced Anti-Radiation Guided Missile to aid in the lethal destruction and suppression of enemy defenses.
- (U) $7,995 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 69DF Target Attack and Recognition Technology	

(U) FY 1996 ($ in Thousands):

- (U) $2,746 Develop synthetic signature capability for ground targets to train automatic target recognition algorithms.
  - (U) Develop and perform initial demonstration of camouflage and obscuration models for partially hidden targets.
  - (U) Demonstrate target models for use in training of automatic target recognition algorithms.
- (U) $2,129 Evaluate automatic target recognition algorithms including model-based vision algorithms for moving and stationary target acquisition and recognition and for Theater Missile Defense surveillance and attack efforts.
  - (U) Evaluate automatic target recognition algorithms, including moving and stationary target acquisition algorithms, using synthetic and measured data to assess maturity.
- (U) $1,427 Develop advanced hostile target identification technologies to provide a capability for beyond visual range, all aspect, high confidence classification, and identification of airborne targets.
  - (U) Demonstrate turnkey synthetic signature generation capability to support hostile target identification program.
- (U) $2,450 Develop advanced air-to-air engagement and weapon delivery technologies to provide a capability of beyond visual range detection, targeting, and weapon deployment against sophisticated and reduced observable airborne threats.
  - (U) Complete critical design for cooperative engagement system for fighter weapon systems.
  - (U) Conduct simulation and ground experiments of cooperative engagement and improved tracking accuracy for air-to-air weapons.
- (U) $587 Develop advanced information fusion technologies to increase air engagement situation awareness and lethality through: longer-range, high confidence identification; integration of offensive and defensive sensor technology; and exploitation of off-board targeting information.
  - (U) Integrate model-based vision algorithms into laboratory test environment to verify operational payoff.
  - (U) Evaluate advanced, multispectral radar fusion, model-based vision algorithms.
- (U) $1,599 Develop advanced tracking algorithms to increase detection range of conventional threats and maintain detection range against low cross section threats. This effort will also increase identification range of airborne threats.
  - (U) Integrate advanced tracking system into airborne data collection device.
  - (U) Collect airborne data and evaluate increase in identification range of advanced tracking algorithms compared to existing tracking systems.
- (U) $2,450 Develop technologies for targeting both moving and stationary ground-based targets utilizing both on-board and off-board targeting information. These technologies provide the targeting solution required to deploy air-to-surface weapons.
  - (U) Complete evaluation of real-time, off-board targeting solutions in support of precision synthetic aperture radar weapon systems.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 69DF Target Attack and Recognition Technology	

- (U) Evaluate off-board targeting schemes for real-time information in the cockpit study using laboratory and airborne data.

- (U) $13,388 Total

(U) FY 1997 ($ in Thousands):

- (U) $2,944 Develop synthetic signature capability for ground targets to train automatic target recognition algorithms.
  - (U) Demonstrate capability to rapidly insert synthetic signatures of new targets into automatic target recognition sensor algorithms.
  - (U) Evaluate tactical target models under camouflage and partial obscuration conditions.
- (U) $2,001 Evaluate algorithms including model-based vision algorithms for moving and stationary target acquisition and recognition and for Theater Missile Defense surveillance and attack efforts.
  - (U) Demonstrate and evaluate maturity of end-to-end algorithms, including moving and stationary target acquisition, for insertion into Theater Missile Defense demonstration efforts.
- (U) $1,448 Develop advanced hostile target identification technologies to provide a capability for beyond visual range, all aspect, high confidence classification and identification of airborne targets.
  (U) Continue to demonstrate synthetic signature generation capability to support fielded automatic target recognition systems.
- (U) $289 Develop advanced air-to-air engagement and weapon delivery technologies to provide for a beyond visual range detection, targeting, and weapon deployment capability against sophisticated and reduced observable airborne threats.
  - (U) Develop cooperative engagement subsystem technology for fighter weapon systems.
  - (U) Evaluate cooperative engagement and tracking accuracy development for air-to-air weapon deployment through continued simulation and ground-based experiments.
- (U) $603 Develop advanced information fusion technologies to increase air engagement situation awareness and lethality through: longer-range, high confidence identification; integration of offensive and defensive sensor technology; and exploitation of off-board targeting information.
  - (U) Complete ground-to-air testing at the Radar Test Facility of multispectral radar signal fusion techniques.
  - (U) Integrate multispectral radar signal fusion into airborne data collection system.
  - (U) Collect airborne data and analyze multispectral radar signature fusion technologies.
- (U) $2,736 Develop advanced tracking algorithms to increase detection range of conventional threats and maintain detection range against low cross section threats. This effort will also increase identification range of airborne threats.
  - (U) Continue to collect airborne data to evaluate the increase in identification range provided by advanced tracking algorithms versus existing tracking systems.
- (U) $3,322 Develop technologies for targeting both stationary and moving ground-based threats with precision, utilizing both on-board and off-board targeting information. These technologies provide the targeting solution required to release air-to-surface weapons.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Avionics for Aerospace Vehicles
PROJECT NO. AND NAME 69DF Target Attack and Recognition Technology	

- (U) Complete performance evaluation of advanced targeting techniques utilizing real-time off-board information from airborne data collection.
- (U) Complete analysis of off-board targeting concepts and provide option to transition to operational aircraft.

- (U) $13,343 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	8,478	14,069	13,823	Cont
(U) Current Budget Submit	7,995	13,388	13,343	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget contraints and priorities within the Science and Technology (S&T) Program. The FY 1995 to FY 1996 horizontal increase is due to an increased emphasis on precision location and targeting.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) Advanced Research Projects Agency, Moving/Stationary Target Acquisition and Recognition.
- (U) Theater Missile Defense System Program Office.
- (U) Low Altitude Night Targeting and Infrared Navigation (LANTIRN) System Program Office.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603205F Flight Vehicle Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	6,336	10,250	8,433	7,395	8,530	9,466	9,702	Continuing	Continuing
2506 Control of Flight	548	0	0	0	0	0	0	Continuing	Continuing
2978 Flight Vehicle Technologies	5,788	7,614	6,200	5,325	6,142	6,816	6,985	Continuing	Continuing
4398 Air Base Technology	0	2,636	2,233	2,070	2,388	2,650	2,717	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates advanced vehicle subsystems, aerodynamic/flight controls, and cockpit technologies for improved performance, improved survivability, reduced logistics support, technology transition, user evaluation, and air base technologies. This program also demonstrates technologies for fixed and bare base assets, including airfield pavements, energy systems, automation, air base survivability, air base recovery, protective systems, fire protection, and crash rescue. Note: This Program Element has consolidated all work previously conducted under PE 0603723F, Project 2104, into Project 4398.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603205F Flight Vehicle Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	6,643	10,793	10,150	Cont
(U) Appropriated Value	6,718	10,793		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-256	-209		
b. SBIR	-126	-234		
c. Omnibus/Other Above Threshold Reprogrammings		-100		
(U) Current Budget Submit	6,336	10,250	8,433	Cont

(U) Change Summary Explanation:

Funding: The horizontal increase from FY 1995 to FY 1996 is due to assumption of responsibility for air base technology efforts previously conducted under PE 0602206F, Project 2673. The FY 1997 horizontal decrease is due to budget constraints and an overall reduction in Air Force total obligation authority. The vertical reductions in this Program Element since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603205F Flight Vehicle Technology

PROJECT NO. AND NAME: 2506 Control of Flight

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2506 Control of Flight	548	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Develops flight control technologies, including integration of flight, propulsion, and vehicle management technologies, for improved total aircraft efficiency, performance, and maneuverability. Develops electrically powered control surface actuator and brake systems to eliminate centralized hydraulic systems and associated maintenance/safety problems. Develops "smart" actuators that utilize embedded sensors and computer actuation to enhance performance (e.g., by compensating for battle damage). Develops integration technologies to reduce the number of individual control and subsystems boxes in an aircraft by combining electrical, environmental, hydraulic, oxygen-generating, and other utility functions. Note: Work conducted under this project has been consolidated into Project 2978.

(U) FY 1995 ($ in Thousands):

- (U) $548 Develop and demonstrate technologies for integrated, multifunction aircraft utilities (e.g., electrical, environmental control, and subsystem management components).
  - (U) In a joint Air Force/Navy/NASA program, flight demonstrated electrohydrostatic and electromechanical actuators in a conventional fighter aileron.
- (U) $548 Total

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603205F Flight Vehicle Technology
PROJECT NO. AND NAME 2506 Control of Flight	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	548	0	0	Cont
(U) Current Budget Submit	548	0	0	Cont

(U) Change Summary Explanation:

Funding: Work and funding performed under this project have been incorporated into Project 2978 in FY 1996 and out.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:
- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0603216F, Aerospace Propulsion and Power.
- (U) PE 0603245F, Advanced Flight Vehicle Multidisciplinary Technologies.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603205F Flight Vehicle Technology
PROJECT NO. AND NAME 2978 Flight Vehicle Technologies	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2978 Flight Vehicle Technologies	5,788	7,614	6,200	5,325	6,142	6,816	6,985	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program designs, develops, demonstrates, and integrates air vehicle technologies for improved performance, reliability, maintainability, and supportability while increasing affordability, survivability, and mission effectiveness. It is focused on exploiting advancements in air vehicle component and subsystem technologies, aerodynamic/flight control technologies, and cockpit technologies. Note: This project continues activities in FY 1996 that were previously conducted in Projects 2506, 2508, and 3422.

(U) FY 1995 ($ in Thousands):

- (U) $5,273 Develop and demonstrate component and subsystem technologies that reduce logistics support (e.g., reduce the volume, weight, and cost of spares deployed and/or improve reliability, availability, and maintainability).
  - (U) Completed Phase 1 development of a computational system to quantitatively predict air vehicle life cycle environmental conditions for use in early design trade off analyses of future air vehicle components, subsystems, and stores.
  - (U) Completed Phase 1 evaluation of an advanced fighter aircraft main tire compound and tread design suitable as a replacement for today's fleet and for future aircraft upgrades which has significantly longer lifetime and reduced logistics/deployment requirements.
- (U) $515 Develop and demonstrate technologies that increase air vehicle survivability and safety.
  - (U) Completed the testing and assessment of the Ada-based critical flight control design and evaluation system for the development, prediction, and maintenance of flight control software in near- and far-term aircraft applications. This technology has been successfully transitioned to industry where it is currently being employed by airframe manufacturers
- (U) $5,788 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603205F Flight Vehicle Technology
PROJECT NO. AND NAME 2978 Flight Vehicle Technologies	

(U) FY 1996 ($ in Thousands):

- (U) $5,964 Develop and demonstrate advanced/integrated air vehicle component subsystems and cockpit technologies to reduce volume, weight, complexity, and cost of required spares through improved reliability, affordability, and maintainability.
  - (U) Conduct Phase 2 design, development, and demonstration of a computational system to quantitatively predict air vehicle operational loads and life cycle environmental conditions. Demonstrate the benefits of predictive technology techniques in the field to the user.
  - (U) Conduct Phase 2 analysis and evaluation of an advanced fighter aircraft main tire compound and tread design suitable for today's fleet and for future aircraft upgrades which has significantly longer lifetime and reduced logistics/deployment requirements.
  - (U) Conduct final design testing and evaluation of a unique air vehicle tire wear assessment system which can simulate operational loads in a controlled environment.
- (U) $1,650 Develop and demonstrate advanced air vehicle and flight control concepts to provide a combat advantage for the next generation aircraft by increasing performance and survivability while decreasing both cost and supportability requirements.
  - (U) Complete the assessment and evaluation of the electromechanical actuator design for flight test demonstration.
  - (U) Complete flight tests of the electrohydrostatic actuator design on an F/A-18 aircraft which will establish a baseline for electric actuation technology as a primary method of flight control.
- (U) $7,614 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603205F Flight Vehicle Technology
PROJECT NO. AND NAME 2978 Flight Vehicle Technologies	

(U) FY 1997 ($ in Thousands):

- (U) $5,600 Develop and demonstrate advanced/integrated air vehicle component subsystems and cockpit technologies to reduce volume, weight, complexity, and cost of required spares through improved reliability, affordability, and maintainability.
  - (U) Complete design, development, and demonstration of the computational system to quantitatively predict air vehicle operational loads and life cycle environmental conditions and transition it to the Systems Program Office and Air Logistics Center users.
  - (U) Complete the development and demonstration of an advanced fighter aircraft main tire compound and tread design suitable for today's fleet and for future aircraft upgrades which has significantly longer lifetime and reduced logistics/deployment requirements.
  - (U) Correlate advanced analytical model predictions with realistic operational load measurements of tread wear obtained from the unique air vehicle tire wear assessment system; establish the baseline for using new tire design technology to obtain extended tire life.
  - (U) Develop and demonstrate advanced radial tire retreading technology for current and future fighter aircraft applications; establish the cost benefits and determine the reliability of retread tire technology for aircraft tire usage.
  - (U) Develop on-board software for automatic in-flight mission re-planning, trajectory generation, flight control coupling, and cockpit controls and displays in order to reduce pilot workload when off-board information enters the cockpit.
- (U) $600 Develop and demonstrate advanced air vehicle and flight control concepts to provide a combat advantage for the next generation aircraft by increasing performance and survivability while decreasing both cost and supportability requirements.
  - (U) Develop methodologies for test and verification of integrated air vehicle technologies which provide affordable, low risk, proof of concept demonstrations of advanced flight controls/cockpits, aeromechanical designs, structural concepts, and subsystems components.
  - (U) Develop design of joint Service, common optical air data system with reduced radar cross section, higher reliability, and lower cost to replace conventional air data probes and flush ports on current and future air vehicles.
  - (U) Ground demonstrate Intelligent Pump Electric Actuation System for high-horsepower, flight critical control surfaces enabling an all electric aircraft reducing aircraft weight and increasing system reliability and maintainability.
- (U) $6,200 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603205F Flight Vehicle Technology
PROJECT NO. AND NAME 2978 Flight Vehicle Technologies	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	6,095	8,017	7,224	Cont
(U) Current Budget Submit	5,788	7,614	6,200	Cont

(U) Change Summary Explanation:

Funding: Horizontal increases from FY 1995 to FY 1996 were to address added emphasis on flight vehicle technologies to meet user needs identified by the Air Force aging aircraft initiative to extend the life of existing operational aircraft. FY 1997 horizontal decrease is due to overall reduction in Air Force total obligation authority. Vertical reductions in the project are due to balancing budget constraints against priorities within the Science and Technology Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0603216F, Aerospace Propulsion and Power.
- (U) PE 0603245F, Advanced Flight Vehicle Multidisciplinary Technologies.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603205F Flight Vehicle Technology
PROJECT NO. AND NAME 4398 Air Base Technology	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4398 Air Base Technology	0	2,636	2,233	2,070	2,388	2,650	2,717	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops technologies for fixed and bare base operations, including airfield pavements, energy systems, air base survivability, air base recovery, protective systems, fire protection, and crash rescue. This project incorporates the work previously started under PE 0603723F, Project 2104.

(U) FY 1995: Not Applicable.

(U) FY 1996 ($ in Thousands):

- (U) $1,041 Develop and demonstrate technologies for improved bare base and fixed site applications (e.g., survivable air base structures, and durable or repairable airfield surfaces).
  - (U) Develop portable ground penetrating radar and user interface for rapid evaluation of bare base contingency runway conditions.
  - (U) Develop in-theater material hardening methods to protect contingency air base assets at 25-30% reduction in cost.
  - (U) Develop new air mobile structures and on-site hardening techniques to improve bare base and contingency site operations.
  - (U) Complete field tests on repairs constructed with non-standard materials.
- (U) $1,595 Develop aircraft and air base fire fighting and power generation technologies (e.g., clean, environmentally-safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment techniques, and fire fighter training systems; lightweight generator systems; and advanced fuel cells).
  - (U) Complete development of a combined fire fighting and hazardous materials ensemble, providing firefighters with a greater ability to operate in intense heat and hazardous environments.
  - (U) Develop advanced hypergolic vapor and fuel fire detection or suppression technologies.
  - (U) Complete development of lightweight generator system, for bare base application, resulting in 30% decrease in weight and 40% decrease in size and transition to Airbase Operability System Program Office.
  - (U) Develop a concept to reduce and stabilize bare base waste stream management by integrating treatment, incineration, and recycling.
  - (U) Develop technologies for improved fire fighting agents, equipment, and techniques to fight large frame aircraft fires, including interior and flowing fuel fires.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603205F Flight Vehicle Technology
PROJECT NO. AND NAME 4398 Air Base Technology	

- (U) $2,636 Total

(U) FY 1997 ($ in Thousands):

- (U) $915 Develop and demonstrate technologies for improved bare base and fixed site applications (e.g., survivable air base structures, and durable or repairable airfield surfaces).
  - (U) Develop man-portable ground penetrating radar for bare base contingency runway conditions.
  - (U) Validate advanced hardening techniques and processes for upgrading existing air base buildings and assets.
  - (U) Complete development of protective systems using in-theater materials to harden critical air base assets in contingency operations.
  - (U) Develop deployable pavement evaluation techniques and equipment for rapid evaluation of bare base runway conditions.
- (U) $1,318 Develop aircraft and air base fire fighting and power generation technologies (e.g., clean, environmentally-safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment techniques, and fire fighter training systems; lightweight generator systems; and advanced fuel cells).
  - (U) Develop advanced hypergolic vapor and fuel fire detection or suppression technologies.
  - (U) Conduct large-scale live fire testing to validate the performance of environmentally acceptable aqueous film forming foam, a replacement agent for Halon.
  - (U) Complete large frame aircraft fire fighting program to aid in extinguishing external and internal fires of transport aircraft.
  - (U) Develop advanced cycle mobile heat pump.
  - (U) Develop control improvements in backup power generation systems.
- (U) $2,233 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603205F Flight Vehicle Technology
PROJECT NO. AND NAME 4398 Air Base Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	2,776	2,926	Cont
(U) Current Budget Submit	0	2,636	2,233	Cont

(U) Change Summary Explanation:

Funding: This project assumes responsibility for air base technology efforts conducted under PE 0603723F, Project 2104, starting in FY 1996 and continuing. The FY 1997 horizontal decrease is due to budget constraints and an overall reduction in Air Force total obligation authority. Vertical reductions in this project since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0602206F, Civil Engineering and Environmental Quality.
- (U) PE 0603307F, Air Base Operability Advanced Technology Development.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603211F Aerospace Structures

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	11,339	12,615	10,423	17,111	17,931	16,724	15,573	Continuing	Continuing
486U Advanced Aerospace Structures	5,435	6,181	10,423	17,111	17,931	16,724	15,573	Continuing	Continuing
69CW Advanced Composites	5,904	6,434	0	0	0	0	0	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates affordable aircraft structures by utilizing innovative metallic and composite structures technologies to reduce the cost of airframe ownership. Innovative structural concepts integrate these two types of materials with design and monitoring techniques to develop and demonstrate solutions and repairs for corrosion fatigue, multi-site damage fatigue, and other damage to which aging aircraft are susceptible. The goal of this program is to develop technologies to restore structural integrity, extend life, and improve survivability of the current fleet. The results are less maintenance intensive, more durable, and more dependable structures for current aerospace systems. This yields lower cost of ownership (by delaying acquisition and by reducing support and maintenance costs), restored and improved sortie rates (due to durability, damage or threat tolerance, and design for supportability), and reduced observability (both radar cross section and infrared).

Note: Starting in FY 1997, this Program Element will consolidate all work done under its two Projects (486U and 69CW) into a single Project (486U). In addition, the title of Project 486U will change from *Advanced Metallics* to *Advanced Aerospace Structures.*

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603211F Aerospace Structures

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	12,064	13,269	12,828	Cont
(U) Appropriated Value	12,300	13,269		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-567	-257		
b. SBIR	-229	-277		
c. Omnibus/Other Above Threshold Reprogrammings	-130	-120		
d. Below Threshold Reprogrammings	-35			
(U) Current Budget Submit	11,339	12,615	10,423	Cont

(U) Change Summary Explanation:

Funding: Horizontal increase from FY 1995 to FY 1996 is to address added emphasis on aerospace structures technology to meet user needs identified by the Air Force aging aircraft initiative to extend the life of existing operational aircraft. FY 1997 horizontal decrease is due to overall reduction in Air Force total obligation authority. Vertical reductions in this Program Element are due to balancing budget constraints against priorities within the Science and Technology Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603211F Aerospace Structures

PROJECT NO. AND NAME: 486U Advanced Aerospace Structures

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
486U Advanced Aerospace Structures	5,435	6,181	10,423	17,111	17,931	16,724	15,573	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project demonstrates new aerospace structures technologies which use advanced metals (such as metal matrix composites, rapidly solidified metal powders, advanced aluminum and titanium alloys, and advanced damping materials) and non-metallic technologies (such as thermoplastics, fiber-reinforced thermoset, carbon-carbon, and ceramics). Technologies demonstrated in this project will yield air vehicles with lower weights, greater reliability, improved survivability (reduced ballistic/laser damage, etc.), reduced signatures, improved supportability, and increased affordability.

(U) FY 1995 ($ in Thousands):

- (U) $2,034 Develop metallic structural design concepts and repair techniques for future and existing air vehicles.
  - (U) Completed preliminary design for exhaust-impinged metallic structures to overcome structural failures of components in severe thermal and acoustic environments.
- (U) $3,401 Demonstrate feasibility of advanced metallic structures via algorithms and demonstrations.
  - (U) Completed detailed design analysis of a smart metallic structures component for demonstration of structural health monitoring for present and future operational aircraft.
- (U) $5,435 Total

(U) FY 1996 ($ in Thousands):

- (U) $2,250 Develop processes for extending the structural life of aircraft.
  - (U) Complete fabrication of a wing spar that demonstrates replacement of corrosion-sensitive components in existing aircraft.
  - (U) Complete full-scale test of a structural demonstration article for a fighter bulkhead with health monitoring capability to automate the inspections for crack growth while decreasing maintenance, repair, and replacement requirements.
- (U) $2,182 Improve durability and performance of vehicle structures operating in extreme thermal and acoustic environments.
  - (U) Complete detailed design of a metallic, exhaust-impinged aft fuselage component to overcome structural failures in components in severe thermal and acoustic environments.
- (U) $1,749 Develop structural concepts and design processes for existing and future air vehicles.
  - (U) Complete preliminary design of a battle-damage resistant aircraft structural component to demonstrate increased aircraft survivability.
- (U) $6,181 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603211F Aerospace Structures
PROJECT NO. AND NAME 486U Advanced Aerospace Structures	

(U) FY 1997 ($ in Thousands):

- (U) $1,424 Validate processes for extending the structural life of aircraft.
  - (U) Complete ground and flight tests of a wing spar to demonstrate replacement of corrosion-sensitive components in an existing aircraft.
  - (U) Develop corrosion fatigue predictive model to assess structural integrity, life, and intervals of inspection for corrosion affected components in existing aircraft.
  - (U) Develop composite repair process for damaged and cracked components in existing aircraft.
- (U) $2,724 Improve durability and performance of vehicle structures operating in extreme thermal and acoustic environments.
  - (U) Complete fabrication of a metallic, exhaust-impinged aft fuselage component to overcome structural failures of components in severe thermal and acoustic environments.
  - (U) Complete preliminary design of an integrated aft fuselage and nozzle section structures to reduce weight and improve aircraft performance.
- (U) $5,903 Develop advanced structural concepts and design methods for future and existing air vehicles.
  - (U) Complete detailed design of aircraft structural component to demonstrate significant increase in survivability of existing military aircraft.
  - (U) Complete detailed design of sandwich structures that reduce weight and cost of primary aircraft structure.
  - (U) Complete acoustical ground testing of an advanced aircraft control surface to demonstrate low-observable characteristics.
  - (U) Complete durability and damage testing of a composite bonded wing structure which will reduce manufacturing costs by 50% and supportability costs by 25%.
  - (U) Complete preliminary design of a flexible wing that twists to control flight, significantly improving maneuverability and range, and reducing air vehicle structural weight.
- (U) $372 Develop advanced airframe concepts which integrate structures with distributed actuators and sensors.
  - (U) Complete ground test of conformal load bearing antenna structure which reduces cost, weight, drag, and low-observable characteristics and providing new and improved antenna performance.
- (U) $10,423 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603211F Aerospace Structures
PROJECT NO. AND NAME 486U Advanced Aerospace Structures	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	6,160	6,502	6,286	
(U) Current Budget Submit	5,435	6,181	10,423	Cont

(U) Change Summary Explanation:

Funding: Horizontal increase from FY 1995 to FY 1996 is to address added emphasis on advanced aerospace structures technology to meet user needs identified by the Air Force aging aircraft initiative to extend the life of existing operational aircraft. FY 1997 horizontal/vertical increase is due to the incorporation of work previously performed under Project 69CW. Vertical reductions in this project in FY 1995 and FY 1996 since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602201, Aerospace Flight Dynamics.
- (U) PE 0603112F, Advanced Materials for Weapon Systems.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603211F Aerospace Structures

PROJECT NO. AND NAME: 69CW Advanced Composites

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
69CW Advanced Composites	5,904	6,434	0	0	0	0	0	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project demonstrates new non-metallic structures technology using fiber reinforced thermoset, thermoplastic, carbon-carbon, ceramic, and other non-metallic materials to yield lower weight, greater reliability, improved survivability (ballistic/laser damage, etc.), reduced signature, supportability, and affordability. Beginning in FY 1997, this project is combined with 486U.

(U) FY 1995 ($ in Thousands):

- (U) $5,904 Develop low-cost composite design concepts and repair techniques for future and existing air vehicles.
  - (U) Completed development and transition of a low-observable F110 engine flap for increased survivability.
  - (U) Expanded low-cost composites design capability to include live fire testing for increased battle damage survivability.
  - (U) Completed conceptual design of robust composite sandwich structures which reduce acquisition and maintenance costs.
- (U) $5,904 Total

(U) FY 1996 ($ in Thousands):

- (U) $1,062 Improve durability and performance of vehicle structures operating in extreme thermal and acoustic environments.
  - (U) Complete testing of wing box component for high-temperature military airframe applications.
  - (U) Develop concept for high-temperature aft fuselage section to reduce weight and increase performance.
- (U) $4,370 Develop advanced concepts and design methods for future and existing air vehicles.
  - (U) Select materials for employing sandwich concepts in primary aircraft structures.
  - (U) Complete live fire test on a bonded composite wing to demonstrate survivability.
- (U) $1,002 Develop advanced airframe concepts which integrate structures with distributed actuators and sensors.
  - (U) Complete fabrication of conformal load bearing antenna structure, combining avionics and structural elements, to reduce cost, weight, and drag, improve low-observance characteristics, and provide new and improved antenna performance.
- (U) $6,434 Total

(U) FY 1997 ($ in Thousands): Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603211F Aerospace Structures
PROJECT NO. AND NAME 69CW Advanced Composites	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,904	6,767	6,542	Cont
(U) Current Budget Submit	5,904	6,434	0	Cont

(U) Change Summary Explanation:

Funding: Horizontal increase from FY 1995 to FY 1996 is to address added emphasis on advanced composites technology to meet user needs identified by the Air Force aging aircraft initiative to extend the life of existing operational aircraft. FY 1996 vertical reduction to this project since the previous President's Budget is due to balancing budget constraints against priorities within the Science and Technology Program. FY 1997 horizontal/vertical decrease is due to consolidation of work under this project into Project 486U.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

- (U) Related Activities:
- (U) PE 062102F, Materials.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603216F Aerospace Propulsion and Power Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	34,133	39,632	38,264	39,282	41,279	42,732	45,761	Continuing	Continuing
2480 Aerospace Fuels Technology	1,682	2,311	1,904	1,931	1,971	1,989	1,978	Continuing	Continuing
2697 Atmospheric Propulsion Concepts	2,774	4,500	2,315	1,570	1,569	1,690	1,680	Continuing	Continuing
3035 Aerospace Power Systems Technology	2,460	2,589	2,731	5,408	5,404	5,817	5,781	Continuing	Continuing
681B Advanced Turbine Engine Gas Generator	27,217	30,232	31,314	30,373	32,335	33,236	36,322	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates affordable turbine engine high pressure core components, advanced airbreathing engine concepts, high heat sink and thermally stable fuels, and power technology for aerospace vehicles. Anticipated technology advances include: turbine engine improvements providing a 33% reduction in aircraft takeoff gross weight for tactical fighter aircraft and a 100% increase in aircraft range/loiter; ducted rocket improvements that increase missile average and terminal velocity by 50% and range by 100% for enhanced lethality; higher temperature fuels for propulsion and thermal management; an aircraft battery with a 20-year maintenance-free life expectancy; and electric aircraft power components projected to provide a two- to five-fold improvement in reliability and maintainability, a 20% reduction in power system weight, and enhanced survivability.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	36,579	41,779	41,222	Cont
(U) Appropriated Value	37,345	41,779		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-1,772	-810		
b. SBIR	-695	-934		
c. Omnibus/Other Above Threshold Reprogrammings	-395	-403		
d. Below Threshold Reprogrammings	-350			
(U) Current Budget Submit	34,133	39,632	38,264	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal reductions in FY 1997 are due to budget constraints and priorities within the S&T Program. Turbine engine efforts restored in FY 1996 and FY 1997 to achieve Phase II Integrated High Performance Turbine Engine Technology goals by FY 1997.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603216F Aerospace Propulsion and Power Technology

PROJECT NO. AND NAME: 2480 Aerospace Fuels Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2480 Aerospace Fuels Technology	1,682	2,311	1,904	1,931	1,971	1,989	1,978	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops and demonstrates new thermally stable and high heat sink fuels and advanced fuel system components that minimize cost, reduce maintenance, and improve performance of aircraft and missiles. Emphasis is on demonstrating the effects/benefits of: 1) JP-8+100 on current systems; and 2) advanced high temperature fuel system designs and components on upgraded and advanced systems.

(U) FY 1995 ($ in Thousands):

- (U) $1,305 Demonstrate thermally stable JP-8+100 and high heat sink fuels that reduce fuel system maintenance on current aircraft and provide greater cooling capacity (performance) for upgraded and future aircraft and missiles.
  - (U) Demonstrated reduced fuel system maintenance in F-16s by conducting field trial of JP-8+100 at the 114FS Air National Guard.
- (U) $377 Demonstrate advanced fuel system designs and high temperature components that permit utilization of the increased cooling capacity of JP-8+100 and high heat sink fuels.
  - (U) Conducted design analysis of fuel system design/hardware to permit utilization of the higher cooling capacity of JP-8+100.
- (U) $1,682 Total

(U) FY 1996 ($ in Thousands):

- (U) $1,637 Demonstrate thermally stable JP-8+100 and high heat sink fuels that reduce fuel system maintenance on current aircraft and provide greater cooling capacity (performance) for upgraded and future aircraft and missiles.
  - (U) Complete demonstration of JP-8+100 effects on turbine materials and on fuel gauging systems.
  - (U) Demonstrate effects/benefits of JP-8+100 in component and engine stand tests of GE F101 and F110 engines.
- (U) $674 Demonstrate advanced fuel system designs and high temperature components that permit utilization of the increased cooling capacity of JP-8+100 and high heat sink fuels.
  - (U) Demonstrate operation of a scaled fan bleed-air/fuel heat exchanger, designed as an aircraft upgrade that will eliminate recirculation of hot fuel through a less efficient ram air/fuel heat exchanger.
  - (U) Continue analysis of fuel system design/hardware to permit utilization of the higher cooling capacity of JP-8+100.
- (U) $2,311 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology
PROJECT NO. AND NAME 2480 Aerospace Fuels Technology	

(U) FY 1997 ($ in Thousands):

- (U) $1,651 Demonstrate thermally stable JP-8+100 and high heat sink fuels that reduce fuel system maintenance on current aircraft and provide greater cooling capacity (performance) for upgraded and future aircraft and missiles.
  - (U) Demonstrate effects/benefits of JP-8+100 in component and engine stand tests of GE F404 engines.
  - (U) Demonstrate reduced fuel system maintenance in B-1s by conducting field trial of JP-8+100 at a selected base.
- (U) $253 Demonstrate advanced fuel system designs and high temperature components that permit utilization of the increased cooling capacity of JP-8+100 and high heat sink fuels.
  - (U) Demonstrate high heat sink fuel/air heat exchanger suitable for incorporation into subsystem integration packages.
- (U) $1,904 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,784	2,436	1,561	Cont
(U) Current Budget Submit	1,682	2,311	1,904	Cont

(U) Change Summary Explanation:

Funding: Vertical increase to this project in FY 1997 since the previous President's Budget is due to emphasis on field demonstration of JP-8+100. Other horizonal/vertical changes are due to budget constraints and priorities within the Science and Technology Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602203F, Aerospace Propulsion.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603216F Aerospace Propulsion and Power Technology

PROJECT NO. AND NAME: 2697 Atmospheric Propulsion Concepts

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2697 Atmospheric Propulsion Concepts	2,774	4,500	2,315	1,570	1,569	1,690	1,680	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Demonstrates unconventional airbreathing propulsion subsystems such as ramjets, air turborockets, dual mode ramjets,and combined/advanced-cycle engines to assure future propulsion options for high-speed missiles. Currently, the Variable Flow Ducted Rocket (VFDR) concept is being developed as an improved propulsion system for current missile upgrades or future missile systems developments.

(U) FY 1995 ($ in Thousands):

- (U) $2,680 Develop VFDR for airbreathing missile applications. This effort transitions technology to current and future tactical missiles providing longer range, higher velocities, and increased maneuverability, resulting in improved overall missile effectiveness.
  - (U) Completed development testing of flightweight nozzleless booster motors.
  - (U) Demonstrated flightweight arm/fire device operation via environmental testing.
  - (U) Fabricated integrated flightweight engines for future rocket-to-ramjet transition and performance documentation testing.
- (U) $94 Plan development of high-speed propulsion systems for manned and unmanned applications. This effort provides technology for future missile systems where time-to-target is critical and technology for next generation reconnaissance/strike vehicles and airbreathing boosters.
  - (U) Performed High-Speed Airbreathing Engine analysis and evaluations to ensure a coordinated and focused future direction for high-speed propulsion options for manned and unmanned Air Force systems.
- (U) $2,774 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology
PROJECT NO. AND NAME 2697 Atmospheric Propulsion Concepts	

(U) FY 1996 ($ in Thousands):

- (U) $4,405 Develop Variable Flow Ducted Rocket (VFDR) for airbreathing missile applications. This effort transitions technology to current and future tactical missiles providing longer range, higher velocities, and increased maneuverability, resulting in improved overall missile effectiveness.
  - (U) Perform rocket-to-ramjet mode transition testing to demonstrate technology maturity for advanced missile propulsion applications.
  - (U) Complete ramburner performance testing.
  - (U) Complete fabrication of flightweight engines for rocket-to-ramjet transition and performance documentation testing.
- (U) $95 Develop high-speed propulsion systems for manned and unmanned applications. This effort provides technology for future missile systems where time-to-target is critical and technology for next generation reconnaissance/strike vehicles and airbreathing boosters.
  - (U) Plan design/development of dual-mode ramjet engines for high-speed missiles for destroying high value, time-critical targets.
  - (U) Plan design/development of combined/advanced-cycle engines for manned and unmanned high-speed vehicles applicable to reconnaissance/strike missions.
- (U) $4,500 Total

(U) FY 1997 ($ in Thousands):

- (U) $2,215 Develop VFDR for airbreathing missile applications. This effort transitions technology to current and future tactical missiles providing longer range, higher velocities, and increased maneuverability, resulting in improved overall missile effectiveness.
  - (U) Complete rocket-to-ramjet mode transition and performance documentation testing to demonstrate technology maturity for advanced missile propulsion applications.
  - (U) Complete ground technology demonstration of VFDR technology and document results.
- (U) $100 Develop high-speed propulsion systems for manned and unmanned applications. This effort provides technology for future missile systems where time-to-target is critical and technology for next generation reconnaissance/strike vehicles and airbreathing boosters.
  - (U) Plan design/development of dual-mode ramjet engines for high-speed missiles for destroying high value, time-critical targets.
  - (U) Plan design/development of combined/advanced-cycle engines for manned and unmanned high-speed vehicles applicable to reconnaissance/strike missions.
- (U) $2,315 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology
PROJECT NO. AND NAME 2697 Atmospheric Propulsion Concepts	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,914	4,743	1,584	Cont
(U) Current Budget Submit	2,774	4,500	2,315	Cont

(U) Change Summary Explanation:

Funding: Vertical increases to this project in FY 1997 since the previous President's Budget is due to changes in completion of Variable Flow Ducted Rocket (VFDR) demonstration. Other horizonal/vertical changes are due to budget constraints and priorities within the Science and Technology Program.

Schedule: Completion of VFDR demonstration delayed until mid-FY 1997.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603216F Aerospace Propulsion and Power Technology

PROJECT NO. AND NAME: 3035 Aerospace Power Systems Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3035 Aerospace Power Systems Technology	2,460	2,589	2,731	5,408	5,404	5,817	5,781	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops and demonstrates aircraft and ground power systems including engine starters, auxiliary power units, and electrical power distribution systems. The principal focus is to provide a two- to five-fold improvement in reliability and maintainability and significantly reduced cost of ownership for aircraft and ground power systems. This will be accomplished by replacing fluid-powered (hydraulics/bleed air) accessories with electrically-powered systems. Representative improvements include: increased reliability (8-18%); improved maintainability (9-12%); and reduced vulnerability (12-14%).

(U) FY 1995 ($ in Thousands):

- (U) $2,460 Design, fabricate, and test components supporting a demonstrator aircraft electrical distribution system. The electrical distribution system ensures fault tolerant architecture, improving aircraft reliability and survivability.
  - (U) Integrated power conditioning and load management components to develop electrical load management center (electronic brain of electrical distribution network) which guarantees a two-fold increase in fault tolerance.
  - (U) Completed fabrication of electrical power system that integrates power generation and electrical distribution functions.
- (U) $2,460 Total

(U) FY 1996 ($ in Thousands):

- (U) $1,989 Design, fabricate, and test components supporting a demonstrator aircraft electrical distribution system. The electrical distribution system ensures fault tolerant architecture, improving aircraft reliability and survivability.
  - (U) Complete hardware fabrication of fault tolerant 270 Volts direct current (Vdc) aircraft electrical power system to demonstrate a two-fold increase in reliability and a 40% weight reduction for the secondary power system.
  - (U) Complete detail design of an advanced motor controller for aircraft offering a 50% improvement in power density and reliability.
- (U) $600 Design, fabricate, and test a demonstrator aircraft on-board Integrated Power Unit (IPU). The IPU is critical for aircraft engine starting, auxiliary power, and emergency power.
  - (U) Complete detailed design and fabrication of aircraft on-board IPU hardware for demonstration testing.
- (U) $2,589 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology
PROJECT NO. AND NAME 3035 Aerospace Power Systems Technology	

(U) FY 1997 ($ in Thousands):

- (U) $2,126 Design, fabricate, and test components supporting a demonstrator aircraft electrical distribution system. The electrical distribution system ensures fault tolerant architecture, improving aircraft reliability and survivability.
  - (U) Test fault tolerant 270 Volts direct current (Vdc) power system demonstrating fault tolerance and a 40% reduction in weight.
  - (U) Fabricate and test advanced motor controller for aircraft demonstrating a 50% improvement in power density.
- (U) $605 Design, fabricate, and test a demonstrator aircraft on-board Integrated Power Unit (IPU). The IPU is critical for aircraft engine starting, auxiliary power, and emergency power.
  - (U) Test aircraft on-board IPU hardware to demonstrate the integration of auxiliary and engine electrical starting power functions providing a two- to three-fold increase in reliability and a two-fold reduction in weight.
- (U) $2,731 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,010	2,728	4,213	Cont
(U) Current Budget Submit	2,460	2,589	2,731	Cont

(U) Change Summary Explanation:

Funding: Horizontal/vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603216F Aerospace Propulsion and Power Technology

PROJECT NO. AND NAME: 681B Advanced Turbine Engine Gas Generator

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
681B Advanced Turbine Engine Gas Generator	27,217	30,232	31,314	30,373	32,335	33,236	36,322	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops turbine engine gas generator technology to meet the requirements of current and future aircraft propulsion systems. The objective is to provide the continued evolution of technologies into an advanced gas generator in which the performance, cost, durability, repairability, and maintainability aspects can be assessed in a real engine environment. The gas generator, or core, is the basic building block of the engine and it consists of a compressor, a combustor, and a high pressure turbine. Experimental core engine testing enhances early, low-risk transition of key engine technologies into engineering development where they can be applied to derivative and/or new systems. These technologies are applicable to a wide range of military and commercial systems including aircraft, missiles, land combat vehicles, and ships. The ATEGG project supports the Integrated High Performance Turbine Engine Technology (IHPTET) initiative. IHPTET is a three phase, totally integrated DOD, ARPA, NASA, and industry initiative focused on doubling turbine engine propulsion capabilities while reducing cost of ownership. The IHPTET program structure provides continuous technology transition for military turbine engine upgrades and derivatives and has the added benefit of enhancing the U.S. turbine engine industry's international competitiveness and demonstrates affordable turbine engine high pressure core components.

(U) FY 1995 ($ in Thousands):

- (U) $25,822 Design, fabricate, and test technology demonstration core engines for turbofan/turbojet engines for fighters, attack aircraft, bombers, and transports.
  - (U) Tested turbofan/turbojet core with a 600°F increase in maximum temperature capability and 40% increase in thrust-to-weight ratio.
  - (U) Completed the preliminary design and fabricated turbofan/turbojet core engine hardware (flexible, variable cycle core; high temperature metal matrix composite compressor rotor; low-cost, cast-cooled turbine blade) in support of performance core engine testing.
  - (U) Completed the detailed design and fabricated turbofan/turbojet core engine hardware (titanium aluminide (TiAl) compressor blades; supercooled turbine components; lamilloy turbine vanes) in support of durability core engine testing.
- (U) $1,395 Design, fabricate, and test technology demonstration core engines for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, and theater transports.
  - (U) Completed turboprop/turboshaft core engine testing demonstrating a 21% reduction in fuel consumption and a 55% increase in power-to-weight ratio (relative to 1986 baseline).
  - (U) Designed and fabricated turboprop/turboshaft core engine hardware for demonstrator engine testing.
- (U) $27,217 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology
PROJECT NO. AND NAME 681B Advanced Turbine Engine Gas Generator	

(U) FY 1996 ($ in Thousands):

- (U) $29,410 Design, fabricate, and test technology demonstration core engines for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports.
  - (U) Fabricate turbofan/turbojet core engine hardware (flexible, variable cycle core; high temperature metal matrix composite compressor rotor; low-cost, cast-cooled turbine blade) in support of performance core engine testing.
  - (U) Complete fabrication of turbofan/turbojet core engine hardware (titanium aluminide (TiAl) compressor blades; supercooled turbine components; lamilloy turbine vanes) in support of durability core engine testing.
- (U) $822 Design, fabricate, and test technology demonstration core engines for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, and theater transports.
  - (U) Test turboprop/turboshaft cores with a goal of 25% reduction in fuel consumption and a 60% increase in power-to-weight ratio (relative to 1986 baseline).
  - (U) Fabricate turboprop/turboshaft core engine hardware in support of core engine testing.
- (U) $30,232 Total

(U) FY 1997 ($ in Thousands):

- (U) $29,627 Design, fabricate, and test technology demonstration core engines for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports.
  - (U) Test turbofan/turbojet core engines demonstrating a 30% reduction in fuel consumption, a 60% increase in thrust-to-weight ratio, a 20% reduction in manufacturing cost, and a 20% reduction in maintenance costs.
  - (U) Conduct durability tests of turbofan/turbojet core engine demonstrating critical technology potential life characteristics.
- (U) $1,687 Design, fabricate, and test technology demonstration core engines for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, and theater transports.
  - (U) Test a turboprop/turboshaft core engine demonstrating a 30% reduction in fuel consumption and an 80% increase in power-to-weight ratio.
- (U) $31,314 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Power Technology
PROJECT NO. AND NAME 681B Advanced Turbine Engine Gas Generator	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	28,871	31,872	33,864	Cont
(U) Current Budget Submit	27,217	30,232	31,314	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Turbine engine efforts restored in FY 1996 and FY 1997 to achieve Phase II integrated High Performance Turbine Engine Technology goals by FY 1997.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0603202F, Aircraft Propulsion Subsystem Integration.
- (U) PE 0602122N, Aircraft Technology.
- (U) PE 0603210N, Aircraft Propulsion.
- (U) PE 0603003A, Aviation Advanced Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603227F Personnel, Training, and Simulation Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	8,382	8,574	7,761	6,778	7,955	8,061	8,262	Continuing	Continuing
2743 Combat Aircrew Training Technology	4,862	4,974	4,884	4,202	5,102	5,130	5,296	Continuing	Continuing
2922 Manpower and Force Management	1,509	1,458	1,151	1,017	1,141	1,172	1,186	Continuing	Continuing
2949 Advanced Training Technology	2,011	2,142	1,726	1,559	1,712	1,759	1,780	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates improved operational readiness and combat training through Manpower, Personnel, and Training (MPT) technologies. MPT includes: systems to write computer-based training programs; decision-aiding systems to optimize personnel use; job performance measurement technologies; analytical tools to better consider MPT in systems design; and realistic aircrew combat training.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603227F Personnel, Training, and Simulation Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	8,889	8,930	7,695	Cont
(U) Appropriated Value	9,000	8,930		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reduction	-354	-173		
b. SBIR	-169	-183		
c. Omnibus/Other Above Threshold Reprogrammings	-95			
d. Below Threshold Reprogrammings				
(U) Current Budget Submit	8,382	8,574	7,761	Cont

(U) Change Summary Explanation:

Funding: Horizontal/vertical changes since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603227F Personnel, Training, and Simulation Technology

PROJECT NO. AND NAME: 2743 Combat Aircrew Training Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2743 Combat Aircrew Training Technology	4,862	4,974	4,884	4,202	5,102	5,130	5,296	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops, demonstrates, and evaluates simulator-based air combat training technology as an affordable, effective, and realistic adjunct to flight-based training. Provides a technology testbed for examining aircrew skills, cognitive functions, behaviors, and instructional strategies contributing to combat success. Evaluates technologies for long-distance computer networking to enhance current methods for joint-Service training.

(U) FY 1995 ($ in Thousands):

- (U) $3,014 Develop and demonstrate aircrew training technology for armed forces personnel training.
  - (U) Developed low-cost, high fidelity, deployable technology training demonstrator for the A-10.
  - (U) Demonstrated deployable visual display technology for combat units.
- (U) $1,848 Develop and demonstrate night vision goggle (NVG) training and guidelines to meet Air Force mission requirements.
  - (U) Developed and evaluated distance estimation training program for rotor wing NVG use.
  - (U) Developed and evaluated NVG training media.
  - (U) Developed guidelines for high fidelity visual imagery for NVG training.
- (U) $4,862 Total

(U) FY 1996 ($ in Thousands):

- (U) $2,636 Develop and demonstrate aircrew training devices and associated technologies for personnel training.
  - (U) Develop, integrate, and evaluate existing joint-Service training environments for Distributed Mission Training.
  - (U) Perform training utility evaluation of a multi-ship training air-to-ground technology testbed.
  - (U) Develop advanced network gateway technology for distributed training and mission rehearsal.
  - (U) Conduct F-15 Situational Awareness Training effectiveness evaluation.
  - (U) Determine four (4) ship versus many ship simulation baseline.
- (U) $2,338 Develop and demonstrate NVG training technologies and guidelines to meet Air Force mission requirements.
  - (U) Continue development of high fidelity visual simulation of NVG imagery for NVG training.
  - (U) Develop advanced NVG training technology.
  - (U) Demonstrate interactive Forward Looking Infrared/NVG procedures/techniques.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603227F Personnel, Training, and Simulation Technology
PROJECT NO. AND NAME 2743 Combat Aircrew Training Technology	

- (U) $4,974 Total

(U) FY 1997 ($ in Thousands):

- (U) $1,893 Develop and demonstrate aircrew training technology for armed forces personnel training.
  - (U) Develop secure network recommendations.
  - (U) Demonstrate and evaluate an F-15 four ship training technology demonstrators in an integrated threat environment.
- (U) $1,119 Demonstrate virtual and constructive environments for distributed mission training.
  - (U) Demonstrate multi-Service capable virtual and constructive environments for Distributed Mission Training.
  - (U) Develop functional specification for networked aircrew training.
- (U) $1,872 Develop and demonstrate Night Vison Goggle (NVG) training and guidelines to meet Air Force requirements.
  - (U) Develop and demonstrate NVG mission specific training technology.
  - (U) Develop and demonstrate low-cost visual display technology suitable for NVG training.
- (U) $4,884 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603227F Personnel, Training, and Simulation Technology
PROJECT NO. AND NAME 2743 Combat Aircrew Training Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,129	5,180	4,550	Cont
(U) Current Budget Submit	4,862	4,974	4,884	Cont

(U) Change Summary Explanation:

Funding: Horizontal/vertical changes since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0604227F, Flight Simulator Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603227F Personnel, Training, and Simulation Technology

PROJECT NO. AND NAME: 2922 Manpower and Force Management

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2922 Manpower and Force Management	1,509	1,458	1,151	1,017	1,141	1,172	1,186	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops technologies to improve weapon system life cycle manpower estimates, joint job structures and classification, and aircrew selection. This project includes technologies to analyze Manpower, Personnel, and Training (MPT) factors early in weapon systems design and acquisition to ensure the factors are supportable and to enable trade offs to accommodate MPT limitations and costs.

(U) FY 1995 ($ in Thousands):

- (U) $1,313 Develop technologies and procedures to assist in linking the design and procurement of new weapon systems and major systems modifications to personnel capabilities and training factors to ensure that future acquisitions are acquired and maintained at lowest life cycle cost.
  - (U) Completed analysis of the MPT Decision Support System (DSS) for use in weapon system acquisition.
  - (U) Developed and demonstrated MPT decision support technology to aircraft design community.
- (U) $196 Develop situational awareness aircrew selection test battery technology.
  - (U) Identified situational awareness aircrew selection methods to include tests for multi-tasking ability, spatial processing ability, and working memory.
  - (U) Developed situational awareness aircrew selection methods to include test delivery and test response scoring capabilities.
- (U) $1,509 Total

(U) FY 1996 ($ in Thousands):

- (U) $908 Deliver technology and procedures to assist in linking the design and procurement of new weapon systems and major systems modifications to personnel capabilities and training factors to ensure that future acquisitions are acquired and maintained with lowest life cycle cost.
  - (U) Make available for transition the MPT DSS technology.
  - (U) Develop technologies to specify job classification standards from a career life cycle perspective.
- (U) $268 Develop technologies to structure Air Force and DoD jobs and classify personnel into jobs to maximize individual and organizational personnel readiness, job performance, and mission accomplishment.
  - (U) Develop an integration procedure to link critical joint-Service individual attributes to joint-Service readiness.
  - (U) Develop a joint-Service job classification technology for use during wartime missions.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603227F Personnel, Training, and Simulation Technology
PROJECT NO. AND NAME 2922 Manpower and Force Management	

- (U) $282 Develop situational awareness aircrew selection test technology.
  - (U) Collect situational awareness aircrew selection test data to validate test battery.
  - (U) Revise aircrew selection test software on basis of data analyses.
- (U) $1,458 Total

(U) FY 1997 ($ in Thousands):

- (U) $817 Develop technologies to structure Air Force and DoD jobs and classify personnel to maximize individual and organizational personnel readiness, job performance, and mission accomplishment.
  - (U) Develop a methodology, plan, and schedule for restructuring joint-Service jobs.
  - (U) Develop technologies to specify minimum acceptable performance levels for entry-level and career jobs.
  - (U) Define key personnel and job attributes necessary for establishing position-neutral job classifications.
  - (U) Develop a Mission Ready Airman Personnel System cost performance trade off capability to assess key Manpower, Personnel, and Training (MPT) factor effects on personnel readiness.
  - (U) Develop critical person attributes/wartime job skill taxonomy to support development of an optimization technology to match the best active and reserve personnel to wartime/mobilization duties.
  - (U) Develop an operational Air Force job structuring decision aid for use by career field managers.
- (U) $149 Develop situational awareness aircrew selection test technology.
  - (U) Revise situational awareness aircrew selection test battery based on pre-test data.
  - (U) Collect data for equating alternate forms of situational awareness aircrew selection test.
- (U) $185 Field test pilot screening and performance evaluation capability to determine predictive validity and increase in reliability of pilot performance measures compared to conventional approaches.
- (U) $1,151 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603227F Personnel, Training, and Simulation Technology
PROJECT NO. AND NAME 2922 Manpower and Force Management	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,579	1,518	1,620	Cont
(U) Current Budget Submit	1,509	1,458	1,151	Cont

(U) Change Summary Explanation:

Funding: Horizonal/vertical reductions to this project since the previous President's Budget are due to budget contraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0604243F, Manpower, Personnel, and Training Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603227F Personnel, Training, and Simulation Technology

PROJECT NO. AND NAME: 2949 Advanced Training Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2949 Advanced Training Technology	2,011	2,142	1,726	1,559	1,712	1,759	1,780	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops and demonstrates computer-based intelligent tutoring technology for representative tasks in high-technology jobs and software enabling Air Force training developers to rapidly and affordably build intelligent computer-assisted training systems which continually interact with students for effective individualized training.

(U) FY 1995 ($ in Thousands):

- (U) $563 Develop and demonstrate advanced tutors and intelligent tutor authoring technologies for avionics and mechanical job families.
  - (U) Evaluated and delivered to Air Combat Command (ACC) troubleshooting tutor technology for hydraulics, radar and penetration aid shops, and flightline maintenance.
- (U) $744 Develop and demonstrate software and authoring tools for intelligent tutors.
  - (U) Continued field evaluation of Rapid Intelligent Tutor System Development System (RIDES) authoring technology by demonstrating tutor technology for B-2 aircraft maintenance technicians and for missile launch console operations.
  - (U) Developed virtual environment-based intelligent tutoring system (ITS) authoring technology.
- (U) $704 Develop career field decision support software for personal computer use.
  - (U) Validated components of an integrated career field training management capability.
  - (U) Evaluated user interface for the training impacts decision technology and developed specifications.
- (U) $2,011 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603227F Personnel, Training, and Simulation Technology
PROJECT NO. AND NAME 2949 Advanced Training Technology	

(U) FY 1996 ($ in Thousands):

- (U) $1,670 Develop and demonstrate software and authoring tools for intelligent tutors.
  - (U) Deliver authoring technology to Air Force customers.
  - (U) Continue to develop and evaluate virtual environment-based Intelligent Tutor System authoring technology.
- (U) $300 Develop career field training decision support software for personal computer use.
  - (U) Develop and deliver operator and analyst training programs for the training impacts decision technology.
  - (U) Evaluate training impacts on decision technology in the field.
- (U) $172 Develop advanced instructional design advisor technology to reduce the cost and time to design and develop interactive courseware.
- (U) $2,142 Total

(U) FY 1997 ($ in Thousands):

- (U) $881 Develop and demonstrate software and authoring tools for intelligent tutors.
  - (U) Continue to develop virtual environment authoring technology.
  - (U) Develop and evaluate advanced intelligent tutors for application to formal technical training programs and on-the-job training.
- (U) $436 Deliver career field decision support software for personal computer use to Air Force customers.
  - (U) Complete field assessment of the training impacts decision technology.
  - (U) Make available for transition to operational Air Force training impacts decision technology.
- (U) $409 Develop advanced instructional design advisor technology to reduce the cost and time to design and develop interactive courseware.
  - (U) Integrate functional and procedural instructional design guidance into authoring design demonstrations.
  - (U) Develop field assessment plan to evaluate new authoring technology.
- (U) $1,726 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603227F Personnel, Training, and Simulation Technology
PROJECT NO. AND NAME 2949 Advanced Training Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,181	2,232	1,525	Cont
(U) Current Budget Submit	2,011	2,142	1,726	Cont

(U) Change Summary Explanation:

Funding: Horizontal/vertical changes in this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0604243F, Manpower, Personnel, and Training Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603231F Crew Systems & Personnel Protection Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	17,666	20,852	17,969	16,833	17,637	18,358	19,377	Continuing	Continuing
2829 Crew-Centered Cockpit Design	2,365	1,892	1,913	1,569	2,097	2,151	2,282	Continuing	Continuing
2830 Advanced Life Support	4,289	4,052	2,848	2,406	3,155	3,238	3,429	Continuing	Continuing
2868 Crew Escape	4,719	8,638	6,148	6,371	7,249	7,704	8,100	Continuing	Continuing
3257 Helmet-Mounted Sensory Technologies	6,293	6,270	7,060	6,487	5,136	5,265	5,566	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates technologies to protect and enhance the performance of Air Force personnel in operational environments. Specific projects advance and integrate human factors technologies into cockpit, life support, and aircrew equipment designs.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	17,332	18,953	19,081	Cont
(U) Appropriated Value	17,700	21,953		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-845	-427		
b. SBIR	-329	-463		
c. Omnibus/Other Above Threshold Reprogrammings		-211		
d. Below Threshold Reprogrammings	+1,140			
(U) Current Budget Submit	17,666	20,852	17,969	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase in FY 1996 is due to $3M Congressional add for crew escape/ejection seats.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603231F Crew Systems & Personnel Protection Technology

PROJECT NO. AND NAME: 2829 Crew-Centered Cockpit Design

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2829 Crew-Centered Cockpit Design	2,365	1,892	1,913	1,569	2,097	2,151	2,282	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project develops, demonstrates, and transitions technology for design and modification of crew stations that will enhance aircrew performance and safety. Using systems engineering, human factors principles, mission requirements, and crew capabilities, the project develops rigorous, traceable, and human-centered ways to design and test cockpits.

(U) FY 1995 ($ in Thousands):

- (U) $1,940 Develop and demonstrate human-centered software tools for design and modification of crew stations.
  - (U) Demonstrated software tools for cockpit design traceability and performance analysis on UNIX and personal computers.
  - (U) Planned beta test program and prepared crew-centered cockpit design software tools and user manuals for release to industry/government cockpit specialists for controlled user evaluation.
  - (U) Completed version 3.0 of crew-centered cockpit design process and evaluation process and incorporated into beta software.
- (U) $425 Demonstrate and document a computer work station for use by test engineers in conducting flight evaluations.
  - (U) Concluded operational test at flight test agencies, documented results, and made technology available for transition to users.
- (U) $2,365 Total

(U) FY 1996 ($ in Thousands):

- (U) $997 Develop and demonstrate human-centered software tools for design modification of operator-stations.
  - (U) Demonstrate utility of crew-centered process and tools for dissimilar platforms/mission types
  - (U) Perform beta test program of crew-centered design and evaluation tools with industry and government.
  - (U) Develop design and evaluation database integration architecture to support streamlined acquisition.
- (U) $895 Develop operator station design and evaluation process overlay to support advanced distributed simulation.
  - (U) Demonstrate test planning, analysis, and evaluation system tools adapted to simulated environments.
- (U) $1,892 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology
PROJECT NO. AND NAME 2829 Crew-Centered Cockpit Design	

(U) FY 1997 ($ in Thousands):

- (U) $544 Develop and demonstrate human-centered software tools for design and modification of operator stations.
  - (U) Transition human-centered cockpit technology to industry and acquisition centers for use in weapon system developments.
  - (U) Conclude field demonstration program with final test of the crew-centered design and evaluation technology, showing ability to correlate human/system-related measures of performance to lethality, survivability, and operability.
- (U) $1,369 Develop and demonstrate human-centered design technology to support advanced distributed simulation.
  - (U) Develop database of human performance model requirements to perform valid advanced distributed simulations.
  - (U) Develop synthetic environment specification tool to support distributed design.
- (U) $1,913 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,319	1,992	2,031	Cont
(U) Current Budget Submit	2,365	1,892	1,913	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0603205F, Aerospace Vehicle Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603231F Crew Systems & Personnel Protection Technology

PROJECT NO. AND NAME: 2830 Advanced Life Support

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2830 Advanced Life Support	4,289	4,052	2,848	2,406	3,155	3,238	3,429	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops and demonstrates advanced aircrew life support technologies. The goal is to improve combat performance while protecting aircrews from physiological stresses such as high altitude, high G-forces, thermal burden, nuclear weapons, and directed energy. This project also develops technologies to protect Air Force personnel working in hazardous environments and effectively treat casualties in diverse combat environments.

(U) FY 1995 ($ in Thousands):

- (U) $1,500 Develop and demonstrate technologies for improved protective equipment for aircrew and support personnel.
  - (U) Demonstrated and made available for transition advanced laser eye protection.
  - (U) Developed advanced technology for improved positive-pressure breathing oxygen mask for high-G maneuvers and high altitude operations.
  - (U) Developed advanced personal protective equipment technology specifically designed for female aviators.
- (U) $1,751 Develop and demonstrate life support technologies for integration into aircraft to improve aircrew safety and reduce logistical burdens.
  - (U) Developed technology for advanced oxygen equipment to replace the requirement for liquid oxygen in air-transportable hospitals, reducing logistics burdens during deployment.
  - (U) Developed advanced personal environmental control technology for aircrew.
- (U) $1,038 Develop technology to protect and sustain Air Force personnel operating in hazardous environments.
  - (U) Developed operational analysis capabilities for wartime medical planning, personnel protection, and combat sustainability.
- (U) $4,289 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology
PROJECT NO. AND NAME 2830 Advanced Life Support	

(U) FY 1996 ($ in Thousands):

- (U) $1,805 Develop and demonstrate technologies to protect and sustain aircrew and support personnel operating in hazardous environments.
  - (U) Develop advanced technology for an improved aircrew oxygen mask for high-G and high altitude operations.
  - (U) Develop personal protective equipment technology to provide improved protection in hostile environments for female aviators.
  - (U) Develop aircrew eye protection against visible wavelength lasers.
- (U) $2,247 Develop and demonstrate life support technologies for integration into aircraft to improve aircrew safety and reduce logistical burdens.
  - (U) Develop advanced hybrid oxygen system technologies to replace current liquid oxygen systems.
  - (U) Complete laboratory demonstration of personal environmental cooling technology for aircrew.
- (U) $4,052 Total

(U) FY 1997 ($ in Thousands):

- (U) $1,220 Develop and demonstrate technologies to protect and sustain aircrew and support personnel operating in hazardous environments.
  - (U) Complete development and demonstration of advanced aircrew oxygen mask technology for high-G and high altitude operations.
  - (U) Complete demonstration of personal protective equipment for female aviators.
  - (U) Develop and demonstrate feasibility of model for integration of laser threat analysis into Air Force mission planning models.
- (U) $1,628 Develop and demonstrate life support technologies for integration into aircraft to improve aircrew safety and reduce logistical burdens.
  - (U) Demonstrate advanced hybrid oxygen system technologies for aeromedical operations.
- (U) $2,848 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology
PROJECT NO. AND NAME 2830 Advanced Life Support	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,101	4,266	3,024	Cont
(U) Current Budget Submit	4,289	4,052	2,848	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0604601F, Chemical Defense Equipment.
- (U) PE 0604703F, Aeromedical/Casualty Care Systems Development.
- (U) PE 0604706F, Life Support Systems.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603231F Crew Systems & Personnel Protection Technology

PROJECT NO. AND NAME: 2868 Crew Escape

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2868 Crew Escape	4,719	8,638	6,148	6,371	7,249	7,704	8,100	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops and demonstrates advanced crew escape technologies to protect aircrews during ejection and improve accommodation of the full range of aircrew sizes. The goal is to reduce aircrew fatalities and major injuries in emergency ejections occurring at up to 700 knots equivalent air speed (KEAS) and at low altitude, adverse attitudes. This project will also improve escape system reliability, maintainability, and logistics supportability.

(U) FY 1995 ($ in Thousands):

- (U) $2,359 Demonstrate advanced technologies for improved crew escape.
  - (U) Completed trade studies of and high-speed life protection devices.
  - (U) Demonstrated solid propellant escape propulsion technology.
  - (U) Demonstrated gel propellant escape propulsion technology.
- (U) $2,360 Develop and demonstrate advanced escape system flight control technologies for ejection seats.
  - (U) Designed flight controller and demonstration seat.
  - (U) Developed advanced catapult technology to control ejection seat accelerations.
  - (U) Evaluated alternative ejection seat technologies.
  - (U) Developed lightweight ejection seat parachute and restraint harness technology to reduce aircrew injuries.
  - (U) Demonstrated lightweight, environmentally-sealed parachute and harness technology.
- (U) $4,719 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology
PROJECT NO. AND NAME 2868 Crew Escape	

(U) FY 1996 ($ in Thousands):

- (U) $2,630 Develop and demonstrate escape system flight control and high-speed life protection devices.
  - (U) Code and verify flight control software.
  - (U) Modify demonstration test ejection seats and fabricate demonstration test flight computer.
  - (U) Design, fabricate, and test high-speed life protection devices.
- (U) $2,170 Develop and demonstrate technologies for controlled ejection seat flight from high-speed/adverse attitudes.
  - (U) Fabricate components for ejection seat propulsion system demonstration tests.
  - (U) Conduct demonstration tests of advanced ejection seat propulsion technologies using high-speed test track at Holloman AFB.
- (U) $3,838 Develop technologies to address accommodation of small occupants in current ejection seat specifications.
  - (U) Design high-speed ejection test manikin to represent small occupants.
  - (U) Perform small occupant restraint and seat adjustability trade studies.
- (U) $8,638 Total

(U) FY 1997 ($ in Thousands):

- (U) $2,659 Develop technology demonstrator for escape system to accommodate full range of aircrew.
  - (U) Develop optimum configuration for escape system demonstrator.
- (U) $2,642 Demonstrate controlled ejection seat flight from high-speed and from adverse launch attitudes.
  - (U) Complete high-speed/adverse attitude ejection seat testing at Holloman AFB.
  - (U) Analyze data and document escape systems technology demonstration program
- (U) $847 Develop technologies to address small occupant requirements for current ejection seats.
  - (U) Fabricate small occupant high-speed ejection test manikin.
  - (U) Develop flight-weight high-speed inertial reel to improve ejection seat restraint system.
- (U) $6,148 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology
PROJECT NO. AND NAME 2868 Crew Escape	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,724	6,095	6,529	Cont
(U) Current Budget Submit	4,719	8,638	6,148	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal increases in FY 1996 are due to increased Congressional emphasis on the requirements of women in combat aircraft ejection seats, a $3M Congressional add.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0603205F, Aerospace Vehicle Technology.
- (U) PE 0603216N, Aircrew Systems Technology.
- (U) PE 0604706F, Life Support Systems.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603231F Crew Systems & Personnel Protection Technology

PROJECT NO. AND NAME: 3257 Helmet-Mounted Sensory Technologies

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3257 Helmet-Mounted Sensory Technologies	6,293	6,270	7,060	6,487	5,136	5,265	5,566	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project develops and demonstrates advanced helmet-mounted subsystem technologies to improve mission effectiveness and pilot situational awareness during day and night missions in all weather conditions. Through the development of advanced helmet-mounted tracker and display technologies (HMT/D), pilots will be able to detect, identify, target, and launch weapons faster and more accurately. This project also develops technology for improved night vision goggles (NVG) to enhance combat capabilities at night.

(U) FY 1995 ($ in Thousands):

- (U) $5,790 Develop and demonstrate helmet-vehicle interface and subsystems technologies for HMT/D.
  - (U) Conducted laboratory test of new advanced HMT/D components for fighter aircraft.
  - (U) Demonstrated standardized helmet-vehicle interface (HVI) for HMT/D on Naval Air Warfare Center ejection tower.
  - (U) Developed new phosphor technology to improve cathode ray tube (CRT) performance for HMT/D applications.
  - (U) Evaluated target acquisition with high off-boresight angle (HOBA) missile seekers using improved HMT/D on two F-15C aircraft.
- (U) $503 Develop and demonstrate advanced night vision technologies for Air Force-specific aircrew requirements.
  - (U) Evaluated improved image source technology for night vision goggles (NVG).
  - (U) Studied anthropometric issues for fit of NVG and HMT/D on full pilot population.
- (U) $6,293 Total

(U) FY 1996 ($ in Thousands):

- (U) $5,534 Develop and demonstrate HVI and subsystems technologies for HMT/D.
  - (U) Demonstrate advanced HMT/D for tactical air-to-air missions in a simulator.
  - (U) Develop new image source for HMT/D that will provide color symbology capability.
  - (U) Evaluate new subsystem technologies for HMT/D.
- (U) $736 Develop and demonstrate advanced night vision technologies for Air Force-specific aircrew requirements.
  - (U) Evaluate improved NVG technologies.
  - (U) Assess anthropometric technology issues for fit of NVG and HMT/D on full pilot population.
- (U) $6,270 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology
PROJECT NO. AND NAME 3257 Helmet-Mounted Sensory Technologies	

(U) FY 1997 ($ in Thousands):

- (U) $5,551 Develop and demonstrate helmet-vehicle interface (HVI) and subsystems technologies for helmet-mounted tracker and display technologies (HMT/D).
  - (U) Develop design for new HMT/D with color symbology display.
  - (U) Demonstrate advanced HMT/D on two operational fighters.
  - (U) Evaluate advanced HVI designs.
- (U) $1,509 Develop and demonstrate advanced night vision technologies for Air Force-specific aircrew requirements.
  - (U) Evaluate improved night vision goggle (NVG) technologies.
  - (U) Develop new image intensifier tube technology for NVG.
  - (U) Continue evaluation of anthropometric technology issues for fit of HMT/D on full pilot population.
  - (U) Demonstrate Panoramic NVG with expanded field-of-view.
- (U) $7,060 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology
PROJECT NO. AND NAME 3257 Helmet-Mounted Sensory Technologies	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	6,188	6,600	7,497	Cont
(U) Current Budget Submit	6,293	6,270	7,060	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase in FY 1997 is due to increased emphasis on life support technologies.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0603238F, Global Surveillance and Communications.
- (U) PE 0604706F, Life Support Systems.
- (U) PE 0604201F, Common Avionics Planning/Development.
- (U) PE 0207130F, F-15 Squadrons.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603238F Global Surveillance and Communications

PROJECT NO. AND NAME: 4216 Warfighter Information Usage, Management, and Integration Technologies

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4216 Warfighter Information Usage, Management, and Integration Technologies	1,883	2,383	2,293	2,404	2,591	2,702	2,760	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program will develop, demonstrate, and integrate the advanced technologies required to link national command authorities and sources to deployed Air Force components of a Joint Task Force, regardless of location, and provide a global distributed infrastructure with which commanders, staff, and warfighters can obtain immediate access to critical Command and Control (C2) information associated with all phases of mission planning, execution, and assessment. This program focuses on network switches, gateways, and transmission systems, to provide deployed commanders and warfighters with secure, survivable, access to information services from this worldwide information network. It will ensure military access to and exploitation of the rapidly developing commercial international network to provide deployed units with the ability to reach back to national resources. Work will also focus on technologies for improved management of communications, distributed computing, survivability, and system integrity. It will address interoperation across echelon, Service, and multi-national force boundaries, as well as provide support for mobile C2, and sensor-to-shooter operations. This program directly responds to user needs as expressed by the Joint Staff (Command, Control, Communications, Computers, and Intelligence for the Warrior), the Air Force (Theater Deployable Communications), Air Mobility Command (Airborne Situational Awareness), and the Defense Information Systems Agency (Far-Term Defense Information Systems Network). This technology directly supports the Joint Chiefs of Staff Future Joint Warfighting Capability: "To maintain near perfect real-time knowledge of the enemy and communicate that to all forces in near-real-time."

(U) FY 1995 ($ in Thousands):

- (U) $1,883 Completed independent cost estimate, feasibility study, technical risk assessment, and rigorous military requirements analysis.
- (U) $1,883 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238F Global Surveillance and Communications
PROJECT NO. AND NAME 4216 Warfighter Information Usage, Management, and Integration Technologies	

(U) FY 1996 ($ in Thousands):

- (U) $950 Demonstrate the connectivity of a worldwide network through continental U.S. to Tanker Airlift Control Center (TACC).
  - (U) Integrate the TACC at Scott Air Force Base to the Advanced Research Projects Agency/Defense Information Systems Network (ARPA/DISN) (i.e., the six node continental U.S. asynchronous switching network).
  - (U) Integrate the ARPA/DISN network with the associated commercially compatible switching technology testbeds in Canada, Australia, and the United Kingdom.
- (U) $400 Develop, demonstrate, and integrate a distributed information management system.
  - (U) Develop an algorithm which permits seamless Air Force interoperation with the allied coalition international network.
  - (U) Conduct demonstration of distributed information management technologies in a tri-Service operational network management facility.
- (U) $1,033 Develop, demonstrate, and integrate advanced command and control (C2), interactive technologies for improved Air Force warfighter global and local situational awareness.
  - (U) Design and develop brassboard capability to process and transmit information to the Air Mobility Command (AMC) transport aircraft cockpits.
  - (U) Design and develop brassboard capability to support C2 information in transport aircraft cockpits.
- (U) $2,383 Total

(U) FY 1997 ($ in Thousands):

- (U) $950 Demonstrate "In-Transit Visibility" capability to locate and communicate with an aircraft cockpit while in flight.
  - (U) Integrate medium-data-rate airborne/ground radio-frequency (RF) brassboard models into asynchronous switching environment.
  - (U) Demonstrate autonomous C2 to transport aircraft cockpits
- (U) $561 Develop an information management system to integrate/consolidate commercial with military management networks.
  - (U) Field test wartime survivable functions (automatic reconstitution) of management networks.
  - (U) Install network management algorithms to monitor heterogeneous Joint Task Force networks.
- (U) $782 Integrate military C2 distributed computer with the international commercial communications network.
  - (U) Interface advanced multi-media, interactive technologies to the international commercial/military communications network.
  - (U) Demonstrate distributed air operations center functions within the international commercial/military information network.
- (U) $2,293 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603238F Global Surveillance and Communications
PROJECT NO. AND NAME 4216 Warfighter Information Usage, Management, and Integration Technologies	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,975	2,483	2,582	Cont
(U) Appropriated Value	2,000	2,483		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-79	-48		
b. SBIR	-38	-52		
(U) Current Budget Submit	1,883	2,383	2,293	Cont

(U) Change Summary Explanation:

Funding: Increase from FY 1995 to FY 1996 reflects added emphasis on information technologies for the warfighter. Decrease from FY 1996 to FY 1997 is due to budget constraints. Vertical reductions in this Program Element since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) Related Activities:

- (U) PE 0602702F, Command, Control, and Communications (C3).
- (U) PE 0603726F, C3 Subsystems Integration.
- (U) PE 0603789F, C3 Advanced Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603245F Flight Vehicle Technology Integration

PROJECT NO. AND NAME: 2568 Flight Vehicle Technology Integration

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2568 Flight Vehicle Technology Integration	8,487	11,857	6,423	10,260	10,032	10,181	11,268	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This Advanced Technology Development program integrates and demonstrates advanced flight vehicle technologies that will improve the performance and supportability of existing and future aircraft. System level integration brings together the air vehicle technologies along with avionics, propulsion, and weapon systems to flight demonstrate them in a near-realistic operational environment. Integration and flight test demonstrations reduce the risk and time required to transition technologies into operational aircraft. This program provides proven flight vehicle technologies for all-weather, day or night operations, and technologies for improved affordability.

(U) FY 1995 ($ in Thousands):

- (U) $3,870 Develop and demonstrate advanced aeromechanics and flight control technologies for evaluation of increased combat effectiveness.
  - (U) Completed development of initial concept of forebody vortex control hardware for an F-16 test aircraft to demonstrate compatibility with existing radome designs, elimination of "hung-stalls," improved stability in extreme attitudes, and overall operational utility.
- (U) $4,617 Develop and demonstrate advanced subsystem technologies and technology integration for evaluation of increased supportability and combat effectiveness.
  - (U) Completed initial design and began fabrication of a long-life, all-envelope, integrated flight and propulsion control subsystem for the Variable Stability Inflight Simulation Test Aircraft (VISTA) F-16 to evaluate impact of advanced maneuvering capabilities on air-to-air and air-to-ground combat.
- (U) $8,487 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603245F Flight Vehicle Technology Integration
PROJECT NO. AND NAME 2568 Flight Vehicle Technology Integration	

(U) FY 1996 ($ in Thousands):

- (U) $5,321 Develop and demonstrate advanced aeromechanics and flight control technologies for evaluation of increased combat effectiveness.
  - (U) Complete design of forebody vortex control hardware for a conventional fighter aircraft to demonstrate compatibility with existing radome designs, elimination of "hung-stalls," improved stability in extreme attitudes, and overall operational utility.
  - (U) Ground test high-authority propulsive flight control systems for demonstration of increased range, elimination of loss of control, and improved supersonic maneuvering.
- (U) $6,536 Develop and demonstrate advanced subsystem technologies and technology integration for evaluation of increased supportability and combat effectiveness.
  - (U) Complete fabrication of a long-life, all-envelope, integrated flight and propulsion control subsystem for the Variable Stability Inflight Simulation Test Aircraft (VISTA) to evaluate impact of advanced maneuvering capabilities on air-to-air and air-to-ground combat.
  - (U) Complete initial design of an exhaust flow control nozzle that reduces radar cross section and improves aircraft performance yet significantly reduces parts count and simplifies engine removal.
- (U) $11,857 Total

(U) FY 1997 ($ in Thousands):

- (U) $1,220 Develop and demonstrate advanced aeromechanics and flight control technologies for evaluation of increased combat effectiveness.
  - (U) Complete fabrication of forebody vortex control hardware for a conventional fighter test aircraft to demonstrate compatibility with existing radome designs, elimination of "hung-stalls," improved stability in extreme attitudes, and overall operational utility.
  - (U) Flight test high-authority propulsive flight control systems for demonstration of increased range, elimination of loss of control, and improved supersonic maneuvering.
- (U) $5,203 Develop and demonstrate advanced subsystem technologies and technology integration for evaluation of increased supportability and combat effectiveness.
  - (U) Complete aircraft modification for long-life, all-envelope, integrated flight and propulsion control subsystem for the VISTA to evaluate impact of advanced maneuvering capabilities for air-to-air and air-to-ground combat.
  - (U) Perform static and sub-scale testing of three next-generation nozzle concepts to determine fluidic control effectiveness in improving stealthiness and performance while simplifying design.
- (U) $6,423 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603245F Flight Vehicle Technology Integration
PROJECT NO. AND NAME 2568 Flight Vehicle Technology Integration	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	8,999	12,491	11,710	Cont
(U) Appropriated Value	9,100	12,491		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-346	-242		
b. SBIR	-171	-271		
c. Omnibus/Other Above Threshold Reprogrammings	-96	-121		
d. Below Threshold Reprogrammings				
(U) Current Budget Submit	8,487	11,857	6,423	Cont

(U) Change Summary Explanation:

Funding: FY 1996 horizontal increase is for completion of scheduled flight test demonstrations. FY 1997 horizontal decrease reflects the reduced funding needed to complete earlier flight test reports and to prepare for outyear flight tests, as well as the impact of budget constraints. Vertical reductions to the Program Element since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603106F, Logistics Systems Technology.
- (U) PE 0603205F, Flight Vehicle Subsystem and Component Technology.
- (U) PE 0603211F, Aerospace Structures.
- (U) PE 0603245F, Advanced Flight Vehicle Multidisciplinary Technologies.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile**: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603253F Advanced Avionics Integration

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	15,772	16,749	15,488	15,539	16,628	16,725	17,811	Continuing	Continuing
2735 Avionics Integration Technology	7,683	7,507	6,989	7,068	7,553	7,600	8,086	Continuing	Continuing
3833 Integrated Avionics for Aging Aircraft	0	2,526	3,416	3,407	3,643	3,665	3,900	Continuing	Continuing
666A Reference and Information Transmission Technology	8,089	6,716	5,083	5,064	5,432	5,460	5,825	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification**: This Advanced Technology Development program develops and demonstrates aircraft communications, navigation, identification, and cockpit display integration technologies and techniques for improved aircraft performance, reduced pilot workload, and reduced avionics support costs. This program develops and improves: advanced solid state inertial guidance units and Global Positioning System receivers; technologies for low probability of detection communications between aircraft to improve aircrew situation awareness; highly reliable and maintainable avionics architectures and advanced processors; integration techniques to reduce aircraft electronic emissions to improve aircraft hostile airspace penetration capability; and affordable avionics technologies to extend the useful life of aging aircraft.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603253F Advanced Avionics Integration

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	16,765	20,421	19,763	Cont
(U) Appropriated Value	17,205	17,621		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-904	-342		
b. SBIR	-318	-360		
c. Omnibus/Other Above Threshold Reprogrammings	-182	-170		
c. Below Threshold Reprogrammings	-29			
(U) Current Budget Submit	15,772	16,749	15,488	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603253F Advanced Avionics Integration

PROJECT NO. AND NAME: 2735 Avionics Integration Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2735 Avionics Integration Technology	7,683	7,507	6,989	7,068	7,553	7,600	8,086	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops and demonstrates technologies that provide for robust implementation and exploitation of offensive and defensive sensors; reduce avionics support costs, weight, and volume; and improve reliability. These advanced technologies provide the avionics integration capability that enables improved cockpit systems management, information display, and weapons targeting and tracking and includes integrated avionics architectures, information integration involving on-board and off-board sensors, and sensor management technologies.

(U) FY 1995 ($ in Thousands):

- (U) $4,674 Develop advanced modular, sharable radio frequency sensor signal processing technologies to provide for avionics cost and weight savings, improved reliability, and increased sensor data fusion opportunities. Modularity will allow for retrofits that reduce avionics support costs.
  - (U) Completed system requirements and preliminary design of an integrated sensor system open system architecture for future and aging aircraft avionics.
  - (U) Developed integrated sensor system demonstration plan for verifying that integrated radio frequency (RF) functions perform resource sharing, simultaneity, and fault tolerance.
- (U) $1,191 Develop advanced sensor integration technologies and algorithms to provide the capability to augment the performance of individual sensors which will enable improved fault tolerance and situation awareness.
  - (U) Developed and demonstrated techniques to mitigate error contributions to Global Positioning System (GPS) sensors.
  - (U) Developed solutions for selective denial protection of current and future "friendly" GPS receivers.
- (U) $1,818 Develop technologies to provide for transition of current generation integrated avionics elements into retrofit applications enabling increased service life with significant support cost savings.
  - (U) Demonstrated modular, portable Ada real-time operating system for low-level mission environments.
  - (U) Designed, developed, integrated, and tested representative low-level mission threat detection and avoidance algorithms.
- (U) $7,683 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603253F Advanced Avionics Integration
PROJECT NO. AND NAME 2735 Avionics Integration Technology	

(U) FY 1996 ($ in Thousands):

- (U) $3,956 Develop advanced modular, sharable radio frequency (RF) sensor signal processing technologies to provide for avionics cost and weight savings, improved reliability, and increased sensor data fusion opportunities. Modularity will allow for retrofits that reduce avionics support costs.
  - (U) Validate the integrated sensor system architecture for future and aging aircraft avionics.
  - (U) Perform detailed design of the integrated sensor system common RF modules and initiate design of embedded control and application software.
  - (U) Complete integrated sensor system demonstration plan.
- (U) $1,522 Develop advanced sensor integration technologies and algorithms that augment the performance of individual sensors and improve fault tolerance and situation awareness.
  - (U) Continue development and demonstration of solutions for selective denial protection of current and future GPS receivers.
  - (U) Develop and demonstrate affordable, improved anti-jam filter/adaptive aircraft antennae electronics.
- (U) $2,029 Develop integrated avionics architecture components which leverage prior technology demonstration developments and incorporate additional user requirements for multi-platform commonality, open system architecture compliance, standard high level software language, affordability, and expandability features.
  - (U) Develop laboratory model of advanced terrain following/terrain avoidance/threat avoidance technology for low-level missions.
  - (U) Integrate hardware components, portable real-time Ada operating system, and low-level algorithms to enable pilot-in-the-loop avionics demonstration in the low-level mission environment.
- (U) $7,507 Total

(U) FY 1997 ($ in Thousands):

- (U) $4,070 Develop advanced modular, sharable RF sensor signal processing technologies to provide for avionics cost and weight savings, improved reliability, and increased sensor data fusion opportunities. Modularity will allow for retrofits that reduce avionics support costs.
  - (U) Fabricate integrated sensor system module types and unit test the embedded application and control software.
- (U) $981 Develop advanced sensor integration technologies and algorithms to provide the capability to augment the performance of individual sensors which will enable improved fault tolerance and situation awareness.
  - (U) Continue to develop and demonstrate affordable, improved anti-jam filter/adaptive aircraft antennae electronics.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603253F Advanced Avionics Integration
PROJECT NO. AND NAME 2735 Avionics Integration Technology	

- (U) $1,938 Develop integrated avionics architecture components which leverage prior technology demonstration developments and incorporate additional user requirements for multi-platform commonality, open system architecture compliance, standard high level software language, affordability, and expandability features.
  - (U) Develop and implement high performance, three-dimensional terrain/threat avoidance display generation technology for the low-level avionics mission environment.
- (U) $6,989 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	8,167	9,152	8,866	Cont
(U) Current Budget Submit	7,683	7,507	6,989	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0603204F, Aerospace Avionics.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603270F, Electronic Warfare Technology.
- (U) PE 0605164F, Global Positioning System (GPS) User Equipment.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603253F Advanced Avionics Integration
PROJECT NO. AND NAME 3833 Integrated Avionics for Aging Aircraft	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3833 Integrated Avionics for Aging Aircraft	0	2,526	3,416	3,407	3,643	3,665	3,900	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops and demonstrates affordable avionics technology to extend the useful life of Air Force aging aircraft and provide the flexibility/supportability needed to support world wide operations with reduced force structure. This project focuses on technologies to support transition of modular avionics, commercially available products, and commercial open system standards for cost-effective retrofit of user-required upgrades to existing avionics systems.

(U) FY 1995: Not Applicable.

(U) FY 1996 ($ in Thousands):

- (U) $2,526 Develop and demonstrate programmable integrated communications, navigation, and identification hardware/software modules for upgrading currently fielded aircraft identification friend or foe systems and providing real time information in the cockpit. Provide a baseline for fleet wide logistics commonality, attendant economies of scale, and increased platform availability.
  - (U) Design and develop technology required to maintain data security and integrate modular communications, navigation, and identification components with aging aircraft systems.
- (U) $2,526 Total

(U) FY 1997 ($ in Thousands):

- (U) $2,619 Develop and demonstrate programmable integrated communications, navigation, and identification hardware/software modules for currently fielded aircraft applications to provide fleet wide commonality, attendant economies of scale, and increased platform availability.
  - (U) Develop and evaluate technology required to maintain data security and integrate modular communications, navigation, and identification components with aging aircraft systems.
- (U) $797 Develop hardware and software technologies to support re-use of existing avionics software with newly developed Ada software in a common, real-time, embedded core avionics environment and to provide a cost-effective incremental upgrade capability.
  - (U) Develop hardware/software technology necessary for simultaneous execution of existing 16-bit, multi-lingual avionics software with new 32-bit Ada application and control software to reduce the life cycle cost of upgrading and adding software to existing weapon systems.
- (U) $3,416 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603253F Advanced Avionics Integration
PROJECT NO. AND NAME 3833 Integrated Avionics for Aging Aircraft	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	3,080	4,290	Cont
(U) Current Budget Submit	0	2,526	3,416	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. The horizontal increases are due to an increased emphasis on life extensions for rapidly obsolescing aircraft avionics. Note: Congress transferred FY 1995 funds to the Joint Advanced Strike Technology (JAST) program for development of advanced avionics. For FY 1996, project was refocused on upgrading and maintaining the current avionics inventory rather than providing advanced technology integration for new developmental aircraft.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary ($ in Thousands):**

(U) Related Activities:

- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0602301E, Intelligence System Program.
- (U) PE 0602232N, Navy Command, Control, and Communications (C3) Technology.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603217N, Maritime Avionics Subsystems Technologies.
- (U) PE 0604201F, Common Avionics.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile**: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603253F Advanced Avionics Integration

PROJECT NO. AND NAME: 666A Reference and Information Transmission Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
666A Reference and Information Transmission Technology	8,089	6,716	5,083	5,064	5,432	5,460	5,825	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Develops and demonstrates advanced, high-speed reference and information transmission technologies and techniques to improve overall aircrew situation awareness. These technologies will also reduce the electromagnetic signatures of navigation and communications gear, increasing aircraft survivability. The focus is on incorporating jam-resistant low probability of detection transceivers, inertial components, navigation systems technology, and techniques into air vehicles and on developing techniques for exploiting the capabilities of the Global Positioning System (GPS) to provide high accuracy reference information. Technologies demonstrated under this project are needed for real-time information in the cockpit, stealth operations, precision targeting and strike, timely bomb damage assessment, force multiplication through multi-platform shared resources, and affordable supportable weapon systems.

(U) FY 1995 ($ in Thousands):

- (U) $1,692 Develop advanced inertial reference technology and architectures to improve robustness of reference functions and weapon/sensor boresight accuracy.
  - (U) Completed evaluation and design of techniques for dynamic airframe flexure compensation and navigation fault detection/isolation for precision targeting and weapon delivery.
- (U) $1,599 Develop jam-resistant, short-range voice and low-data-rate transmission capability to provide for cooperative, low probability of detection operations.
  - (U) Completed system design of integrated avionics and discrete system brassboards for a real-time adaptive, highly covert, jam-resistant, 96 thousand bits per second voice and data transfer capability.
- (U) $1,552 Develop enhancements to GPS user equipment and system integration techniques to maximize position accuracy and jam resistance and to exploit the benefits of GPS to improve offensive and defensive combat capabilities at reduced costs.
  - (U) Completed evaluation and preliminary design of GPS-based techniques for electronic countermeasures to and rapid location of enemy emitters for enhanced suppression of enemy air defenses.
- (U) $2,353 Develop multi-user, medium to high capacity, jam-resistant airborne network to provide for low probability of detection exchange of time-critical threat, sensor, and cooperative operations information between aircraft.
  - (U) Completed preliminary design of technology for 1.544 million bits per second data transfer capability for secondary dissemination of reconnaissance/intelligence data and imagery to support real-time precision targeting and strike.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603253F Advanced Avionics Integration
PROJECT NO. AND NAME 666A Reference and Information Transmission Technology	

- (U) $893 Develop advanced, very-high-reliability, all solid state navigation and reference technologies to provide for reduced life cycle costs and increased navigation system availability in both new system and retrofit applications.
  - (U) Completed laboratory characterization test of solid state, strapped down, stellar inertial system for three times improvement in cost and reliability.
- (U) $8,089 Total

(U) FY 1996 ($ in Thousands):

- (U) $746 Develop advanced inertial reference technology and architectures to improve robustness of reference functions and weapon/sensor boresight accuracy.
  - (U) Develop techniques for dynamic airframe flexure compensation and navigation system fault detection/isolation to meet precision targeting and weapon delivery requirements.
- (U) $2,418 Develop jam-resistant, short-range voice and low-data-rate transmission capability to provide for cooperative, low probability of detection operations.
  - (U) Complete system design of integrated avionics and discrete system brassboards for a low-cost, real-time adaptive, highly covert, jam-resistant voice and data transfer capability.
- (U) $876 Develop enhancements to Global Positioning System (GPS) user equipment and system integration techniques to maximize position accuracy and jam resistance, and exploit the benefits of GPS to improve offensive and defensive combat capabilities at reduced costs.
  - (U) Develop and demonstrate GPS-based techniques for electronic countermeasures to and rapid location of enemy emitters for an enhanced, low-cost suppression of enemy air defenses capability for tactical fighters.
- (U) $2,676 Develop multi-user, medium to high capacity, jam-resistant airborne network to provide for low probability of detection exchange of time-critical threat, sensor, and cooperative operations information between aircraft.
  - (U) Complete design and initiate fabrication of technology for 1.544 million bits per second data transfer capability for secondary dissemination of reconnaissance/intelligence data and imagery to support real-time precision targeting and strike.
- (U) $6,716 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603253F Advanced Avionics Integration
PROJECT NO. AND NAME 666A Reference and Information Transmission Technology	

(U) FY 1997 ($ in Thousands):

- (U) $936 Develop advanced inertial reference technology and architectures to improve robustness of reference functions and weapon/sensor boresight accuracy.
  - (U) Integrate techniques and plan flight experiments for dynamic airframe flexure compensation and navigation fault detection/isolation to meet precision targeting and weapon delivery requirements.
- (U) $1,069 Develop enhancements to Global Positioning System (GPS) user equipment and system integration techniques to maximize position accuracy and jam resistance and exploit the benefits of GPS to improve offensive and defensive combat capabilities at reduced costs.
  - (U) Complete ground experiments and initiate flight experiments of GPS-based techniques for electronic countermeasures to and rapid location of enemy emitters for enhanced suppression of enemy air defenses for an enhanced, low-cost suppression of enemy air defenses capability for tactical fighters.
- (U) $3,078 Develop multi-user, medium to high capacity, jam-resistant airborne network to provide for low probability of detection exchange of time-critical threat, sensor, and cooperative operations information between aircraft.
  - (U) Complete fabrication and demonstration of technology for high-speed, high-bandwidth data transfer capability for secondary dissemination of reconnaissance/intelligence data and imagery to support real-time precision targeting and strike.
- (U) $5,083 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603253F Advanced Avionics Integration
PROJECT NO. AND NAME 666A Reference and Information Transmission Technology	

(U) B. **Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	8,598	8,189	6,607	Cont
(U) Current Budget Submit	8,089	6,716	5,083	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. **Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0602782A, Command, Control, and Communications (C3) Technology.
- (U) PE 0602232N, Navy C3 Technology.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603363F, Armament Technology Integration.
- (U) PE 0603270F, Electronic Warfare Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. **Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat (EC) Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	16,979	21,464	25,202	27,357	28,891	27,438	28,456	Continuing	Continuing
2222 Expendable Countermeasures	3,621	1,936	1,815	2,591	1,831	2,050	1,978	Continuing	Continuing
2432 Defensive System Fusion	6,297	11,417	5,528	3,895	1,651	1,630	2,631	Continuing	Continuing
2754 Suppression of Enemy Defenses	2,242	3,414	2,538	3,139	5,626	4,376	2,132	Continuing	Continuing
431G Threat Alert	3,851	1,948	3,348	1,810	3,875	1,589	2,509	Continuing	Continuing
691X On-board Countermeasures	968	2,749	11,973	15,922	15,908	17,793	19,206	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This Advanced Technology Development program expands the EC technology base by proving design concepts and demonstrating technologies to support critical Air Force EC requirements. The projects are categorized by the development of components, subsystems, and technologies that have potential application to satisfy combat, special operations, and airlift EC requirements and to reduce acquisition and life cycle costs of EC systems. The program develops and demonstrates: radio frequency (RF); infrared (IR); electro-optical (EO); and command, control, and communications (C3) countermeasure technologies. Technology demonstrations include flyable brassboards against validated threat simulators. In addition, the program develops and demonstrates technologies and concepts for signature reduction, advanced electronic warfare (EW) transmitters, receivers, and power management. This program ensures a strong EC technology base to provide demonstrated counters to current and future threat capabilities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC) Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	17,845	25,079	25,091	Cont
(U) Appropriated Value	18,299	22,579		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-947	-442		
b. SBIR	-339	-452		
c. Omnibus/Other Above Threshold Reprogrammings		-221		
d. Below Threshold Reprogrammings	-34			
(U) Current Budget Submit	16,979	21,464	25,202	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal increases reflect a realignment based on warfighter priorities for increased emphasis on aircrew self-protection against infrared and radar guided missiles.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat (EC) Technology

PROJECT NO. AND NAME: 2222 Expendable Countermeasures

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2222 Expendable Countermeasures	3,621	1,936	1,815	2,591	1,831	2,050	1,978	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project develops and demonstrates systems and components for infrared (IR), electro-optical (EO), laser, radio frequency (RF), and multi-spectral expendable countermeasure technologies. Improved antenna, transmitter, and multi-spectral/multi-technique off-board countermeasure technologies are also developed and demonstrated.

(U) FY 1995 ($ in Thousands):

- (U) $223 Develop IR, multi-spectral expendables to address Air Mobility Command decoy requirements.
  - (U) Developed shielding for spectral matching to aircraft signature.
- (U) $230 Develop future generation expendables to counter rapidly advancing threat environment.
  - (U) Conducted field demonstrations and characterized EO/IR jammer for large aircraft.
- (U) $3,168 Completed development of communication, navigation, and identification enhancement algorithms/testbed.
  - (U) Completed software development of Tactical Information Broadcast System waveform and demonstrated in laboratory.
  - (U) Completed software to exploit four simultaneous off-board intelligence data sets.
- (U) $3,621 Total

(U) FY 1996 ($ in Thousands):

- (U) $47 Develop IR, multi-spectral expendables to address Air Mobility Command decoy requirements.
  - (U) Conduct laboratory evaluations of expendable source materials to determine burn duration and spectrum of operation.
  - (U) Complete mechanical design and fabrication of multi-spectral expendable samples for characterization.
- (U) $35 Develop future generation expendables to counter rapidly advancing threat environment.
  - (U) Complete field demonstrations and characterize EO/IR jammer for large aircraft.
- (U) $1,854 Develop integrated multi-spectral countermeasure expendables for IR and dual mode (IR/RF) seeker threats.
  - (U) Complete preliminary design of expendables designed to defeat non-imaging threat missiles.
  - (U) Conduct joint test with United Kingdom on flares against internationally operational missiles.
- (U) $1,936 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC) Technology
PROJECT NO. AND NAME 2222 Expendable Countermeasures	

(U) FY 1997 ($ in Thousands):

- (U) $1,815 Develop integrated multi-spectral countermeasure expendables for infrared (IR) and dual mode (IR/radio frequency(RF)) seeker threats.
  - (U) Complete critical design and fabricate test samples of IR expendables which defeat non-imaging threat missiles.
  - (U) Design and analyze dual mode (IR/RF) technologies to counter enemy dual mode missile seekers.
- (U) $1,815 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,806	2,262	3,043	Cont
(U) Current Budget Submit	3,621	1,936	1,815	Cont

(U) Change Summary Explanation:

Funding: Vertical decreases in this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Horizontal decreases in this project are due to increased emphasis on on-board countermeasures in Project 691X.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0604270F, Electronic Warfare (EW) Development.
- (U) PE 0604270N, EW Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat (EC) Technology

PROJECT NO. AND NAME: 2432 Defensive System Fusion

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2432 Defensive System Fusion	6,297	11,417	5,528	3,895	1,651	1,630	2,631	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops and demonstrates techniques and technologies for sensor and system fusion and integration. It also develops advanced architecture, algorithm, and assessment techniques. These technologies and techniques will cope with the projected multi-spectral threat and countermeasure environments for combat aircraft. This project develops advanced EC algorithms and expert software for application on existing and future EC systems. This project also conducts real-time man-in-the-loop and hardware-in-the-loop integrated defensive avionics demonstrations.

(U) FY 1995 ($ in Thousands):

- (U) $236 Develop techniques and algorithms for multi-sensor integration, threat assessment, sensor management, and response strategy.
  - (U) Conducted final demonstration, stressing operational issues through man-in-the-loop demonstrations involving mission planning, on-the-fly reconfiguration, and simulated flight using advanced defensive avionics response strategy algorithms.
- (U) $1,073 Conduct demonstrations using the Integrated Defense Avionics Laboratory showing benefit of integrating electronic warfare sensor suites for situation awareness and electronic attack response strategy. This effort will be transferred to Project 691X in FY 1996.
  - (U) Completed technology demonstration of multi-spectral electronic combat evaluation tool.
  - (U) Completed installation of situation awareness, electronic attack response strategy, and radio frequency (RF) countermeasures processing capability into the Integrated Defense Avionics Laboratory.
- (U) $3,310 Develop technology to demonstrate low-cost (based on commercial processors and open architecture), off-board and on-board threat sensor fusion for improving situation awareness for both new and existing aircraft.
  - (U) Developed hardware and software requirements for sensor fusion technology design.
  - (U) Completed the design of sensor fusion technology demonstration model.
- (U) $1,678 Develop technology to demonstrate single aperture precision location and identification of both ground and airborne RF emitters for low-cost insertion into existing fielded equipment.
  - (U) Developed technology design requirements for single aperture precision location and identification capability.
  - (U) Completed hardware/software design for a single aperture precision location and identification technology demonstration.
- (U) $6,297 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC) Technology
PROJECT NO. AND NAME 2432 Defensive System Fusion	

(U) FY 1996 ($ in Thousands):

- (U) $8,211 Develop technology to demonstrate low-cost (based on commercial processors and open architecture), off-board and on-board threat sensor fusion for improving situation awareness for both new and existing aircraft.
  - (U) Complete development of software requirements and design of a sensor fusion technology demonstration model.
  - (U) Complete fabrication of hardware and development of software and begin in-laboratory sensor fusion technology demonstrations.
  - (U) Prepare plans and begin hardware integration for interim flight demonstration of a sensor fusion technology model.
- (U) $3,206 Develop technology to demonstrate capability for single aperture precision location and identification of both ground and airborne radio frequency emitters for low-cost insertion into fielded equipment. This effort will be transferred to Project 431G in FY 1997.
  - (U) Conduct preliminary and critical design reviews for demonstration of single aperture precision location and identification technology.
  - (U) Fabricate/integrate hardware and develop software for a single aperture precision location and identification technology demonstration.
  - (U) Lab demonstrate single aperture precision location and identification to prove hardware and software technology approaches.
- (U) $11,417 Total

(U) FY 1997 ($ in Thousands):

- (U) $5,528 Develop technology to demonstrate low-cost (based on commercial processors and open architecture), off-board and on-board threat sensor fusion for situation awareness that meets needs for both new and existing aircraft.
  - (U) Conduct preliminary flight demonstrations for hardware and software optimization of off-board and on-board threat sensor fusion technology.
  - (U) Optimize hardware and algorithms/software in preparation for final demonstration of sensor fusion technology model.
- (U) $5,528 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC) Technology
PROJECT NO. AND NAME 2432 Defensive System Fusion	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	6,618	13,340	7,692	Cont
(U) Current Budget Submit	6,297	11,417	5,528	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. The FY 1996 horizontal increase provided a one year emphasis on expanded situational awareness and precision emitter location and identification techniques. For FY 1997, the precision location and identification efforts have been moved to Project 431G.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0604270F, Electronic Warfare (EW) Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC) Technology
PROJECT NO. AND NAME 2754 Suppression of Enemy Defenses	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2754 Suppression of Enemy Defenses	2,242	3,414	2,538	3,139	5,626	4,376	2,132	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops and demonstrates technologies and techniques for command and control warfare, standoff, and support countermeasures which deny, disrupt, and suppress adversary air defense operations. The project includes: 1) evaluation of new concepts and techniques; 2) components and techniques needed to jam enemy radar; 3) electronic collection systems to inform the field commander of changes in the electronic environment; and 4) advanced standoff jammer technologies.

(U) FY 1995 ($ in Thousands):

- (U) $1,960 Develop and investigate techniques to suppress adversary defense command and control networks.
  - (U) Integrated hardware and conducted laboratory and field tests of techniques and software algorithms to counter specific types of command and control warfare signals to meet critical suppression needs.
  - (U) Integrated off-the-shelf components and developed software to counter threat airborne navigation systems.
- (U) $282 Completed an investigation of X-Ku band linear power amplifier for electronic warfare expendables and higher power radio frequency countermeasure applications.
- (U) $2,242 Total

(U) FY 1996 ($ in Thousands):

- (U) $3,414 Develop and investigate techniques to suppress adversary defense command and control networks.
  - (U) Flight demonstrate hardware and software techniques to counter specific types of command and control warfare signals.
  - (U) Develop and flight demonstrate an approach to counter airborne navigation aids.
  - (U) Develop techniques to counter modern threat command and control processing nets/nodes.
  - (U) Develop/design (using new commercial technologies) affordable, modular, efficient, wide-band, high-power amplifier for use in existing and new command and control warfare systems.
- (U) $3,414 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC) Technology
PROJECT NO. AND NAME 2754 Suppression of Enemy Defenses	

(U) FY 1997 ($ in Thousands):

- (U) $2,538 Develop and investigate techniques to suppress adversary defense command and control networks.
  - (U) Complete demonstrations of techniques to counter specific types of command and control warfare signals.
  - (U) Complete development and demonstration of an approach to counter airborne navigation aids.
  - (U) Fabricate and integrate components (based on new commercial technology) to demonstrate techniques to counter threat command and control processing nets/nodes.
  - (U) Design and analyze advanced techniques for countering airborne navigation systems.
- (U) $2,538 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,356	3,990	5,115	Cont
(U) Current Budget Submit	2,242	3,414	2,538	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. The FY 1997 horizontal decrease reflects an increased emphasis on on-board countermeasures in Project 691X.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602204F, Aerospace Avionics.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat (EC) Technology

PROJECT NO. AND NAME: 431G Threat Alert

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
431G Threat Alert	3,851	1,948	3,348	1,810	3,875	1,589	2,509	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops and demonstrates advanced technologies for threat warning to enhance aircraft survivability and provide air crew situation awareness. Missile/aircraft warning, laser warning, and radio frequency (RF) receiver technologies are developed and demonstrated under this project. The project also develops and demonstrates advanced electronic combat (EC) preprocessor technologies, advanced sorting and preprocessing algorithms, and expert software for applications on existing and future EC systems.

(U) FY 1995 ($ in Thousands):

- (U) $3,205 Develop infrared (IR) missile warning technology for product improvement of existing and new aircraft-installed equipment, lowering life cycle costs and improving performance to meet the critical needs of detecting advanced, lower signature threats.
  - (U) Completed development and a field technology demonstration of an approach to determine time-to-intercept for an incoming missile to enhance countermeasure effectiveness.
  - (U) Developed technology approaches to utilizing an advanced IR sensor array that eliminates the need for expensive cryogenic
  - cooling.
  - (U) Developed techniques to enhance the detection of current and advanced threat missiles in a variety of high-background-clutter environments.
- (U) $576 Completed development and demonstration of technology for detecting threat laser beamrider missiles for warning and countermeasure responses -- a rapidly emerging need for aircraft survivability.
- (U) $70 Conduct risk reduction efforts, forming joint program with Army and Navy, for low-cost advanced radar and other RF emitters warning concepts and techniques which address future, complex, and low probability of intercept RF environments.
  - (U) Analyzed projected threat information to determine requirements for future IR/RF receiver technology development.
- (U) $3,851 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC) Technology
PROJECT NO. AND NAME 431G Threat Alert	

(U) FY 1996 ($ in Thousands):

- (U) $1,894 Develop infrared (IR) missile warning technology for product improvement of existing and new aircraft-installed equipment, lowering life cycle costs and improving performance to meet the critical needs of detecting advanced, lower signature threats.
  - (U) Develop concepts for using an advanced sensor array that eliminates the need for expensive cryogenic cooling.
  - (U) Complete development of techniques to enhance the detection of threat missiles in a variety of high-background-clutter environments.
- (U) $54 Conduct risk reduction efforts for low-cost advanced radar and other radio frequency (RF) emitters and IR warning concepts and techniques.
  - (U) Establish technology requirements for further IR/RF technology development.
- (U) $1,948 Total

(U) FY 1997 ($ in Thousands):

- (U) $636 Develop IR missile warning technology for product improvement of existing and new aircraft-installed equipment, lowering life cycle costs and improving performance to meet the critical need of detecting advanced, lower signature threats.
  - (U) Complete design for an IR missile warning subsystem which utilizes an advanced IR sensor array that eliminates the expensive cryogenic cooling requirement.
  - (U) Complete evaluation of a temporal algorithm with a commercial image processor for IR missile warning applications.
- (U) $547 Conduct risk reduction efforts for low-cost advanced radar, RF emitters, and IR warning concepts and techniques.
  - (U) Define performance requirements for an advanced radar warning receiver operating in a complex RF environment.
  - (U) Develop design concepts for a digital RF receiver (cooperative effort with Navy).
- (U) $173 Develop algorithms which provide aircraft defensive systems with threat missile time-to-intercept data using sensor information from a passive, on-board IR missile warning receiver.
- (U) $1,992 Complete technology development for single aperture precision location and identification of ground and airborne RF emitters.
  - (U) Develop demonstration plans and integrate precision location hardware into technology demonstration aircraft.
  - (U) Complete flight demonstration of technology for single aperture precision location and identification of ground RF emitters and transition to users.
- (U) $3,348 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC) Technology
PROJECT NO. AND NAME 431G Threat Alert	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,048	2,276	400	Cont
(U) Current Budget Submit	3,851	1,948	3,348	Cont

(U) Change Summary Explanation:

Funding: The FY 1995 vertical and the FY 1996 vertical and horizontal decreases to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. The FY 1997 vertical and horizontal increases are due to movement of the final year of precision location and identification technology development efforts from Project 2432 into this project. In FY 1997, precision location and identification capabilities will be flight demonstrated and transitioned to users.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0604270F, Electronic Warfare (EW) Development.
- (U) PE 0604270N, EW Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat (EC) Technology

PROJECT NO. AND NAME: 691X On-board Countermeasures

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
691X On-board Countermeasures	968	2,749	11,973	15,922	15,908	17,793	19,206	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops and demonstrates infrared (IR), electro-optical (EO), laser, and radio frequency (RF) countermeasure technologies for on-board application to combat aircraft. These technologies are vital to protecting aircrews from rapidly emerging advanced threat missile systems.

(U) FY 1995 ($ in Thousands):

- (U) $958 Test and report on new techniques to counter advanced RF missile threats.
  - (U) Completed technology demonstration of an advanced digital RF memory on a single chip for EC applications.
  - (U) Completed the defensive airborne missile countermeasure flight demonstration program.
- (U) $10 Develop joint-Service technology demonstration plan for protection of large aircraft from advanced IR missiles.
- (U) $968 Total

(U) FY 1996 ($ in Thousands):

- (U) $2,099 Develop threat-adaptable, laser-based infrared countermeasure (IRCM) technology for large aircraft to defeat current and future IR missiles in multiple threat scenarios.
  - (U) Complete joint-Service technology demonstration plan for application of closed loop IRCM technology to large aircraft.
  - (U) Conduct tower tests of laser-based IRCM jamming techniques and evaluate their potential to defeat potential IR missile seeker threats.
  - (U) Develop and demonstrate closed loop IRCM technologies under laboratory and field conditions necessary to provide risk reduction for transition.
  - (U) Conduct hardware-in-the-loop tests in the Dynamic Infrared Missile Evaluator to develop countermeasure techniques and assist in the development of digital models of potential threat seekers.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC) Technology
PROJECT NO. AND NAME 691X On-board Countermeasures	

- (U) $650 Conduct continuing demonstrations to establish the benefits of integrating electronic warfare sensor suites to support situation awareness and electronic attack response strategy.
  - (U) Complete integration of multi-spectral electronic combat testbed to include processing capability for situation awareness, attack response strategy, and radio frequency (RF) countermeasures.
  - (U) Complete implementation and integration of testbeds for Expanded Situation Awareness Insertion and Precision Location and Identification technology developments.
- (U) $2,749 Total

(U) FY 1997 ($ in Thousands):

- (U) $7,521 Develop threat-adaptable, laser-based infrared countermeasure (IRCM) technology for large aircraft to defeat current and future infrared (IR) missiles in multiple threat scenarios, for large aircraft.
  - (U) Continue tower testing of threat-adaptable laser-based IRCM jamming techniques and evaluate their potential to defeat infrared (IR) missiles in accordance with the joint-Service demonstration plan.
  - (U) Complete live fire field demonstration of static, closed-loop IRCM brassboard against air-to-air missiles at White Sands Missile Range North Obscura Peak.
  - (U) Develop and demonstrate closed-loop IRCM technologies under laboratory and field conditions necessary for continued risk reduction.
  - (U) Continue to conduct hardware-in-the-loop tests in the Dynamic Infrared Missile Evaluator to analyze threat missile operations, develop countermeasure techniques, and assist in developing digital models of potential threat seekers.
- (U) $1,118 Develop laser-based electro-optical (EO)/IRCM technology to defeat advanced day/night vision EO/IR acquisition/tracking sensors on threat air defense weapon systems.
  - (U) Conduct threat analysis, vulnerability studies, and associated experiments to determine optimum countermeasure techniques for threat EO/IR acquisition/tracking sensors.
- (U) $3,334 Develop aircraft RF self-protection technology to counter the advanced RF threats associated with air defense weapon systems expected to be deployed over the next ten years.
  - (U) Continue cooperative efforts with the other Services and other countries to conduct tests to evaluate various RF countermeasure algorithm and/or hardware solutions.
  - (U) Identify promising algorithms and/or hardware solutions and design/fabricate technology to demonstrate approaches for countering RF threats.
- (U) $11,973 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC) Technology
PROJECT NO. AND NAME 691X On-board Countermeasures	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,017	3,211	8,841	Cont
(U) Current Budget Submit	968	2,749	11,973	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project in FY 1995 and FY 1996 since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. The FY 1996 horizontal increase and the FY 1997 horizontal and vertical increases are due to the increased emphasis, based on strong warfighter support, on advanced countermeasures to protect our aircraft from the prevalent threat.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0604270F, Electronic Warfare (EW) Development.
- (U) PE 0604270N, EW Development.
- (U) PE 0603203F, Avionics for Aerospace Vehicles.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603302F Space and Missile Rocket Propulsion

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	15,318	19,246	15,740	15,114	17,069	17,733	17,726	Continuing	Continuing
0003 Launch Vehicle Technology	0	571	612	617	624	631	639	Continuing	Continuing
4373 Launch and Orbit Transfer Propulsion Technology	0	16,770	14,050	13,681	15,606	16,253	16,221	Continuing	Continuing
6339 Tactical Propulsion Technology	0	286	309	313	321	327	335	Continuing	Continuing
6340 Satellite Control and Maneuvering Propulsion Technology	7,662	1,619	769	503	518	522	531	Continuing	Continuing
6341 Missile Systems Propulsion Technology	7,656	0	0	0	0	0	0	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates advanced rocket propulsion and space launch technologies. This program provides the technological step necessary to transition the most promising rocket propulsion and space launch technologies to applications using full-scale, proof-of-principle demonstrations. The projects within this program are structured to support Air Force Space Command's and Air Combat Command's mission area requirements for space and missile technologies which include the goals established in the Integrated High Payoff Rocket Propulsion Technology Initiative, a multi-agency/industry effort to focus the development of U.S. rocket propulsion technology.

New and improved components will be integrated with the environmentally improved propellants developed in this program to create new propulsion systems for the next generation of launch vehicles and satellites. Anticipated technological advances in this program will improve the performance of expendable systems' payload capabilities by 21% and reduce the launch and operations and support (O&S) costs by 28%. In a reusable launch system, the anticipated improvements are an increase in payload capability of 170% and a reduction in launch and O&S costs of 79%. The advances in propulsion in this program result from the achievement of the 2010 goals of the Integrated High Payoff Rocket Propulsion Technology Initiative. The development of these technologies has been coordinated with NASA to eliminate duplication of efforts. The space launch and missile propulsion industry will leverage the technologies from this program to enhance the country's industrial competitiveness.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	16,492	15,203	14,441	Cont
(U) Appropriated Value	16,800	20,203		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-761	-451		
b. SBIR	-313	-305		
c. Omnibus/Other Above Threshold Reprogrammings		-201		
e. Below Threshold Reprogrammings	-408			
(U) Current Budget Submit	15,318	19,246	15,740	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase to this PE in FY 1996 is due to a $5M Congressional add for Integrated High Payoff Rocket Propulsion Technology (IHPRPT). Also, in FY 1996, Project 0003, Launch Vehicle Technology, is transferred from PE 0603401F to this PE to combine all space launch technologies into a single PE.

Schedule: Not Applicable.

Technical: Not Applicable

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603302F Space and Missile Rocket Propulsion

PROJECT NO. AND NAME: 0003 Launch Vehicle Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
0003 Launch Vehicle Technology	0	571	612	617	624	631	639	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Advanced and innovative launch vehicle technologies in the areas of structures (i.e., fairings, interstages, struts, thermal protection systems, etc.), tanks, and operations will be developed in this project. This project was transferred from PE 0603401F into this PE in FY 1996.

(U) FY 1995: Not Applicable.

(U) FY 1996 ($ in Thousands):
- (U) $571 Develop space launch vehicle technology.
  - (U) Define technological needs for future expendable and reusable military launch vehicles including operations technologies, light-weight airframe structures, durable composite cryogenic tanks, and all-weather thermal protection.
  - (U) Design and fabricate advanced composite sub-scale vehicle stage connectors (interstages) using techniques that promise up to 50% weight reductions and 30-60% cost reductions.
- (U) $571 Total

(U) FY 1997 ($ in Thousands):
- (U) $612 Develop space launch vehicle technology.
  - (U) Continue to define technological needs for future expendable and reusable military launch vehicles including operations technologies, light-weight airframe structures, durable composite cryogenic tanks, and all-weather thermal protection.
  - (U) Fabricate full-size advanced composite interstages for future launch vehicles, using and validating techniques that promise up to 50% weight reductions and 30-60% cost reductions.
- (U) $612 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion
PROJECT NO. AND NAME 0003 Launch Vehicle Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	600	600	0
(U) Current Budget Submit	0	571	612	Cont

(U) Change Summary Explanation:

Funding: This project was transferred to this program from PE 0603401F beginning in FY 1996.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603401F, Advanced Spacecraft Technology.
- (U) PE 0603853F, Evolved Expendable Launch Vehicle Program.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion
PROJECT NO. AND NAME 4373 Launch and Orbit Transfer Propulsion Technology	

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4373 Launch and Orbit Transfer Propulsion Technology	0	16,770	14,050	13,681	15,606	16,253	16,221	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Advanced and innovative, low-cost rocket turbomachinery and components, low-cost space and missile launch propulsion system manufacturing technologies, and environmentally acceptable propellants are developed in this project. Characteristics such as environmental acceptability, affordability, reliability, reduced weight, reduced operation and launch costs, and increased life and performance of propulsion systems are emphasized in this project. Technological advances developed in this program will improve the performance of expendable systems' payload capabilities by 21% and reduce the launch and operations and maintenance (O&M) costs by 28%. The advances in propulsion in this program result from the achievement of the 2010 goals of the Integrated High Payoff Rocket Propulsion Technology Initiative. In FY 1996, all launch technology was combined into this project from Projects 6340 and 6341.

(U) FY 1995: Not Applicable.

(U) FY 1996 ($ in Thousands):

- (U) $7,249 Develop advanced, environmentally acceptable propellants for current and future launch systems.
  - (U) Complete large-scale testing of non-toxic, chlorine-free space launch propellant and verify the performance capabilities and cost-benefit analyses for replacement of current propellants.
  - (U) Quantify costs and benefits, and performance characteristics of solid motors developed using environmentally acceptable manufacturing techniques.
  - (U) Conduct impact analyses of environmentally improved propellants on solid rocket motor components (such as hotter burning temperatures and highly erosive environments) and determine performance needs of replacement components.
  - (U) Develop low-cost, carbon/carbon nozzles, quantifying the manufacturing cost savings of a new, rapid densification process.
- (U) $9,521 Develop propulsion technologies for existing and future launch vehicles.
  - (U) Complete design and begin fabrication of low-cost, highly reliable turbopump, preburner, and thrust chamber components with fluid film bearing technologies to increase liquid booster propulsion capabilities.
- (U) $16,770 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion
PROJECT NO. AND NAME 4373 Launch and Orbit Transfer Propulsion Technology	

(U) FY 1997 ($ in Thousands):

- (U) $2,374 Develop advanced, environmentally acceptable propellants technology for current and future launch systems.
  - (U) Publish final report assessing the increased performance benefits of a new, non-toxic chlorine-free propellant for replacement of current propellants in solid launch systems.
  - (U) Continue studying current and proposed environmental regulations for their impact on the manufacturing of large-scale solid rocket booster propellants.
  - (U) Begin development of a new solid-fuel motor which maintains motor integrity and performance while drastically increasing safety by creating a method to load the fuel at the launch site. (This eliminates the risk of explosion during transport).
- (U) $11,676 Develop propulsion technologies for existing and future launch vehicles.
  - (U) Integrate fluid film bearing technologies into the oxygen and hydrogen rocket turbopumps, increasing liquid-booster propulsion performance.
  - (U) Begin development of advanced, lightweight, thrust chamber components to be integrated with rocket turbopumps and preburners.
  - (U) Design and fabricate a complete thrust chamber with extended thermal-cycle life, decreased system costs, and increased liquid engine reliability, that will be used in boost and orbit transfer missions.
- (U) $14,050 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion
PROJECT NO. AND NAME 4373 Launch and Orbit Transfer Propulsion Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	12,603	11,641	0
(U) Current Budget Submit	0	16,770	14,050	Cont

(U) Change Summary Explanation:

Funding: In FY 1996, all launch technology was combined into a single project from Projects 6340 and 6341. Vertical increase to this project in FY 1996 since the previous President's Budget is due to a $5M Congressional add for Integrated High Payoff Rocket Propulsion Technology (IHPRPT) which also explains why FY 1997 appears to reflect "reduced" funding. Vertical increase in FY 1997 is due to increased emphasis on space launch technology.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603853F, Evolved Expendable Launch Vehicle Program.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion
PROJECT NO. AND NAME 6339 Tactical Propulsion Technology	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
6339 Tactical Propulsion Technology	0	286	309	313	321	327	335	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: Highly energetic, and environmentally-safe propellants and propulsion systems will be developed in this project. Improved case, insulation, and propellant interfaces as well as better performing nozzles will be developed. Technology such as thrust vector control, thrust modulation, signature characterization, and signature reduction will be developed in this project. The emphasis in this project is on rocket propulsion system affordability, reliability, weight reduction, and operating cost reductions that increase space launch system life and performance. Anticipated payoffs from these developments, identified through the Integrated High Payoff Rocket Propulsion Technology Initiative (IHPRPT), include a 49% range increase, 50% size reduction, 100% increase in loiter time, 100% payload increase, and 21% reduction in time-to-target. This project was previously part of Project 6341.

(U) FY 1995: Not Applicable.

(U) FY 1996 ($ in Thousands):
- (U) $136 Develop and characterize, in lab-size quantities, propellants and components that can be incorporated into the design and manufacturing of missile systems that will result in higher performance, lower environmental impacts, and reduced missile signatures.
  - (U) Complete analysis of environmentally acceptable, reduced smoke, and low-erosion propellants, insulators and nozzle coatings, as well as solventless manufacturing processes, designed to improve missile thrust and reduced signature.
- (U) $150 Conduct system payoff analyses which validate program objectives and approaches in pursuit of the IHPRPT goals for tactical missiles.
  - (U) Conduct payoff analyses to identify rocket component technologies and determine their benefit to aircraft survivability and kill ratio.
- (U) $286 Total

(U) FY 1997 ($ in Thousands):
- (U) $309 Develop and characterize, in lab-size quantities, propellants and components that can be incorporated into the design and manufacturing of missile systems that will result in higher performance, lower environmental impacts, and reduced signature characteristics.
  - (U) Demonstrate environmentally acceptable, reduced smoke, low-erosion tactical missile propellants and components that improve missile thrust and reduce plume signatures.
- (U) $309 Total

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion
PROJECT NO. AND NAME 6339 Tactical Propulsion Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	300	500	0
(U) Current Budget Submit	0	286	309	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. This effort was previously part of Project 6341.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0602303A, Missile Technology.
- (U) PE 0603313A, Missile and Rocket Advanced Technology.
- (U) PE 0603792N, Advanced Technology Transition.
- (U) This project has been coordinated through the Project Reliance Process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603302F Space and Missile Rocket Propulsion

PROJECT NO. AND NAME: 6340 Satellite Control and Maneuvering Propulsion Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
6340 Satellite Control and Maneuvering Propulsion Technology	7,662	1,619	769	503	518	522	531	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Chemical, electric, and solar rocket propulsion system technologies for station keeping and on-orbit maneuvering applications are developed in this project. Technology areas investigated include ground demonstrations of compact, lightweight, advanced propulsion systems, higher efficiency energy conversion systems (derived from an improved understanding of combustion fundamentals), and high-energy chemical propellants. The payoffs for the Integrated High Payoff Rocket Propulsion Technology Initiative (IHPRPT) include a seven year increase in satellite on-orbit time, a 50% increase in satellite maneuvering capability, a 25% reduction in orbit transfer operational costs, and a 15% increase in satellite payload.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion
PROJECT NO. AND NAME 6340 Satellite Control and Maneuvering Propulsion Technology	

(U) FY 1995 ($ in Thousands):

- (U) $1,666 Demonstrate orbit transfer and maneuvering propulsion technology.
  - (U) Delivered and integrated the 30-kilowatt (kW) ammonia arcjet thruster onto the space test and transportation satellite for the demonstration of advanced orbit transfer capability.
- (U) $5,996 Develop space propulsion technologies.
  - (U) Completed risk mitigation testing of liquid rocket engine components.
- (U) $7,662 Total

(U) FY 1996 ($ in Thousands):

- (U) $1,619 Demonstrate orbit transfer and maneuvering propulsion technology.
  - (U) Integrate and demonstrate the 30-kW ammonia arcjet thruster on the space test and transportation satellite. The satellite will be measured for its performance and successful intergration with an electric propulsion system. Electromagnetic impulse, contamination, solar array degradation, etc. will be scrutinized.
- (U) $1,619 Total

(U) FY 1997 ($ in Thousands):

- (U) $769 Demonstrate orbit transfer and maneuvering propulsion technology.
  - (U) Support launch and space demonstration of the 30-kW ammonia arcjet thruster, analyze data, and draft final report.
  - (U) Design the ground demonstration hardware for an improved anode layer thruster.
  - (U) Design a high altitude balloon experiment for demonstrating an improved solar thermal thruster.
- (U) $769 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion
PROJECT NO. AND NAME 6340 Satellite Control and Maneuvering Propulsion Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	8,836	1,700	1,700	Cont
(U) Current Budget Submit	7,662	1,619	769	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602601F, Phillips Laboratory.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion
PROJECT NO. AND NAME 6341 Missile Systems Propulsion Technology	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
6341 Missile Systems Propulsion Technology	7,656	0	0	0	0	0	0	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Innovative and advanced solid propulsion systems for tactical and ballistic missile applications are developed in this program. The emphasis of this project is environmental acceptability, reduction of development and fabrication costs, and increasing the reliability and life of future missile propulsion systems. In FY1996, funding for this project was transferred to Project 4373.

(U) FY 1995 ($ in Thousands):

- (U) $5,145 Develop technolgy for advanced, environmentally acceptable solid propellants for current and future missile systems.
  - (U) Completed hazard testing of chlorine-free space launch propellant. Demonstrated performance capabilities and ballistic properties to establish a baseline for future environmental propellant development.
  - (U) Completed hazard verification of a storable, low-chlorine or chlorine-free replacement propellant.
  - (U) Demonstrated scaled-up, environmentally acceptable techniques to produce environmentally safe propellants, liners, and insulations.
- (U) $2,511 Developed new components that can withstand the increased temperatures caused by the use of environmentally acceptable propellants in solid boosters.
- (U) $7,656 Total

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion
PROJECT NO. AND NAME 6341 Missile Systems Propulsion Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	7,656	0	0	Cont
(U) Current Budget Submit	7,656	0	0	Cont

(U) Change Summary Explanation:

Funding: In FY 1996, this project was combined in Project 4373.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603401F, Advanced Spacecraft Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603311F Ballistic Missile Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	4,489	3,694	2,828	2,741	2,828	2,853	2,909	Continuing	Continuing
4091 Missile Electronics	4,450	3,694	2,828	2,741	2,828	2,853	2,909	Continuing	Continuing
4092 Reentry Vehicle Technology	39	0	0	0	0	0	0	0	TBD

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program funds the devlopment, and particularly the integrated demonstration, of advanced guidance, navigation, and control packages for ballistic missiles. Also funded in this project are upgrades for range and safety instrumentation for ballistic missiles. Emphasis is on technologies which increase safety, reduce maintenance, and improve reliability of the currently deployed intercontinental ballistic missile force at a lower life cycle cost.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603311F Ballistic Missile Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,939	3,085	3,184	Cont
(U) Appropriated Value	5,000	8,785		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-196	-174		
b. SBIR	-94	-183		
c. Omnibus/Other Above Threshold Reprogrammings	-53	-4,734		
d. Below Threshold Reprogrammings	-168			
(U) Current Budget Submit	4,489	3,694	2,828	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Note: Congress added $5.7M in the FY 1996 President's Budget to this program for suborbital flight testing, however, $4.7M of these funds have been proposed as a part of the FY 1996 Rescission package.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603311F Ballistic Missile Technology
PROJECT NO. AND NAME 4091 Missile Electronics	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4091 Missile Electronics	4,450	3,694	2,828	2,741	2,828	2,853	2,909	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops and demonstrates advanced technologies which increase safety, reduce maintenance, and improve reliability of the intercontinental ballistic missile force at a lower life-cycle cost.

(U) FY 1995 ($ in Thousands):

- (U) $1,000 Develop advanced, boost-guidance technology to reduce current operations costs and improve the reliability and maintainability of existing systems.
  - (U) Flew the Missile Technology Demonstration-1 (MTD-1) flight experiment.
  - (U) Developed and tested advanced, integrated Global Positioning System (GPS)-inertial navigation technology for intercontinental ballistic missiles.
- (U) $3,450 Develop advanced navigation technology to support range instrumentation and improve safety requirements.
  - (U) Developed, integrated, and tested GPS-based navigation aids to improve the accuracy, range, and safety of ballistic missiles.
- (U) $4,450 Total

(U) FY 1996 ($ in Thousands):

- (U) $1,000 Develop advanced boost guidance technology to reduce current operations costs and improve reliability and maintainability of existing systems.
  - (U) Develop, integrate, and test advanced solid state navigation technology for intercontinental ballistic missile applications.
- (U) $2,694 Develop advanced navigation technology to support range instrumentation and improve safety requirements.
  - (U) Develop, integrate, and test GPS-based navigation packages which improve the accuracy, range, and safety of ballistic missiles.
- (U) $3,694 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603311F Ballistic Missile Technology
PROJECT NO. AND NAME 4091 Missile Electronics	

(U) FY 1997 ($ in Thousands):

- (U) $971 Develop advanced boost guidance technology to reduce current operations costs and improve reliability and maintainability of existing systems.
  - (U) Develop, integrate, and test advanced solid state navigation technology for intercontinental ballistic missile applications.
- (U) $1,857 Develop advanced navigation technology to support range instrumentation and improve safety requirements.
  - (U) Develop, integrate, and test Global Positioning System-based navigation packages which improve the accuracy, range, and safety of ballistic missiles.
- (U) $2,828 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,900	3,085	3,184	Cont
(U) Current Budget Submit	4,450	3,694	2,828	Cont

(U) Change Summary Explanation:

Funding: Horizontal/vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602204F, Aerospace Avionics.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603311F Ballistic Missile Technology

PROJECT NO. AND NAME: 4092 Reentry Vehicle Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4092 Reentry Vehicle Technology	39	0	0	0	0	0	0	0	TBD

(U) **A. Mission Description and Budget Item Justification:** This project funded the study of reentry phenomena, such as ionized plasma sheaths around a reentry vehicle, ablative material needs, and the aerodynamic performance characteristics of ballistic missiles.

(U) FY 1995 ($ in Thousands):

- (U) $39 Analyzed the penetration tactics and options for defeating current and projected antiballistic missile threats.
  - (U) Completed testing of ablative material for advanced reentry vehicles.
- (U) $39 Total

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603311F Ballistic Missile Technology
PROJECT NO. AND NAME 4092 Reentry Vehicle Technology	

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	39	0	0	TBD
(U) Current Budget Submit	39	0	0	TBD

(U) Change Summary Explanation:

Funding: Project is terminated after FY 1995 due to the reduced Air Force emphasis on intercontinental ballistic missile reentry vehicle development.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602201F, Flight Dynamics.
- (U) PE 0602203F, Aerospace Propulsion and Power.
- (U) PE 0602204F, Aerospace Avionics.

(U) PE 0602601F, Phillips Laboratory.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	44,991	71,629	39,637	44,942	48,044	52,861	55,839	Continuing	Continuing
0003 Reusable Launch Vehicle Technology	27,157	25,000	0	0	0	0	0	0	52,157
1026 Space Structures and Controls Technology	548	1,139	1,105	1,841	2,599	3,222	4,020	Continuing	Continuing
2181 Space Electronics and Software Technology	9,325	10,241	12,538	13,325	12,786	12,694	12,326	Continuing	Continuing
3784 Space Sensors and Satellite Communication Technology	640	2,551	2,547	2,784	3,249	3,580	4,339	Continuing	Continuing
3834 Integrated Space Technology Demonstrations	3,300	24,441	14,604	18,509	20,187	23,142	24,035	Continuing	Continuing
4400 Satellite Survivability Technology	0	3,037	4,049	3,599	3,445	3,225	3,297	Continuing	Continuing
682J Space Power and Thermal Management Technology	4,021	5,220	4,794	4,884	5,778	6,998	7,822	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates advanced spacecraft technologies through integrated ground, flight, and space demonstrations. The broad goals of the program are to decrease the time for innovative space technology to be transitioned to the warfighter and to reduce the associated development costs and risks of future Air Force space-based systems. Developmental efforts are focused on five high-payoff, satellite technology areas: (1) advanced space structures and structural controls; (2) hardened space electronics and satellite control software; (3) advanced passive/active space-based sensors and satellite communications; (4) compact, low-cost space power and thermal management; and (5) satellite survivability. All efforts in this program element contain the resources necessary, including civilian salaries, to manage, conduct, and document the listed technical activities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	48,291	32,627	36,443	Cont
(U) Appropriated Value	49,400	78,627		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-2,440	-1,593		
b. SBIR	-917	-1,640		
c. Omnibus/Other Above Threshold Reprogrammings		-3,765		
d. Below Threshold Reprogrammings	-1,052			
(U) Current Budget Submit	44,991	71,629	39,637	Cont

(U) Change Summary Explanation:

Funding: Vertical changes in FY 1995 since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T)

Program. Vertical/horizontal changes in FY 1996 are due to increases of $46M by Congress: $25 million for Reusable Launch Vehicle (RLV) technology; $20M for microsat development; and $1M for miniature threat reporting system. These FY 1996 adds also explain the perceived horizontal decrease in FY 1997. Vertical changes in FY 1997 reflect increased Air Force priority on space-related Science and Technology.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology

PROJECT NO. AND NAME: 0003 Reusable Launch Vehicle Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
0003 Reusable Launch Vehicle Technology	27,157	25,000	0	0	0	0	0	0	52,157

(U) A. **Mission Description and Budget Item Justification:** This project accounts for the FY 1995 and 1996 Congressional adds for Reusable (space) Launch Vehicle (RLV) technology development. Congressional direction stipulated funds were to support the ongoing National Aeronautics and Space Administration (NASA) single-stage-to-orbit (SSTO) vehicle program. This Air Force RLV technology project directly complements and fully supports the NASA-led RLV program and has been coordinated and approved by NASA Headquarters. The tasks identified in this project summary represent the DoD stake in RLV technology development as recommended by the Space Launch Modernization Plan (SLMP) study. The project does not incur any outyear funding commitment except as budgeted in PE 0603302F, Project 0003. (This project was moved in FY 1996 to PE 0603302F, Space and Missile Launch Technology.) The project title was also revised to Launch Vehicle Technologies, allowing for all reusable and expendable technologies to be investigated by the Air Force.

(U) FY 1995 ($ in Thousands):

- (U) $10,865 Apply advanced rocket propulsion technology to RLVs.
  - (U) Modified the design of the Integrated Power-Head (IPHD) pre-burner components.
  - (U) Demonstrated application of the advanced long life turbopump fluid film bearing technologies to RLVs.
  - (U) Investigated high performance thrust cell unconventional nozzles and fundamental technologies.
- (U) $9,976 Perform advanced RLV structures/tankage technology development.
  - (U) Designed and demonstrated lightweight, reusable launch vehicle structures.
  - (U) Designed and demonstrated RLV composite, cryogenic propellant tanks.
- (U) $2,660 Perform advanced RLV thermal protection system technology development.
  - (U) Designed and demonstrated lightweight, reusable, maintainable and affordable RLV thermal protection critical technologies.
- (U) $914 Perform advanced RLV operations technology development.
  - (U) Developed and demonstrated reliable, cost-effective RLV ground and flight operations.
- (U) $2,742 Demonstrate advanced RLV high density propellant technology.
  - (U) Investigated application of high density, high mass fraction propellant technologies to RLVs.
- (U) $27,157 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 0003 Reusable Launch Vehicle Technology	

(U) FY 1996 ($ in Thousands):

- (U) $5,000 Apply advanced rocket propulsion technology to reusable launch vehicles (RLVs).
  - (U) Continue modifications to the design of the Integrated Power-Head pre-burner components.
  - (U) Continue demonstration of the advanced long life turbopump fluid film bearing technologies to RLVs.
  - (U) Continue investigation of high performance thrust cell unconventional nozzles and fundamental technologies.
- (U) $5,000 Perform RLV structures/tankage technology development.
  - (U) Continue demonstrations of lightweight, RLV structures.
  - (U) Continue demonstrations of RLV composite, cryogenic propellation tanks.
- (U) $2,000 Perform advanced RLV thermal protection system technology development.
  - (U) Continue demonstration of lightweight, reusable, maintainable, and affordable RLV thermal protection critical technologies.
- (U) $5,000 Perform advanced RLV operations technology development.
  - (U) Continue development and demonstration reliable, cost-effective RLV ground and flight operations.
  - (U) Develop technologies for integrated avoices and guidance, navigation, and control, vehicle health monitoring, and automated mission planning.
- (U) $2,000 Perform technology development for upperstages as they apply to RLVs.
  - (U) Develop concepts and technologies for use in an upperstage.
- (U) $3,000 Perform application and feasibility analyses to assess capability of RLVs to meet military unique needs.
  - (U) Develop concepts and technologies which are necessary to meet the unique needs of the military in its application of a RLV.
- (U) $3,000 Execute and coordinate the DoD RLV program including operations at White Sands.
- (U) $25,000 Total

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 0003 Reusable Launch Vehicle Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	29,223	0	0	0
(U) Current President's Budget	27,157	25,000	0	52,157

(U) Change Summary Explanation:

Funding: Budget reflects Congressional adds in FY 1995 and FY 1996. Vertical reductions to this project in FY 1995 since the previous President's Budget are due to Congressional general reductions.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602269F, Hypersonic Technology Program.
- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603302F, Space and Missile Launch Technology.
- (U) PE 0603853F, Evolved Expendable Launch Vehicle Program.
- (U) UPN 242, NASA Reusable Launch Vehicle Program.
- (U) This project has been coordinated through the Project Reliance process and with NASA to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology

PROJECT NO. AND NAME: 1026 Space Structures and Controls Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1026 Space Structures and Controls Technology	548	1,139	1,105	1,841	2,599	3,222	4,020	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project demonstrates advanced composite structures and structural control technologies for future Air Force space and missile systems. Prior to FY 1995, the Air Force relied on Ballistic Missile Defense Organization (BMDO) funding to address its needs in this technology area. As BMDO budgets have declined, so has their funding in this area, necessitating an increased Air Force investment to maintain critical spacecraft structures and controls technologies. Advanced space structure component efforts focus on the demonstration of new composite structure technologies. The goal is to significantly improve the payload mass fraction and reduce overall spacecraft fabrication time and cost. This project also pays for the development of advanced passive and active spacecraft structural control technologies. Structural vibration and shock suppression technologies are intended to significantly enhance space platform stability, improving the focusing/imaging ability of space-based optical components such as focal plane arrays developed in Project 3784 or solar cells developed in Project 682J.

(U) FY 1995 ($ in Thousands):
- (U) $274 Develop former Ballistic Missile Defense Organization (BMDO) advanced-composite space vehicle structure technologies.
  - (U) Completed design of all-composite satellite bus technology demonstrator to be flown on MightySat-1 demonstrator.
- (U) $274 Develop former BMDO advanced spacecraft structural control technology.
  - (U) Finished fabrication of non-pyrotechnic release device with the potential for improved operability and reliability.
- (U) $548 Total

(U) FY 1996 ($ in Thousands):
- (U) $570 Develop advanced composite spacecraft structures.
  - (U) Complete fabrication of the all-composite satellite structure to be flown on MightySat-1 demonstrator, showing 30-50 percent weight savings.
- (U) $569 Develop advanced spacecraft structural controls technology.
  - (U) Prepare the non-pyrotechnic release device technology demonstration experiment for flight on MightySat-1 demonstrator.
- (U) $1,139 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 1026 Space Structures and Controls Technology	

(U) FY 1997 ($ in Thousands):

- (U) $505 Develop advanced composite spacecraft structures technology.
  - (U) Develop preliminary design of next generation composite satellite structure for future space applications like the MilSatCom program.
- (U) $600 Develop advanced spacecraft structural controls technology.
  - (U) Complete first phase of technology demonstration program to isolate sensitive payloads from vibrations during launch.
- (U) $1,105 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	600	1,200	1,200	Cont
(U) Current Budget Submit	548	1,139	1,105	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal increase from FY 1995 to FY 1996 is due to change in priority within the S&T Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603218C, Research and Support.
- (U) PE 0603302F, Space and Missile Launch Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology

PROJECT NO. AND NAME: 2181 Space Electronics and Software Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2181 Space Electronics and Software Technology	9,325	10,241	12,538	13,325	12,786	12,694	12,326	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project funds the demonstration and evaluation of electronic hardware and software. Improved space-qualifiable electronics and software for data and signal processing are to be more interchangeable, interoperable, and standardized. This project sponsors the demonstration of space-qualified circuits such as Very High Speed Integrated Circuit (VHSIC)-based components, wafer scale integration (WSI) packages, electronic processors, and reusable standardized satellite control software. In the near-term, this project's work concentrates on converting (i.e., hardening) commercial data and signal processor technologies for use in Air Force space systems. Advanced electronic packaging technologies that reduce weight and volume are being developed for military space applications. Space data processor technologies like the Advanced Technology Insertion Module (ATIM 32-bit) technology are developed and demonstrated. The Advanced Spaceborne Computer Module (ASCM), ATIM's 16-bit predecessor, is currently baselined into 65 DoD, NASA, and commercial programs. Also developed and demonstrated are space signal processor technologies like the Hardened Ada Signal Processor (HASP) program. Low-cost, easily modifiable software and hardware architectures for ground control, satellite components, and autonomous satellite operations are developed. The Multi-mission Advanced Ground Intelligent Control (MAGIC) program in this project has developed a low-cost, flexible architecture for satellite control and mission operations. In the long-term, this project area focuses on developing an integrated avionics-like architecture for satellites where high-speed data busses centralize many of the functions now distributed on the spacecraft. Additionally, this project demonstrates very low-power electronics allowing dramatic size, weight, and power reductions for future Air Force Space applications.

(U) FY 1995 ($ in Thousands):

- (U) $6,492 Develop space-qualifiable, advanced low-power, hardened data processors and memory technologies.
  - (U) Designed and fabricated processor chips and other integrated circuits for advanced technology space computers.
  - (U) Fabricated a breadboard and tested the functionality of a computer and its operating system software.
- (U) $914 Develop space-qualifiable, hardened signal processor electronics technologies and standard electronic devices.
  - (U) Negotiated license to fabricate a space-qualifiable version of a commercial digital signal processor design.
  - (U) Developed transfer of a commercial digital signal processor to a space-qualified integrated circuit manufacturing line.
- (U) $546 Develop space-qualifiable, advanced mixed-signal electronics packaging technology using commercial technology base.
  - (U) Continue developing a high-speed, single layer computer for three-dimensional integrated sensor processor.
  - (U) Developed robust, analog processor multi-chip module/brassboard for space flight, demonstrating advanced packaging reliability.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 2181 Space Electronics and Software Technology	

- (U) $550 Develop astrodynamic routines and reusable, space-standardized satellite operations software.
  - (U) Developed and demonstrated the Multi-mission Advanced Ground Intelligent Control (MAGIC) telemetry analysis software.
  - (U) Continued support of the command and control system software technology upgrade.
- (U) $823 Develop space-qualifiable, standard microelectronic components.
  - (U) Transferred commercial, field-programmable gate array to a space-qualified integrated circuit manufacturing line.
  - (U) Fabricated and ground tested space-qualifiable, 8,000 gate, field-programmable gate array.
- (U) $9,325 Total

(U) FY 1996 ($ in Thousands):

- (U) $6,291 Develop space-qualifiable, advanced low-power, hardened data processors and memory technologies.
  - (U) Fabricate engineering model of standard satellite computer to improve functionality and performance of data processors.
  - (U) Develop fully capable operating system and applications software environment using desktop computer and hardware-in-the-loop.
- (U) $1,000 Develop space-qualifiable, hardened signal processor electronics and standard electronics devices.
  - (U) Fabricate Digital Signal Processor in bulk silicon.
  - (U) Demonstrate functionality and performance of space-qualifiable digital signal processor using commercial hardware/software tools.
- (U) $1,150 Develop space-qualifiable, advanced mixed-signal electronics packaging technology using commercial technology base.
  - (U) Demonstrate two-fold increase in density and two-fold decrease in cost to space-qualified, high-density electronic interconnections.
  - (U) Integrate plastic/non-hermetic and three-dimensional (3-D) packaging technologies into a space demonstration.
- (U) $900 Develop astrodynamic routines and reusable, space-standardized satellite operations software.
  - (U) Enhance MAGIC software to provide operator assistance in known-anomaly resolution.
  - (U) Install the MAGIC software system in the Falcon AFB, CO, Demonstration Laboratory.
  - (U) Continue software support of the command and control system upgrade.
- (U) $900 Develop space-qualifiable, standard microelectronic components.
  - (U) Fabricate and ground test space-qualifiable 2,000 gate, field-programmable gate array.
  - (U) Demonstrate programmability of 8,000 gate, field-programmable gate array using commercial hardware/software tools.
- (U) $10,241 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 2181 Space Electronics and Software Technology	

(U) FY 1997 ($ in Thousands):

- (U) $7,038 Develop space-qualifiable, advanced low-power, hardened data processors and memory technologies.
  - (U) Fabricate space-qualifiable 32-bit processor-based computers and demonstrate the full range of performance capabilities.
  - (U) Design an advanced high throughput, low-power data processor-based on commercial technology base.
- (U) $1,300 Develop space-qualifiable, hardened signal processor electronics technologies.
  - (U) Fabricate silicon on insulator (SOI) version of space-qualifiable digital signal processor.
  - (U) Evaluate the ability of both bulk silicon and SOI version of the digital signal processor to perform in the space environment.
- (U) $1,400 Develop space-qualifiable, advanced, mixed-signal electronics packaging technology such as three-dimensional (3-D) wafer scale integration.
  - (U) Demonstrate integrated sensor processing 3-D electronics assembly in robust space-qualifiable configuration.
  - (U) Demonstrate improved multi-chip module technology by constructing a complex multi-processor system.
- (U) $2,600 Develop astrodynamic routines and reusable, space-standardized satellite operations software.
  - (U) Continue enhancing multi-mission advanced ground intelligent control software to provide operator assistance with unknown anomaly resolution and expand to include independent decision making capability.
  - (U) Continue developing technology for an artificial intelligence satellite operator system.
  - (U) Integrate and test autonomous satellite operations software system technologies.
  - (U) Continue software support of the satellite command and control system upgrade.
- (U) $200 Design and develop space-qualifiable silicon components using advanced micro-electromechanical systems (MEMS) techniques.
  - Evaluate the compatibility of fabrication and packaging processes for highly integrated MEMS/electronics components able to operate in the space environment.
  - Design advanced experimental MEMS devices and demonstrate their performance in a space environment.
- (U) $12,538 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 2181 Space Electronics and Software Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	10,068	11,527	11,527	Cont
(U) Current Budget Submit	9,325	10,241	12,538	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints within the Science and Technology (S&T) Program. Horizontal/vertical increases reflect increasing Air Force priority on space-related Science and Technology.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0303601F, MILSTAR Satellite Communications System.
- (U) PE 0305160F, Defense Meteorological Satellite Program (DMSP).
- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603311F, Ballistic Missile Technology.
- (U) PE 0603215C, Limited Defense System.
- (U) PE 0603218C, Research and Support.
- (U) PE 0603226E, Experimental Evaluation of Major Innovative Technologies.
- (U) PE 0604609F, Reliability and Maintainability Technology Insertion Program (RAMTIP).
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology

PROJECT NO. AND NAME: 3784 Space Sensors and Satellite Communication Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3784 Space Sensors and Satellite Communication Technology	640	2,551	2,547	2,784	3,249	3,580	4,339	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: The focus of this project was changed in FY 1995 because of previous Congressional actions regarding the 60 GigaHertz (GHz) communication work. Also, the Air Force assumed responsibility for spaceborne passive reconnaissance/surveillance sensors from the Ballistic Missile Defense Organization (BMDO). This project funds the development of military space-based ground surveillance and satellite communication technologies. The project's work focuses on advancing space-based applications of commercial sensors and communication technologies while improving the performance, schedule, maturity, cost, and/or risk reduction. The focus of the space sensor effort is to meet spaceborne sensor needs for national missile defense and intelligence, surveillance, and reconnaissance missions. The focus of the satellite communications effort is to develop radio frequency (RF) technologies for future military, intra-space, and space-ground communication systems. This project seeks to improve affordability, reliability, and performance while significantly reducing space sensor and satellite communication size, weight, cost, and cooling and power requirements. The FY 1995 program continued former Ballistic Missile Defense Organization funded efforts critical to the Air Force.

(U) FY 1995 ($ in Thousands):
- (U) $640 Develop former BMDO space-based reconnaissance/surveillance passive sensor technology for Air Force high priority needs.
  - (U) Completed design and fabrication of large format, focal plane array for mid-wave infrared applications.
- (U) $640 Total

(U) FY 1996 ($ in Thousands):
- (U) $2,251 Develop space-based reconnaissance/surveillance sensor technology to meet high priority Air Force needs.
  - (U) Evaluate and deliver large format focal plane arrays for mid-wave infrared applications.
  - (U) Evaluate performance of advanced signal processing algorithms for surveillance sensors.
  - (U) Assess operational utility of candidate space-based surveillance technologies.
- (U) $300 Develop satellite communication technology which supports space communications needs.
  - (U) Assess commercial communication technology for transition to military systems.
- (U) $2,551 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 3784 Space Sensors and Satellite Communication Technology	

(U) FY 1997 ($ in Thousands):

- (U) $2,247 Develop space-based reconnaissance/surveillance sensor technology to meet Air Force high priority needs.
  - (U) Conduct design study for dual-band space-based reconnaissance sensors for missile defense applications.
  - (U) Investigate efforts to increase yield and reliability of large format infrared focal plane arrays.
  - (U) Evaluate performance of advanced signal processing algorithms for surveillance sensors.
  - (U) Assess operational utility of candidate space-based surveillance technologies.
- (U) $300 Develop satellite communication technology which supports space communications needs.
  - (U) Continue assessing commercial communication technology for transition to military systems.
- (U) $2,547 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 3784 Space Sensors and Satellite Communication Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	700	2,700	2,700	Cont
(U) Current Budget Submit	640	2,551	2,547	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints within the Science and Technology (S&T) Program. Horizontal changes reflect increased Air Force priority on space-related Science and Technology efforts.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0303601F, MILSTAR Satellite Communications System.
- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0602702F, Command/Control/Communication Technology.
- (U) PE 0603226E, Experimental Evaluation of Major Innovative Technologies.
- (U) PE 0604711F, Extremely High Frequency Satellite Communications Research and Development.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology

PROJECT NO. AND NAME: 3834 Integrated Space Technology Demonstrations

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3834 Integrated Space Technology Demonstrations	3,300	24,441	14,604	18,509	20,187	23,142	24,035	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** The Integrated Space Technology Demonstration (ISTD) program provides for the integration of government and commercially developed technologies onto satellites. ISTD seeks to demonstrate the value of these new technologies to address new space tactics, techniques, procedures, doctrine, and possibly revolutize future acquisitions of DOD space systems. The ISTD program will enhance commercial and civil space assets in a cost-effective manner, allowing the warfighter to assess the utility of new space technologies through leveraging opportunities and, when required, through space flight demonstration of this new program.

The highly successful Technology for Autonomous Operational Survivability (TAOS) satellite was the first of the ISTD series. TAOS was integrated with highly space survivable components, and is the only DoD satellite demonstrating autonomous (from the ground) navigation. TAOS was launched in March 1994 and is currently demonstrating advanced warfighter concepts and the viability of advanced computers, autonomous navigation hardware/software, laser sensors, radar sensors, and data busses in space. TAOS has allowed operators and users, for the first time, to directly conduct space exercises in conjunction with the Phillips Laboratory (PL).

In FY 1995, the ISTD program office initiated a cooperative agreement with NASA's small satellite technology program. The goal of this agreement was to leverage existing NASA research and development efforts with Air Force funding and technologies. PL agreed to integrate an S-band transmitter on a NASA satellite which would allow command, control, and reception of imaging payload data from mobile ground stations controlled by the warfighter. A second major FY 1995 effort was an evaluation to determine what were the right technologies to fly on the first mission. This six-month study was performed by two major aerospace system houses in cooperation with the PL ISTD program office and Air Force Space Command. From this study, it was determined that the mission focus for the advanced space technology demonstration would be a commercially leveraged program focusing on a hyperspectral imaging sensor with automatic target recognition. In general, the ISTD series of space technology demonstrations will allow users to assess new space technologies, which, when integrated, will become technology options for space systems.

(U) FY 1995 ($ in Thousands):

- (U) $2,300 Conduct TAOS flight demonstration.
  - (U) Recovered spacecraft after major anomaly.
  - (U) Performed exercises that improved how space control missions are performed.
  - (U) Performed navigation, laser, and radar sensor experimentation.
- (U) $1,000 Analyze the effectiveness and survivability of TAOS technologies.
  - (U) Continued technology (navigation, laser, and radar sensors) assessments.
- (U) $3,300 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 3834 Integrated Space Technology Demonstrations	

(U) FY 1996 ($ in Thousands):

- (U) $3,000 Perform the Technology for Autonomous Operational Survivability (TAOS) flight demonstration.
  - (U) Perform TAOS mission data analysis and outline final report.
  - (U) Continue the navigator, laser, and radar sensor experimentation with Air Force Space Command operators.
- (U) $4,500 Conduct Integrated Space Technology Demonstration (ISTD) program: Clark and Warfighter-1.
  - (U) Procure, integrate, and test an S-band transmitter on NASA's Clark demonstrator spacecraft.
  - (U) Fabricate, assemble, integrate, and test the Clark spacecraft mobile ground station equipment.
  - (U) Begin on-orbit operations and data collection from the Clark satellite.
  - (U) Begin Warfighter-1 (Integrated Space Technology Flight-1). Release final Request for Proposal (RFP). Conduct source selection.
  - (U) Award Warfighter-1 contract and start long-lead hardware procurement.
- (U) $1,000 Develop algorithm for integrated satellite payloads and mission utility.
  - (U) Complete satellite and environmental effects simulation software interfaces and demonstrate real-time throughput.
- (U) $15,941 Develop and demonstrate miniaturized space technologies.
  - (U) Identify appropriate technologies and design microsat to incorporate this technology.
- (U) $24,441 Total

(U) FY 1997 ($ in Thousands):

- (U) $1,500 Complete the TAOS flight demonstration.
  - (U) Complete TAOS mission data analysis and deliver final report.
  - (U) De-orbit TAOS spacecraft, dispense mission unique equipment/software, and close out contract.
- (U) $12,104 Conduct ISTD demonstration series program.
  - (U) Continue joint Air Force-NASA on-orbit technology assessments and data collection.
  - (U) Complete demonstrator spacecraft long lead-time hardware fabrication.
  - (U) Begin design, fabrication, integration, and test of payload.
- (U) $1,000 Develop algorithm for integrated satellite payloads, mission utility, and system engineering.
  - (U) Establish real-time connectivity to operational test and evaluation environments.
- (U) $14,604 Total

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 3834 Integrated Space Technology Demonstrations	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,300	8,500	12,967	Cont
(U) Current Budget Submit	3,300	24,441	14,604	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes reflect increased Air Force priority on integrated flight demonstrations of space Science and Technology. FY 1996 reflects $20M Congressional add for micro-satellite development.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603605F, Advanced Weapons Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology

PROJECT NO. AND NAME: 4400 Satellite Survivability Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4400 Satellite Survivability Technology	0	3,037	4,049	3,599	3,445	3,225	3,297	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project funds the development and demonstration of technologies required to assure operation of U.S. space assets in potentially hostile warfighting environments. Work performed includes assessment of critical components, subsystems, and systems' threat susceptibility and vulnerability. This project also develops technologies to mitigate identified vulnerabilities. Further, technology options are developed and demonstrated to support balanced satellite protection strategies for detecting, avoiding, and operating in a hostile space environment. Efforts under this project will be closely integrated with exploratory space technologies such as those developed under PE 0602601F, Project 8809, and advanced space technologies developed in Projects 1026, 2181, 3784, and 682J. Where appropriate, end products include integrated demonstrations with technologies developed in Project 3834. Through this project, the Air Force assumes responsibility for critical spacecraft survivability technology from the Ballistic Missile Defense Organization (BMDO). Starting in FY 1996, PE 0603438F, Satellite Systems Survivability, was transferred to this PE as Project 4400.

(U) FY 1995: Not Applicable.

(U) FY 1996 ($ in Thousands):

- (U) $925 Assess selected directed energy weapon threat environment susceptibility/vulnerability of critical space-based sensor and communications subsystems.
  - (U) Perform sensor laser jamming model refinements and vulnerability assessments.
  - (U) Perform sensor radio frequency susceptibility evaluations.
  - (U) Perform communication subsystems disruption/degradation modeling and susceptibility evaluations.
  - (U) Initiate ground-based observations of vulnerability to spacecraft-environment interaction threat.
- (U) $2,037 Select candidate radio frequency/high-powered microwave detector technologies for threat warning sensor development.
  - (U) Develop miniaturized radar warning detector.
  - (U) Evaluate communication intrusion/interference detection technologies.
  - (U) Evaluate high-power microwave detection concepts.
  - (U) Develop/integrate sensor signal processor design.
- (U) $75 Evaluate candidate directed energy weapon sensor jamming protection techniques for critical sensor optical components.
  - (U) Assess candidate radio frequency mitigation techniques for optical sensors.
- (U) $3,037 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 4400 Satellite Survivability Technology	

(U) FY 1997 ($ in Thousands):

- (U) $1,300 Assess selected directed energy weapon threat environment susceptibility/vulnerability of critical space-based sensor and communications subsystems.
  - (U) Perform analytical and experimental verification of selected laser and radio frequency jamming sensor protection techniques.
  - (U) Perform analytical and experimental verification of radio frequency interference mitigation techniques for advanced space communication technologies.
  - (U) Complete ground-based observations of vulnerability to spacecraft-environment interaction threat..
- (U) $1,766 Perform radio frequency/high-powered microwave threat warning Space-based sensors testing.
  - (U) Integrate radar warning, intrusion/interference, and high-powered microwave detector concepts.
  - (U) Optimize/integrate spacecraft signal processor designs.
  - (U) Test integrated radio frequency/high-powered microwave threat warning sensor.
- (U) $500 Select, for evaluation, laser weapon detector technologies for satellites in hostile environments.
  - (U) Develop and evaluate selected pulsed laser detection concepts.
- (U) $483 Evaluate and demonstrate directed energy weapon space sensor and communications jamming protection techniques.
  - (U) Demonstrate satellite communication subsystem front-end radio frequency protection devices.
- (U) $4,049 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 4400 Satellite Survivability Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	3,200	2,549	Cont
(U) Current Budget Submit	0	3,037	4,049	Cont

(U) Change Summary Explanation:

Funding: Starting in FY 1996, PE 0603438F, Satellite Systems Survivability, was transferred to this PE as Project 4400. Vertical/horizontal increases are due to increased Air Force emphasis on space-related Science and Technology. FY 1996 reflects a $1M Congressional add for Miniature Satellite Threat Report System.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603410F, Space Systems Environmental Interactions Technology.
- (U) PE 0603605F, Advanced Weapons Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology

PROJECT NO. AND NAME: 682J Space Power and Thermal Management Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
682J Space Power and Thermal Management Technology	4,021	5,220	4,794	4,884	5,778	6,998	7,822	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops and demonstrates compact, low-cost, spacecraft and ballistic missile power generation, storage, distribution, and thermal management technologies, including cryogenic cooling technologies. Power generation work focuses on lightweight, low-cost, low volume, and survivable solar cell arrays. Energy storage work focuses on lightweight nickel hydrogen (NiH_2) and sodium sulfur (NaS) spacecraft batteries for extended (five-ten year) satellite missions. Power distribution efforts focus on producing lightweight, high efficiency, standardized power busses for use on future Air Force space programs. This project also funds the development and demonstration of the non-nuclear technologies associated with space nuclear power systems such as power conversion, conditioning, and power system thermal management. In addition, investigations into alternative technologies to increase space vehicle power subsystem performance, lifetime, survivability, and safety while reducing costs/risks. In FY 1995, the Air Force assumed responsibility for the Ballistic Missile Defense Organization's (BMDO's) goal to develop spacecraft thermal management technologies. Examples of this are cryogenic coolers necessary to maintain passive (e.g., infrared focal plane array) sensors in low-light backgrounds through this project.

(U) FY 1995 ($ in Thousands):

- (U) $1,100 Develop space conventional power technologies such as advanced solar cell arrays.
  - (U) Investigated addition of active germanium bottom cell to gallium indium phosphide/gallium arsenide dual-junction cell to boost efficiency to >26%.
  - (U) Investigated all-back mounted electrical contact, thin gallium arsenide cells for improved efficiency and system integration.
- (U) $2,100 Develop space vehicle conventional power technologies such as compact volume/weight batteries.
  - (U) Completed abuse testing of sodium sulfur cells for flight test in FY 1996.
  - (U) Conducted solid state primary battery development program for space applications.
  - (U) Accomplished initial life test verification of nickel hydrogen battery, aiming towards an operationally more realistic 22-cell.
- (U) $410 Develop non-nuclear technologies associated with space nuclear power systems such as thermionics technology.
  - (U) Continued testing energy conversion technologies such as alkali-metal thermal to electric converter and liquid metal heat pipes.
- (U) $411 Develop former Ballistic Missile Defense Organization space vehicle cryogenic cooler technology.
  - (U) Examined thermal and mechanical isolation of cryogenic coolers from payloads using heat pipes and phased-energy storage units.
- (U) $4,021 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 682J Space Power and Thermal Management Technology	

(U) FY 1996 ($ in Thousands):

- (U) $2,520 Develop space conventional power technologies such as advanced solar cells and arrays.
  - (U) Complete and transition multi-junction higher efficiency solar cell technology to the Manufacturing Technology office.
  - (U) Complete development of Thin-Film Roll-out Array for improved stowage and deployment.
  - (U) Flight test 'Channel Astro' edge concentrating solar array (150 watts/kilogram) on a small satellite.
- (U) $1,400 Develop space vehicle conventional power technologies such as compact volume/weight batteries.
  - (U) Perform life testing of nickel hydrogen (NiH_2) batteries.
  - (U) Flight test sodium sulfur (NaS) batteries.
- (U) $300 Develop non-nuclear technologies associated with space nuclear power systems such as thermionics technology.
  - (U) Initiate more efficient alkali-metal thermal to electric converter cells (25%) development.
- (U) $1,000 Develop space vehicle thermal management technology such as cryogenic coolers for infrared focal plane arrays.
  - (U) Begin single-stage, reverse Brayton-cycle cryocooler development.
- (U) $5,220 Total

(U) FY 1997 ($ in Thousands):

- (U) $2,800 Develop space conventional power technologies such as advanced solar cells and arrays.
  - (U) Flight test Thin Film Roll-Out Array.
  - (U) Develop 30% efficient energy conversion devices.
- (U) $1,400 Develop space vehicle conventional power technologies such as compact volume/weight batteries.
  - (U) Continue NiH_2 low earth orbit life testing.
  - (U) Develop 200 watt hour/kilogram (WHr/kg) solid state lithium battery for satellite applications.
- (U) $200 Develop non-nuclear technologies associated with space nuclear power systems such as thermionics technology.
  - (U) Develop 25% alkali metal thermal to electric conversion cells.
  - (U) Design and fabricate thermionic bed power system components for evaluation.
- (U) $394 Develop Space vehicle thermal management technology such as cryogenic coolers for infrared focal plane arrays.
  - (U) Qualify single-stage reverse Brayton-cycle cryocooler for space applications.
- (U) $4,794 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology
PROJECT NO. AND NAME 682J Space Power and Thermal Management Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,400	5,500	5,500	Cont
(U) Current Budget Submit	4,021	5,220	4,794	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603302F, Space and Missile Launch Technology.
- (U) PE 0603218C, Research and Support.
- (U) PE 0603226E, Experimental Evaluation of Major Innovative Technologies.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603410F Space Systems Environmental Interactions Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	3,867	3,349	2,914	3,488	3,577	3,586	3,636	Continuing	Continuing
2822 Space Environmental Impact Test	2,877	2,112	1,731	2,412	2,561	2,604	2,778	Continuing	Continuing
2823 Space Hazards Mitigation	990	1,237	1,183	1,076	1,016	982	858	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program's objectives are to improve the survivability and reliability of Air Force space systems, and expedite the transfer of new technologies into military hardware. Cost-effective solutions to mitigate hazardous, space-environmental interactions that degrade spacecraft operations are developed and demonstrated in this program. The information gained through these programs is directly transferred to operational users in the form of new and revised military standards, handbooks, and computer-aided engineering and assessment tools. Advanced technology goals include: (1) an autonomous active charge control system to prevent charge buildup on high-altitude spacecraft; (2) a compact environmental anomaly sensor to provide warning to satellites of space-environmental conditions likely to cause anomalous operations; and (3) improved specifications for advanced solar array technologies from the Photovoltaic Array Space Power Plus Diagnostics experiment. These goals will be achieved through space experiments such as the Charging Hazards and Wake Studies experiment (that will determine space environmental hazards to exposed high voltages), the Shuttle Potential and Return Electrons Experiment (which will investigate the effect of high current electron beams on the ambient space environment), and the Space Waves in Plasmas Experiment (which will look at space effects on high-frequency radio transmissions).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603410F Space Systems Environmental Interactions Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,148	3,479	3,280	Cont
(U) Appropriated Value	4,200	3,479		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-165	-67		
b. SBIR	-79	-63		
c. Below Threshold Reprogrammings	-89			
(U) Current Budget Submit	3,867	3,349	2,914	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603410F Space Systems Environmental Interactions Technology
PROJECT NO. AND NAME 2822 Space Environmental Impact Test	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2822 Space Environmental Impact Test	2,877	2,112	1,731	2,412	2,561	2,604	2,778	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project conducts experiments to understand how to counter adverse spacecraft-environment interactions. Experiments will be conducted to ascertain the interactions that cause plasma-induced current leakage and arcing at higher operating voltages. Radiation damage to solar arrays and electronic sensors, and deep-dielectric charging arcs that cause spurious signals and upsets in microelectronics will be studied. Space instrumentation to measure hazards posed by the natural environment and increase the performance and longevity of space systems will be developed.

(U) FY 1995 ($ in Thousands):

- (U) $900 Develop and test miniaturized space plasma sensors; characterize plasma in and around spacecraft wakes to provide critical validation of charge analysis modeling codes necessary for spacecraft designers.
  - (U) Continued analysis of plasma data collected from the space hazard sensors on the Wake Shield Facility on shuttle flight STS 60 in February 1994 (Mission 1). Results from these experiments were published in reports to validate charge analysis modeling codes.
  - (U) Launched Mission 2 with upgraded space hazard sensors on STS 69 in September 1995 to demonstrate improved performance over Mission 1.
  - (U) Analyzed plasma data collected during Mission 2 to verify performance of space plasma sensors and to validate modeling codes.
  - (U) Based on Mission 1 and 2 performances, provided the Defense Meteorological Satellite Program a miniaturized space plasma sensor design.
- (U) $793 Demonstrate next-generation solar array technologies that provide the required performance standards in space before being integrated into future power systems. Characterize array interactions with natural space environment.
  - (U) Supported on-orbit operations of advanced solar arrays required to conduct the experiments and collect data required to improve performance.
  - (U) Analyzed data and produced preliminary reports on high-voltage plasma interactions and on advanced solar array radiation degradation for use in updating space power design guidelines and test standards.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603410F Space Systems Environmental Interactions Technology
PROJECT NO. AND NAME 2822 Space Environmental Impact Test	

- (U) $466 Determine vehicle charging and environmental interactions which will result in new preventive measures to protect spacecraft from charging hazards. Enhance analytical models of vehicle charging and spacecraft environmental interactions which are directly applicable to future high-powered space systems.
  - (U) Incorporated charging algorithm from Shuttle Potential and Return Electrons Experiment into modeling codes.
  - (U) Prepared hardware for reflight to obtain data on vehicle charging effects and environmental interactions of the very high-power generated by a long tether in space and the associated high energy electron beam discharges.
- (U) $265 Determine space environment interactions that limit performance of long-range, high frequency communications and radar systems. This results in design and performance standards to counter scintillation effects and to decrease radio systems susceptibility to plasma-induced environmental interactions.
  - (U) Delivered hardware and integrated it on a sounding rocket for data collection of interactions with high frequency transmissions in space.
- (U) $453 Develop and test a suite of miniaturized, low-power, instruments to measure the populations of natural space particles responsible for radiation dose effects and hazardous charge buildups.
  - (U) Designed a miniaturized low-power electron telescope to provide charge buildup information during space tests of new space technologies.
  - (U) Designed a miniaturized low-power proton telescope to provide low energy dose information during space tests of new space technologies.
  - (U) Designed a miniaturized low-power dosimeter to provide high energy dose and single event upset information during space tests of new space technologies.
- (U) $2,877 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603410F Space Systems Environmental Interactions Technology
PROJECT NO. AND NAME 2822 Space Environmental Impact Test	

(U) FY 1996 ($ in Thousands):

- (U) $583 Develop and test miniaturized space plasma sensors. Characterize plasma in and around spacecraft wakes to improve low-earth environmental specifications and provide critical validation of charge analysis modeling codes necessary for spacecraft designers.
  - (U) Continue analysis of plasma data collected during Mission 2 to verify performance of space plasma sensors and to validate analysis modeling codes.
  - (U) Develop the Digital Ion Driftmeter (space plasma sensor designed for use on the National Polar Orbiting Experimental Satellite) for space test to obtain the space qualification data needed to assess operational use.
- (U) $200 Demonstrate next-generation solar array technologies that provide the required performance standards in space before being integrated into future power systems. Characterize array interactions with natural space environment.
  - (U) Analyze data and produce detailed reports on high-voltage plasma interactions and on advanced solar array radiation degradation for use in updating space power design guidelines and test standards.
- (U) $660 Determine vehicle charging and environmental interactions which will result in new preventive measures to protect spacecraft from charging hazards. Enhanced analytical models of vehicle charging and spacecraft environmental interactions directly applicable to future high-powered space systems also will be studied.
  - (U) Begin data analysis leading to improvements in modeling codes for vehicle charging effects and environmental interactions.
- (U) $272 Determine the interactions between spacecraft and their environment that limit performance of long-range, high frequency communications and radar systems, resulting in design and performance standards to counter scintillation effects and decrease radio systems susceptibility to plasma-induced environmental interactions.
  - (U) Support the sounding rocket launch and data collection.
  - (U) Conduct preliminary analysis data for eventual incorporation into design and performance standards to counter scintillation effects and decrease susceptibility to plasma interactions.
- (U) $397 Develop and test a suite of miniaturized, low-power instruments to measure the populations of natural space particles responsible for radiation dose effects and hazardous charge buildups. (Additional funding is provided through Project 2823.)
  - (U) Complete design and begin fabrication of a miniaturized, low-power electron telescope to provide charge buildup information during space tests of new space technologies.
  - (U) Complete design and begin fabrication of a miniaturized, low-power dosimeter to provide high energy dose and single event upset information during space tests of new space technologies.
- (U) $2,112 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603410F Space Systems Environmental Interactions Technology
PROJECT NO. AND NAME 2822 Space Environmental Impact Test	

(U) FY 1997 ($ in Thousands):

- (U) $401 Develop and test miniaturized space plasma sensors; characterize plasma in and around spacecraft wakes to improve low-earth environmental specifications to provide critical validation of charge analysis modeling codes necessary for spacecraft designers.
  - (U) Complete data analysis and publish results from space plasma sensors to validate charge analysis modeling codes.
  - (U) Deliver and integrate the Digital Ion Driftmeter and support launch operations to obtain the space qualification needed for operational use.
- (U) $432 Demonstrate next-generation solar array technologies that provide the required performance standards in space before being integrated into future power systems. Characterize array interactions with natural space environment.
  - (U) Complete analysis and publish final technical reports on high-voltage plasma interactions and on advanced solar array radiation degradation for use in updating space power design guidelines and test standards.
  - (U) Begin conceptual design of future solar array technologies to prove their space performance before being integrated into future space power systems.
- (U) $407 Determine vehicle charging and environmental interactions which will result in new preventive measures to protect spacecraft from charging hazards. Enhanced analytical models of vehicle charging and spacecraft environmental interactions directly applicable to future high-powered space systems will be developed.
  - (U) Continue data analysis and publish report to improve modeling codes for vehicle charging effects and environmental interactions.
- (U) $57 Determine the interactions between spacecraft and their environment that limit performance of long-range, high frequency communications and radar systems.
  - (U) Continue analysis of sounding rocket data for eventual incorporation into design and performance standards used to counter scintillation effects and decrease susceptibility to plasma interactions.
- (U) $434 Develop and test a suite of miniaturized, low-power instruments to measure the populations of natural space particles responsible for radiation dose effects and hazardous charge buildups. (Additional funding is provided through Project 2823.)
  - (U) Complete fabrication of a miniaturized dosimeter to provide high energy dose and single event upset information during space tests.
- (U) $1,731 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603410F Space Systems Environmental Interactions Technology
PROJECT NO. AND NAME 2822 Space Environmental Impact Test	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,158	2,194	1,747	Cont
(U) Current Budget Submit	2,877	2,112	1,731	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this project are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603401F, Advanced Spacecraft Technology.
- (U) PE 0603402F, Space Test Program.
- (U) NASA/Air Force Space technology Interdependency Group coordinates efforts and reviews programs annually.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603410F Space Systems Environmental Interactions Technology

PROJECT NO. AND NAME: 2823 Space Hazards Mitigation

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2823 Space Hazards Mitigation	990	1,237	1,183	1,076	1,016	982	858	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** The Air Force needs to prevent electrical charge buildup and the resulting disabling discharges on operational satellites. Charge control systems are being developed which will provide warnings on space conditions likely to produce anomalous operational behavior (low-medium orbits) or provide autonomous active charge control (high altitude and geosynchronous orbits).

(U) FY 1995 ($ in Thousands):

- (U) $250 Develop and demonstrate an autonomous active charge control system to prevent hazardous charge buildup on high-altitude and geosynchronous orbit satellites, decreasing circuitry upsets and component damage, improving on-orbit reliability, and enhancing system performance.
  - (U) Launched an advanced charge control system on the Defense Satellite Communications System B-7 satellite. Evaluated system performance from initial on-orbit operations.
- (U) $740 Develop and test an autonomous, compact, lightweight, low-power instrument to monitor the space environment near a satellite and warn of hazardous conditions.
  - (U) Completed fabrication, calibration, and testing of autonomous, compact, lightweight, low-power environmental hazards monitoring flight unit sensor to prove its space performance before its integration into future space systems.
- (U) $990 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603410F Space Systems Environmental Interactions Technology
PROJECT NO. AND NAME 2823 Space Hazards Mitigation	

(U) FY 1996 ($ in Thousands):

- (U) $63 Develop and demonstrate an autonomous, active charge control system to prevent hazardous charge buildup on high-altitude and geosynchronous orbit satellites, decreasing circuitry upsets and component damage, and mproving on-orbit reliability, and performance.
  - (U) Continue evaluation of the data obtained from the advanced charge control system on Defense Satellite Communications System satellite. Support initial on-orbit operations and begin evaluating performance of the advanced charge control system.
- (U) $256 Develop and test an autonomous, compact, lightweight, low-power instrument to monitor the space environment near a satellite that warns of hazardous conditions.
  - (U) Support integration and testing of the charge-warning instruments on the Space Test Program TSX-5 satellite.
- (U) $918 Develop and test a suite of miniaturized, low-power, scientific quality instruments to measure the populations of natural space particles responsible for radiation dose effects and hazardous charge buildups.
  - (U) Complete design and begin fabrication of a miniaturized low-power proton telescope to provide low energy dose information during space tests of new space technologies.
- (U) $1,237 Total

(U) FY 1997 ($ in Thousands):

- (U) $22 Develop and demonstrate an autonomous active control system to prevent hazardous-charge buildup on high-altitude and geosynchronous orbit satellites, decreasing circuitry upsets and component damage, improving on-orbit reliability, and enhancing system performance.
  - (U) Finish evaluating the data from the Defense Satellite Communications System flight and produce a final report.
- (U) $257 Develop and test an autonomous, compact, lightweight, low-power instrument to monitor the space environment near a satellite that warns of hazardous conditions.
  - (U) Support the launch of and provide on-orbit support for the charge-warning instruments on the Space Test Program TSX-5 satellite.
- (U) $904 Develop and test a suite of miniaturized, low-power instruments to measure the populations of natural space particles responsible for radiation dose effects and hazardous charge buildups. (Additional funding is provided through Project 2822.)
  - (U) Complete fabrication of a miniaturized, low-power, electron telescope to provide charge buildup information during space tests of new space technologies.
  - (U) Complete fabrication of a miniaturized, low-power, proton telescope that provides low energy dose information during space tests of new space technologies.
- (U) $1,183 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603410F Space Systems Environmental Interactions Technology
PROJECT NO. AND NAME 2823 Space Hazards Mitigation	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	990	1,285	1,533	Cont
(U) Current Budget Submit	990	1,237	1,183	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603401F, Advanced Spacecraft Technology.
- (U) PE 0603402F, Space Test Program.
- (U) NASA/Air Force Space technology Interdependency Group coordinates efforts and reviews programs annually.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603601F Conventional Weapons Technology

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	28,710	32,455	24,885	26,490	24,919	25,170	26,531	Continuing	Continuing
670A Ordnance Technology	17,125	20,278	16,385	18,878	17,417	17,971	19,202	Continuing	Continuing
670B Guidance Technology	11,585	12,177	8,500	7,612	7,502	7,199	7,329	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This Advanced Technology Development program develops and demonstrates air-to-surface and air-to-air conventional weapons technologies including guidance, ordnance, and aeromechanics. This program develops the following technologies: autonomous, adverse-weather advanced guidance seekers; fuzes; energetic, insensitive, and less sensitive explosives; hard target warheads; explosives, bombs, submunitions, and their dispensing mechanisms; guns and ammunition; air-to-surface composite weapon airframes; smart submunitions; weapon ordnance subsystems; and instrumentation. Hardware/software for advanced technologies are developed and evaluated to determine effectiveness and potential operational value.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603601F Conventional Weapons Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	30,652	31,637	30,278	Cont
(U) Appropriated Value	31,250	34,137		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-1,440	-674		
b. SBIR	-582	-676		
c. Omnibus/Other Above Threshold Reprogrammings	-331	-330		
d. Below Threshold Reprogrammings	-187			
(U) Current Budget Submit	28,710	32,455	24,885	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal changes are due to restructuring of the program for advanced technology development of conventional weapons technology to meet warfighter needs.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603601F Conventional Weapons Technology

PROJECT NO. AND NAME: 670A Ordnance Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
670A Ordnance Technology	17,125	20,278	16,385	18,878	17,417	17,971	19,202	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops and demonstrates the effectiveness and operational utility of conventional (non-nuclear) ordnance technologies for current and future air-delivered weapons. The project develops the following technologies: fuzes; energetic, insensitive and less sensitive explosives; hard target warheads; explosives, bombs, submunitions, and their dispensing mechanisms; guns and ammunition; air-to-surface composite weapon airframes; smart submunitions; weapon ordnance subsystems; and instrumentation.

(U) FY 1995 ($ in Thousands):

- (U) $12,681 Develop advanced air-delivered munition and submunition technologies for components, subsystems, and systems to increase performance, lethality, safety, affordability, and supportability.
  - (U) Performed integration of antimateriel multimode warhead components (case, explosive, and fireset) to develop a warhead for future antimateriel submunitions which is highly effective against all mobile ground targets.
  - (U) Performed large-scale testing of agent defeat kill mechanism to develop weapon payloads for defeating chemical and biological weapons.
  - (U) Expanded envelope for the smart hard target fuze to improve burst point control for different sized weapons.
  - (U) Completed the demonstration of an improved ordnance package (i.e., target detection device, electronic safe and arm, and warhead) for future upgrades of air-to-air missiles.
- (U) $4,444 Demonstrate advanced ordnance, weapon airframe and carriage, and instrumentation technologies for air-to-air and air-to-surface munitions and submunitions to demonstrate operational effectiveness.
  - (U) Designed and began fabrication of an affordable weapon-size Global Positioning System/Inertial Navigation System (GPS/INS) hardware receiver which improves GPS accuracy in a jammed environment.
  - (U) Evaluated concepts for advanced suspension and release equipment for future fighter aircraft which will reduce size, weight, and supportability issues associated with conventional pyrotechnic racks, maximize weapon loadout, and reduce drag and radar cross section.
- (U) $17,125 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603601F Conventional Weapons Technology
PROJECT NO. AND NAME 670A Ordnance Technology	

(U) FY 1996 ($ in Thousands):

- (U) $13,004 Develop advanced air-delivered munition and submunition technologies for components, subsystems, and systems to increase performance, lethality, safety, affordability, and supportability.
  - (U) Complete final integrated design of an antimateriel submunition (e.g., warhead, seeker, submunition airframe, etc.) to demonstrate advanced antimateriel submunition technology which is highly effective against all mobile ground targets.
  - (U) Complete design of a general purpose bomb with an insensitive explosive and an improved fuze that can be stored indefinitely with the fuze installed.
  - (U) Complete design and begin fabrication of an active hard target smart fuze to determine optimum burst point during the penetration event.
  - (U) Perform large-scale testing of agent defeat kill mechanism to develop weapon payloads for defeating chemical and biological weapons.
- (U) $7,274 Demonstrate advanced ordnance, weapon airframe and carriage, and instrumentation technologies for air-to-air and air-to-surface munitions and submunitions to demonstrate operational effectiveness.
  - (U) Complete subsystem testing of an affordable anti-jam Global Positioning System/Inertial Navigation System (GPS/INS) receiver and integrate it into a weapons airframe for flight test to enable GPS accuracy in a jammed environment.
  - (U) Complete design and begin fabrication of advanced suspension and release equipment for future fighter aircraft which will reduce size, weight, and supportability issues associated with conventional pyrotechnic racks, maximize weapon loadout, and reduce drag and radar cross section.
- (U) $20,278 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603601F Conventional Weapons Technology
PROJECT NO. AND NAME 670A Ordnance Technology	

(U) FY 1997 ($ in Thousands):

- (U) $9,170 Develop advanced air-delivered munition and submunition technologies for components, subsystems, and systems to increase performance, lethality, safety, affordability, and supportability.
  - (U) Complete flight test demonstration of a 250 pound class miniature munition.
  - (U) Complete detailed design of a 1000 pound unitary penetrator compatible with future fighter aircraft.
  - (U) Complete detailed design of a boosted penetrator warhead and rocket booster, and initiate sled track tests of penetrator warhead and rocket booster.
  - (U) Complete in-house testing of an antimateriel submunition and fabrication of instrumented and live-fire units for flight testing to demonstrate advanced antimateriel submunition technology which is highly effective against all mobile ground targets.
  - (U) Conduct requirements study and design a multi-event hard target fuze for agent defeat warheads.
- (U) $7,215 Demonstrate advanced ordnance, weapon airframe and carriage, and instrumentation technologies for air-to-air and air-to-surface munitions and submunitions to demonstrate operational effectiveness.
  - (U) Integrate and ground test a Global Positioning System/Inertial Navigation System (GPS/INS) jam resistant receiver demonstration unit in a weapon flight test vehicle.
  - (U) Develop overall air-to-air missile concept and conduct technology trade studies for a highly agile dual range missile capable of within visual range and beyond visual range engagements.
- (U) $16,385 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603601F Conventional Weapons Technology
PROJECT NO. AND NAME 670A Ordnance Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	17,754	18,812	17,994	Cont
(U) Current Budget Submit	17,125	20,278	16,385	Cont

(U) Change Summary Explanation:

Funding: Horizontal/vertical changes to this project since the previous President's Budget are due to restructuring of the program for advanced development of conventional weapons technology to meet warfighter needs.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602602F, Conventional Munitions.
- (U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology.
- (U) PE 0603792N, Advanced Technology Demonstrations.
- (U) PE 0604407D, Joint Standoff Weapon.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603601F Conventional Weapons Technology
PROJECT NO. AND NAME 670B Guidance Technology	

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
670B Guidance Technology	11,585	12,177	8,500	7,612	7,502	7,199	7,329	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project develops and demonstrates affordable, autonomous, and adverse-weather advanced guidance technologies for conventional air-to-air and air-to-surface armament. Objectives include: increased accuracy, adverse-weather operation; real-time targeting and battle damage assessment (BDA); enhanced target classification/identification; standoff delivery munitions; detection and "lock-on" of reduced signature targets; improved survivability; more reliable system operation; improved countermeasure performance; and enhanced affordability.

(U) FY 1995 ($ in Thousands):

- (U) $7,965 Develop and demonstrate affordable, autonomous, and adverse-weather advanced air-to-surface guidance technologies.
  - (U) Completed preliminary design of a five-cubic-inch optical correlator coupled with a laser radar (LADAR) to enable autonomous target identification in a cluttered environment.
  - (U) Evaluated concepts for an advanced synthetic aperture radar guidance terminal seeker for upgrades of direct attack and standoff munitions.
  - (U) Completed preliminary design of an advanced digital electronic processor for weapons seeker applications, suitable for air-to-surface and counterair guided munition applications; tera-op (10^{12} operations per second) throughput capability will be demonstrated.
  - (U) Completed low-cost anti-armor design of tactical size, solid state, pulsed LADAR sensor for use in antimateriel submunition, and conduct flight test demonstrations for the LADAR sensor, guidance algorithms, and submunition airframe.
- (U) $2,011 Develop and demonstrate technologies for real-time targeting by advanced guidance seekers.
  - (U) Demonstrated feasibility of real-time targeting under the Advanced Synthetic Aperture Radar Guidance program using off-board imagery.
- (U) $1,609 Develop and demonstrate advanced guidance technologies and affordable, reliable components to counter the next generation air-to-air threats.
  - (U) Fabricated and tested a high-fidelity, wideband, two-color, infrared scene projector for use in imaging infrared sensor development and test.
  - (U) Completed preliminary design of a conformal array seeker that utilizes an antenna that conforms to the missile aeroskin, enabling smaller missile diameters and improved aerodynamic performance.
- (U) $11,585 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603601F Conventional Weapons Technology
PROJECT NO. AND NAME 670B Guidance Technology	

(U) FY 1996 ($ in Thousands):

- (U) $11,493 Develop and demonstrate affordable, autonomous, and adverse-weather advanced air-to-surface guidance technologies.
  - (U) Complete detailed design of a five-cubic-inch optical correlator coupled with a laser radar (LADAR) to enable autonomous target identification in a cluttered environment.
  - (U) Conduct detailed integration analysis and design for an affordable, adverse-weather capable, autonomous, precision synthetic aperture radar (SAR) guidance seeker.
  - (U) Complete design and fabricate an advanced digital electronic processor for weapons seeker applications suitable for air-to-surface and counterair guided munition applications; demonstrate tera-op (10^{12} operations per second).
- (U) $684 Develop and demonstrate advanced guidance technologies and affordable, reliable components to counter the next generation air-to-air threats.
  - (U) Demonstrate capability for the primary high-fidelity, wideband, two-color, infrared scene projector for use in imaging infrared sensor development and test.
- (U) $12,177 Total

(U) FY 1997 ($ in Thousands):

- (U) $7,400 Develop and demonstrate affordable, autonomous, and adverse-weather advanced air-to-surface guidance technologies.
  - (U) Fabricate and ground test an optical correlator and LADAR for autonomous target identification in a cluttered environment.
  - (U) Fabricate and bench test an affordable, autonomous, adverse-weather capable, precision SAR seeker.
  - (U) Assess degree of commonality of components across LADAR seekers designed for direct attack and cruise missile operations; identify critical technical issues for each design; and focus development of critical component technologies for the direct attack munition seeker design to support testbed fabrication.
- (U) $1,100 Develop and demonstrate advanced guidance technologies and affordable, reliable components to counter the next generation air-to-air threats.
  - (U) Conduct analyses on an advanced digital electronic processor for weapons seeker applications suitable for air-to-surface and counter-air guided munition applications; demonstrate tera-op throughput capability.
- (U) $8,500 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603601F Conventional Weapons Technology
PROJECT NO. AND NAME 670B Guidance Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	12,898	12,825	12,284	Cont
(U) Current Budget Submit	11,585	12,177	8,500	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. Horizontal changes are due to restructuring of the program for advanced development of affordable, autonomous, and adverse-weather guidance technologies to meet warfighter needs.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology.
- (U) PE 0603792N, Advanced Technology Demonstrations.
- (U) PE 0604618F, Joint Direct Attack Munitions.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	87,120	71,603	41,895	40,148	39,798	38,528	40,344	0	Continuing
3150 Advanced Optics Technology	28,646	18,360	2,038	2,679	2,751	2,737	2,887	0	Continuing
3151 High Power Semiconductor Laser Technology	8,940	7,640	4,697	4,229	6,852	8,182	9,365	Continuing	Continuing
3152 High Power Microwave Technology	19,411	19,810	9,961	9,960	10,227	10,089	10,330	Continuing	Continuing
3647 High Energy Laser Technology	30,123	25,793	25,199	23,280	19,968	17,520	17,762	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program demonstrates advanced directed energy and optical imaging concepts. Speed-of-light weapons and long-range, high resolution optical imaging through the turbulent atmosphere offer significant payoffs for many Air Force missions, such as theater missile defense, suppression of enemy air defenses, and control of space. This program already demonstrated many major technological breakthroughs such as removing atmospheric distortions from optical transmissions (e.g., laser beams) and producing small, relatively high power laser diode phased arrays. Major emphasis areas include: high power microwave and high energy laser technologies; long-range optical imaging; and high power laser diodes and diode arrays.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	93,590	47,919	46,624	Cont
(U) Appropriated Value	96,500	74,919		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-5,472	-2,016		
b. SBIR	-1,778	-1,300		
c. Omnibus/Other Above Threshold Reprogrammings				
d. Below Threshold Reprogrammings	-2,130			
(U) Current Budget Submit	87,120	71,603	41,895	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program. For FY 1996, Congress appropriated an additional $27 million for laser radar and excimer technologies which also explains the dramatic horizontal "reduction" in FY 1997. The remaining FY 1997 horizontal reduction is due to budget constraints and priorities within the S&T Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT NO. AND NAME: 3150 Advanced Optics Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3150 Advanced Optics Technology	28,646	18,360	2,038	2,679	2,751	2,737	2,887	0	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops advanced optical technologies for identifying distant and/or dim objects. This work supports high energy laser technologies because an imaging subsystem is required for target verification, accurate and sustainable laser beam placement on target, and near-real time damage assessment. Several advanced technologies including nonlinear optics, adaptive optics, and specialized signal processing are being developed. The goal is high quality optical image reconstruction, concentrating on removing turbulent atmosphere-induced distortions. Many of these technologies developed/being developed have significant application to astronomy research.

(U) FY 1995 ($ in Thousands):

- (U) $437 Develop and demonstrate advanced optical imaging technologies that support applications such as space object imaging.
  - (U) Produced first high resolution satellite images on 3.5 meter telescope using speckle image sensing and reconstruction.
  - (U) Conducted initial field tests on 3.5 meter telescope of daylight space object imaging concepts using adaptive optics for atmospheric compensation.
- (U) $1,083 Develop and implement techniques to exploit optical images of satellites to support space object imaging identification/mission payload assessment applications.
  - (U) Delivered first-generation workstation for optical image exploitation to U.S. Space Command Combined Intelligence Center.
- (U) $1,812 Develop nonlinear optics technologies.
  - (U) Demonstrated feasibility of using nonlinear optics concepts for a sodium-wavelength laser at a ten watt power level, providing a laser source option for atmospheric compensation using a laser beacon and adaptive optics.
- (U) $453 Perform upgrades/demonstrations at the Air Force Maui Optical Site, HI, and the Malabar, FL, optical sites.
  - (U) Completed statistical analysis to establish sky coverage advantages of networking remote optical sites to support space object identification applications.
- (U) $9,208 Develop excimer-based active imaging technology.
  - (U) Completed illuminator laser development.
  - (U) Completed design and fabrication of the active imaging receiver and tracker.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3150 Advanced Optics Technology	

- (U) $15,653 Develop the laser imaging, detection, and ranging (LIDAR) field demonstration.
  - (U) Completed design, fabrication, and delivery of full-scale laser source.
  - (U) Conducted initial demonstrations of laser ranging and imaging for low earth orbit satellites at the Air Force Maui Optical Station.
  - (U) Completed modifications to laser system to incorporate wavelength agility in support of remote sensing applications.
- (U) $28,646 Total

(U) FY 1996 ($ in Thousands):

- (U) $1,422 Develop and demonstrate advanced optical imaging technologies that support applications such as space object imaging.
  - (U) Demonstrate daylight satellite imaging concepts using adaptive optics for atmospheric compensation.
  - (U) Demonstrate advanced electro-optical exploitation software tool.
- (U) $491 Develop nonlinear optics technologies for non-mechanical corrections in optical imaging.
  - (U) Design breadboard model of an ultra-high resolution, lightweight imaging satellite subsystem using nonlinear optics to compensate for deformations in a large diameter, deployable primary mirror.
- (U) $88 Perform upgrades/demonstrations at Air Force Maui Optical Site, HI.
  - (U) Evaluate the potential of laser imaging, detection, and ranging (LIDAR) technology as a permanent addition to the Maui capabilities for space object surveillance and identification.
- (U) $9,623 Develop excimer-based active imaging technology.
  - (U) Complete delivery and installation of laser illuminator.
  - (U) Complete active imaging receiver and tracker integration with the 3.5 meter telescope at Starfire Optical Range.
  - (U) Conduct initial active imaging field tests and demonstrations.
  - (U) Evaluate feasibility of active imaging techniques for long-range imaging applications.
- (U) $6,736 Develop the LIDAR field demonstration.
  - (U) Complete installation of the complete LIDAR system at the Air Force Maui Optical Station.
  - (U) Conduct full-scale LIDAR demonstrations against low-earth orbit satellites.
- (U) $18,360 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3150 Advanced Optics Technology	

(U) FY 1997 ($ in Thousands):

- (U) $751 Develop and demonstrate advanced optical imaging technologies that support applications such as space object imaging.
  - (U) Transition technology for daytime imaging of low-earth orbit satellites to the 3.67 meter telescope at the Air Force Maui Optical Site, HI.
- (U) $404 Develop nonlinear optics technologies for non-mechanical corrections in optical imaging.
  - (U) Construct, characterize, and demonstrate a laboratory breadboard model of the primary mirror and compensation system for an ultra-high resolution, lightweight imaging satellite concept which uses nonlinear optics to compensate for deformations in a large diameter, deployable primary mirror.
- (U) $777 Develop and demonstrate very long-range optical imaging technologies for increased resolution and data fusion to support missions such as space object identification.
  - (U) Begin development of field hardware to demonstrate feasibility of long-range optical imaging for space object identification/mission payload assessment out to geosynchronous altitudes.
- (U) $106 Perform upgrades/demonstrations at the Air Force Maui Optical Site, HI, optical site.
  - (U) Begin integration of newly-completed 3.67 meter telescope at Maui into site control systems to allow routine use as a new contributing sensor for the Space Surveillance Network.
- (U) $2,038 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3150 Advanced Optics Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	30,242	2,210	2,118	Cont
(U) Current Budget Submit	28,646	18,360	2,038	Cont

(U) Change Summary Explanation:

Funding: Vertical changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. For FY 1996, Congress appropriated an additional $17 million for laser radar and excimer related imaging technologies.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0305910F Spacetrack
- (U) PE 0305160F, Defense Meteorological Satellite Program.
- (U) PE 0602102F, Materials.
- (U) PE 0602601F, Phillips Laboratory.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT NO. AND NAME: 3151 High Power Semiconductor Laser Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3151 High Power Semiconductor Laser Technology	8,940	7,640	4,697	4,229	6,852	8,182	9,365	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project continues to yield revolutionary breakthroughs in compact, robust, and affordable laser system technology for a wide range of military applications requiring small, compact laser sources with low to moderate optical power. This is a long-term technology development project with both near-term and long-term goals. Near-term goals include developing compact, reliable infrared sources for a range of applications including night vision systems, battlefield surgery, and covert communication systems. Longer term goals focus on producing compact, significantly higher power sources. This project leads the development of and builds upon a wide range of commercial advancements. Commercially available semiconductor lasers are widely used due to their low-cost, small size and weight, high reliability, and high efficiency in converting electricity to laser energy. This project preserves these attractive features while continually scaling output to higher powers/efficiencies and/or to military application-specific wavelengths. The project is divided into three technology areas. The first area investigates methods to increase output power from individual laser diodes. Secondly, semiconductor laser array integration methods, which produce a single, high quality laser beam at significantly higher power levels are developed. Thirdly, wavelength-specific laser diodes for military applications are developed. Project scientists/managers also work directly with field users to develop proof-of-capability demonstrations and field tests for these revolutionary laser sources. This technology has many commercial applications, especially for eye-safe lasers.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3151 High Power Semiconductor Laser Technology	

(U) FY 1995 ($ in Thousands):

- (U) $2,158 Develop laser diodes for improved performance/higher power in near-term applications such as illumination, designation, and communication and for incorporation into laser diode array architectures.
  - (U) Demonstrated nine watts continuous wave power with good beam quality from a single broad-area diode laser.
  - (U) Completed development and demonstrated 500-watt diode-pumped, solid-state laser breadboard for active tracking illumination.
- (U) $2,943 Develop coherent laser diode arrays for improved performance/higher power in applications requiring high power levels.
  - (U) Demonstrated a suitable array architecture that can be scaled to the 50-100 watt power level by FY 1996.
- (U) $3,344 Develop high power laser diodes and diode arrays at alternate wavelengths that will be transitioned to many military applications such as eye-safe optical systems and infrared countermeasures.
  - (U) Demonstrated two watt continuous wave laser diode output power at 2.1 microns wavelength at room temperature.
  - (U) Demonstrated two watts peak output power from an optically pumped semiconductor structure at four microns wavelength.
- (U) $495 Investigate applications for these advanced semiconductor laser diodes and diode arrays.
  - (U) Transitioned a rifle-mounted visible diode laser illuminator (Saber 203) to the U.S. Army for pre-production development.
  - (U) Transitioned the Field Medical Laser System and Medical (Med) Pen to an industry partner for commercialization.
- (U) $8,940 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3151 High Power Semiconductor Laser Technology	

(U) FY 1996 ($ in Thousands):

- (U) $2,563 Develop laser diodes for improved performance/higher power in near-term applications such as illumination, designation, and communication and for incorporation into laser diode array architectures.
  - (U) Demonstrate three watts of continuous output power from a single mode fiber.
  - (U) Demonstrate semiconductor laser devices that will have the potential to be modulated and scaled to higher powers, with payoff to optical communications applications.
- (U) $2,463 Develop coherent laser diode arrays for improved performance/higher power in applications requiring high power levels.
  - (U) Demonstrate 50 watts continuous power from a phased array of diode lasers.
  - (U) Demonstrate the ruggedness and reliability of a high power system with a one cubic foot laser head.
- (U) $1,985 Develop high power laser diodes and diode arrays at alternate wavelengths that will be transitioned to many military applications such as eye-safe optical systems and infrared countermeasures.
  - (U) Demonstrate lasing of 100 milliwatt electrically-pumped laser diode at a four micron wavelength.
  - (U) Demonstrate lasing of a one watt electrically-pumped laser diode at a wavelength of 3.3 microns.
- (U) $629 Investigate applications for these advanced semiconductor laser diodes and diode arrays.
  - (U) Transition Pocket Laser Communicator to an industry partner for commercialization.
  - (U) Continue transition of semiconductor laser technology to multiple users for illumination/designation field applications.
- (U) $7,640 Total

(U) FY 1997 ($ in Thousands):

- (U) $2,526 Develop laser diodes for improved performance/higher power in near-term applications such as illumination, designation, and communication and for incorporation into laser diode array architectures.
  - (U) Demonstrate five watts of continuous power from a single mode fiber.
  - (U) Demonstrate devices that will have the potential to be modulated and scaled to high powers.
- (U) $2,171 Develop coherent laser diode arrays for improved performance/higher power in applications requiring high power levels.
  - (U) Demonstrate 75 watts of continuous power from a phased array of diode lasers.
  - (U) Demonstrate the scalability of a one cubic foot laser head to 200 watts continuous wave output power.
  - (U) Demonstrate lasing of a five watt average power laser diode at 2.1 microns wavelength.
- (U) $4,697 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3151 High Power Semiconductor Laser Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	10,292	7,994	8,175	Cont
(U) Current Budget Submit	8,940	7,640	4,697	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions in FY 1995 and FY 1996 to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. The FY 1997 vertical/horizontal reduction reflects the results of a reevaluation of the technology maturity of some parts of this important program, with some efforts being placed in applied research, PE 0602601F, Phillips Laboratory.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0602234N, Systems Support Technology.
- (U) Representatives from Army, Navy, Ballistic Missile Defense Organization, National Laboratories, and Air Force using commands are members of the government review team for this technology.
- (U) Joint field demonstrations of this technology are ongoing with: the Air Force Pararescue School; the Air Force Special Operations Command; the U.S. Coast Guard; and the U.S. Customs Service.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3152 High Power Microwave Technology	

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3152 High Power Microwave Technology	19,411	19,810	9,961	9,960	10,227	10,089	10,330	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops high power microwave generation technologies. It also develops a susceptibility/vulnerability/lethality data base to identify potential vulnerabilities of U.S. systems to high power microwave threats and to provide a basis for future offensive and defensive weapons system decisions. Representative U.S. and foreign assets will be tested to understand real system susceptibilities. Both wideband (wide frequency range) and narrowband (very small frequency range) technologies are being developed. The technologies developed in this project will demonstrate the applicability of high power microwaves that can damage/degrade/deny/destroy electronic systems and subsystems for missions such as suppression of enemy air defense, command and control warfare, space control, and aircraft self-protection.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3152 High Power Microwave Technology	

(U) FY 1995 ($ in Thousands):

- (U) $1,439 Develop generic high power microwave technology.
  - (U) Continued to develop narrowband and wideband high power microwave sources and antennas for various applications.
- (U) $428 Evaluate the susceptibility of representative military hardware and software to high power microwave effects.
  - (U) Completed aircraft shelter high power microwave penetration effects.
  - (U) Completed ultra-wideband F-16 high power microwave effects.
  - (U) Characterized susceptibility of current-generation jet engine control systems.
  - (U) Transitioned frequency mode-stir techniques to aircraft and automobile industry that reduce the time for susceptibility tests by 90%.
- (U) $2,160 Develop suppression of enemy air defense technologies.
  - (U) Began weapons application experiment design.
  - (U) Downselected high power microwave narrowband source.
  - (U) Conducted experiments on selected integrated air defense assets.
- (U) $3,523 Develop aircraft self-protection technologies.
  - (U) Developed detailed weapons application design.
  - (U) Designed an experimental proof-of-concept.
- (U) $1,540 Develop active denial technology.
  - (U) Completed development of X-band hardware for active denial technology demonstration.
- (U) $1,113 Develop command and control warfare and space control technologies.
  - (U) Began development of wideband submunition concept for disruption in the command and control warfare mission.
  - (U) Explored ultra-wideband high power microwave weapon concept for electronics damage.
  - (U) Continued development of communications equipment effects database and began database on aircraft maintenance and avionics equipment.
- (U) $9,208 Develop the laser-induced microwave emissions related technologies including excimer laser technology.
  - (U) Performed laser-induced microwave emissions experiments on simulated systems.
  - (U) Developed short pulse source for laser-induced microwave emissions.
- (U) $19,411 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3152 High Power Microwave Technology	

(U) FY 1996 ($ in Thousands):

- (U) $1,951 Develop generic high power microwave technology.
  - (U) Continue development of narrowband and wideband high power microwave sources and antennas.
- (U) $500 Evaluate the susceptibility of representative military hardware and software to high power microwave effects.
  - (U) Conduct effects studies of electromagnetic propagation into facilities.
  - (U) Complete database on various ground and flightline maintenance equipment.
  - (U) Complete susceptibility report for large U.S. aircraft and begin hardening criteria development.
  - (U) Complete experiments to determine coupling of high power microwave energy into hangers.
- (U) $1,615 Develop suppression of enemy air defense technologies.
  - (U) Conduct low power coupling and high power damage experiments on selected integrated air defense assets.
  - (U) Refine system parameter requirements and perform go/no go decision for one concept.
- (U) $2,000 Develop aircraft self-protection technologies.
  - (U) Develop host aircraft hardening criteria.
  - (U) Downselect high power microwave wideband source and begin source/antenna design integration.
  - (U) Design source evaluation experiment.
  - (U) Continue susceptibility testing and dynamic simulations of guided missiles.
- (U) $11,070 Develop the laser-induced microwave emissions related technologies including excimer laser technology.
  - (U) Develop an integrated response model of the laser-induced microwave emissions phenomenon. An end-to-end code will be developed for trade-off analyses.
  - (U) Conduct laboratory and field experiments on operational systems to quantify effects and compare with models and predictions.
  - (U) Develop conceptual designs that will satisfy military mission requirements. Construct critical hardware and conduct feasibility experiments of laser-induced microwave emissions applications.
  - (U) Quantify the physical mechanisms associated with this technology such as coupling mechanisms..
- (U) $1,722 Develop command and control warfare technologies.
  - (U) Continue development of compact wideband sources and antennas for both damage and disruption missions.
  - (U) Perform limited in situ experiments on command/control/communications equipment in building/facilities.
  - (U) Extend materials studies to in situ effects applications.
- (U) $952 Develop high power microwave space control technologies.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3152 High Power Microwave Technology	

- (U) Initiate application concept studies.
- (U) Continue vulnerability testing of various satellite receivers and provide data to developers.

– (U) $19,810 Total

(U) FY 1997 ($ in Thousands):

– (U) $3,534 Develop suppression of enemy air defense technologies.
- (U) Conduct experiments on selected integrated air defense assets.
- (U) Complete concept design of technology demonstration.
- (U) Begin narrowband high power microwave source technology integration.
- (U) Continue development of narrowband high power microwave sources and antennas.

– (U) $2,004 Develop aircraft self-protection technologies.
- (U) Complete high power microwave hardening criteria evaluation for large U.S. aircraft.
- (U) Continue development of wideband high power microwave sources and antennas for aircraft self-protection applications.
- (U) Initiate hardening requirements on experimental platform.
- (U) Conduct experiment to demonstrate protection technologies.
- (U) Prepare plan to transition technology to system program offices.

– (U) $1,168 Develop command and control warfare technologies.
- (U) Finalize wideband source and pulse power designs for command and control warfare applications.
- (U) Complete susceptibility effects database on foreign aircraft to high power microwave.
- (U) Continue equipment characterization of command and control assets.
- (U) Conduct effects experiments of electromagnetic propagation into command and control facilities.

– (U) $1,000 Develop laser-induced microwave emissions technology.
- (U) Validate the integrated response model of the laser-induced microwave emissions phenomenon.
- (U) Complete experiments, begun in FY 1996, on operational systems and develop draft hardening specifications.
- (U) Complete feasibility experiments and analyze results for various applications.

– (U) $500 Develop active denial technology.
- (U) Begin application concept studies for next-generation technology.

– (U $ 1,755 Develop high power microwave space control technologies.
- (U) Continue application concept studies.
- (U) Perform subsystem susceptibility experiments.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3152 High Power Microwave Technology	

- (U) Perform subsystem and system modeling and assessments.

- (U) $9,961 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	20,852	10,728	10,781	Cont
(U) Current Budget Submit	19,411	19,810	9,961	Cont

(U) Change Summary Explanation:

Funding: Vertical reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program. Congress added $10 million in FY 1995 and FY 1996 for excimer laser-related technologies.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0602120A, Electronic Survivability and Fuzing Technology.
- (U) PE 0602111N, Anti-Air Warfare, Anti-Surface Warfare Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603605F Advanced Weapons Technology

PROJECT NO. AND NAME: 3647 High Energy Laser Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3647 High Energy Laser Technology	30,123	25,793	25,199	23,280	19,968	17,520	17,762	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification**: This project provides for the development, demonstration, and detailed assessment of technology needed for high energy laser weapons. Near-term focus is on ground-based and airborne high energy laser missions, although the technology developed for this project is directly applicable to most high energy laser applications. Critical technologies demonstrated include: scaleable laser devices, with near-term emphasis on the Chemical Oxygen-Iodine Laser (COIL); optical components; and laser beam control to efficiently compensate and propagate laser radiation through the atmosphere to a target. Detailed computational models to establish high energy laser weapon effectiveness and satellite and missile vulnerability will be developed. Correcting the laser beam for distortions induced by propagation through the turbulent atmosphere is the key technology in most high energy laser applications. The beam control technology developed in this project has a significant benefit to the astronomy community.

(U) FY 1995 ($ in Thousands):

- (U) $3,116 Develop and demonstrate high energy laser components for potential weapon applications.
  - (U) Demonstrated optimized rotating-disk oxygen generator for a COIL device, achieving better than 50% increase in laser power from a given size laser hardware.
  - (U) Demonstrated lasing with advanced spray oxygen generator concept, completing initial evaluation of key performance parameters.
  - (U) Demonstrated efficient COIL operation at increased cavity pressure (twice the standard pressure) on a moderate-scale COIL device, indicating the feasibility of significantly reducing pressure recovery hardware requirements for high energy COIL devices.
- (U) $15,797 Perform atmospheric compensation/beam control experiments from ground-based platforms.
  - (U) Completed first-generation adaptive optics for the 3.5 meter telescope at Starfire Optical Range (SOR).
  - (U) Established feasibility of tilt anisoplanatism compensation through field observation of binary stars with atmospheric compensation and post-test data processing, increasing confidence to meet laser pointing stabilization requirements for long-range laser engagements.
  - (U) Completed upgrade of SOR one meter beam director to support satellite illumination for planned active tracking and active imaging experiments. Demonstrated ability to routinely illuminate low-earth orbit satellites.
  - (U) Demonstrated high-bandwidth atmospheric compensation during daytime on SOR 1.5 meter telescope, using bright stars.
  - (U) Integrated improved tracker and multiple-beam illuminator into existing ground-based hardware to evaluate the performance of integrated tracking/atmospheric compensation, simulating the high altitude, horizontal propagation path for theater missile defense scenarios.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3647 High Energy Laser Technology	

- (U) $2,368 Develop and demonstrate active imaging technology to support ground-based laser beam control for target verification, aimpoint designation, and damage assessment.
  - (U) Completed hardware fabrication and integration of an active imaging receiver, to be used in field testing with an existing active imaging illuminator laser during FY 1996.
- (U) $7,142 Perform atmospheric measurements and characterization of the high energy laser beam propagation environment from ground and airborne platforms.
  - (U) Completed high altitude airborne flights to obtain optical measurements of atmospheric turbulence along long horizontal propagation paths.
- (U) $1,700 Perform vulnerability assessments for potential high energy laser targets.
  - (U) Completed ground tests against full-scale theater missile targets.
  - (U) Completed technical report documentation on analytical assessment results on first six priority satellite targets.
  - (U) Incorporated uncertainty methodology into satellite vulnerability assessment process.
  - (U) Completed three new satellite models and vulnerability assessments.
  - (U) Completed vulnerability analysis on two satellite optical systems.
- (U) $30,123 Total

(U) FY 1996 ($ in Thousands):

- (U) $4,060 Develop and demonstrate high energy laser device components for potential weapon applications.
  - (U) Complete advanced diagnostics development and conduct diagnostic Chemical Oxygen-Iodine Laser (COIL) testing to quantitatively determine the excited oxygen generator yield, water pressure, and laser cavity gas temperature for optimum performance.
  - (U) Evaluate COIL diagnostic data to improve understanding of current COIL device performance and identify areas for further development to improve performance.
  - (U) Begin development of hardware to demonstrate efficient wavelength-shifting with a COIL device, to establish the technology base for COIL-based illuminator laser for active tracking.
- (U) $1,713 Perform vulnerability assessments for potential high energy laser targets.
  - (U) Conduct laser vulnerability experiments on satellite subsystems.
  - (U) Begin detailed vulnerability analysis on satellite optical payload systems.
  - (U) Begin detailed satellite vulnerability assessments using newly incorporated uncertainty method.
  - (U) Assess the potential of near-term laser countermeasures on satellites.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3647 High Energy Laser Technology	

- (U) $1,434 Perform atmospheric measurements and characterization of the high energy laser beam propagation environment from ground and airborne platforms.
  - (U) Complete analysis and evaluation of optical measurements collected in high altitude airborne flights during FY 1995.
- (U) $2,124 Develop and demonstrate active imaging technology to support ground-based laser beam control for target verification, aimpoint designation, and damage assessment.
  - (U) Demonstrate feasibility and performance of promising active imaging concepts, using the active imaging receiver developed during FY 1995, coupled to the 3.5 meter telescope at the Starfire Optical Range.
- (U) $16,462 Perform atmospheric compensation/beam control experiments from ground-based platforms to support applications ranging from weaponization to space object identification.
  - (U) Complete development and integration of one kilowatt track illuminator laser with the one meter beam director at Starfire Optical Range.
  - (U) Demonstrate real-time compensation for tilt anisoplanatism on 1.5 meter telescope, establishing ability to meet laser pointing stabilization requirements for long-range laser engagements.
  - (U) Conduct initial atmospheric compensation experiments with first-generation adaptive optics on 3.5 meter telescope.
  - (U) Begin active tracking experiments with both 1.5 meter and 3.5 meter telescopes, using 1 kilowatt illuminator laser.
  - (U) Evaluate synergistic effects between atmospheric compensation and active tracking of satellite targets.
  - (U) Begin development of 200 watt, sodium-wavelength laser, to be used as a high altitude laser beacon for full-scale compensation of the 3.5 meter telescope.
  - (U) Complete integrated active tracking/atmospheric compensation experiments in static ground testing simulating the high-altitude, horizontal propagation path for theater missile defense scenarios.
  - (U) Conduct active tracking experiments against boosting missiles at White Sands Missile Range, reproducing realistic target phenomenology for the theater missile defense scenario.
- (U) $25,793 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3647 High Energy Laser Technology	

(U) FY 1997 ($ in Thousands):

- (U) $3,006 Develop and demonstrate high energy laser components for potential weapon applications.
  - (U) Demonstrate a 10-20% additional improvement in Chemical Oxygen-Iodine Laser (COIL) performance, based on advanced concepts developed from diagnostic testing and evaluation during FY 1996.
  - (U) Demonstrate a pulsed, multi-kilowatt COIL device with good beam quality, suitable for high efficiency wavelength-shifting for illuminator applications.
- (U) $1,829 Perform vulnerability assessments for potential high energy laser targets.
  - (U) Continue to conduct laser vulnerability experiments on satellite subsystems.
  - (U) Continue to perform detailed vulnerability analysis on satellite optical payload systems.
  - (U) Continue detailed satellite vulnerability assessments on satellites using newly incorporated uncertainty methodology.
  - (U) Continue assessing the potential of near-term laser countermeasures on satellites.
- (U) $20,364 Perform atmospheric compensation/beam control experiments from ground-based platforms to support applications ranging from weaponization to space object identification.
  - (U) Complete development and install a 200 watt sodium wavelength laser to support full-scale beacon sensing for 3.5 meter telescope.
  - (U) Continue satellite active tracking experiments, to evaluate synergistic effects with atmospheric compensation. Investigate phenomena resulting from satellite target illumination for various targets and engagements. Demonstrate 24-hour satellite tracking capability.
  - (U) Integrate tilt anisoplanatism compensation with atmospheric compensation and active tracking capability and demonstrate ability to point a laser beam with sufficient accuracy to maintain a selected aimpoint on a satellite target.
  - (U) Complete development and installation of next generation adaptive optics for the 3.5 meter telescope.
  - (U) Complete active tracking experiments with advanced hardware and track algorithms against boosting missiles at White Sands Missile Range, reproducing realistic target phenomenology for the theater missile defense scenario.
- (U) $25,199 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology
PROJECT NO. AND NAME 3647 High Energy Laser Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	32,204	26,987	25,550	Cont
(U) Current Budget Submit	30,123	25,793	25,199	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602601F, Phillips Laboratory.
- (U) PE 0603319F, Airborne Laser Demonstration.
- (U) PE 0305910F, Spacetrack.
- (U) PE 0603217C, Ballistic Missile Defense, Advanced Development (High Altitude Balloon Experiment).
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603707F Weather Systems Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	4,778	4,414	3,406	3,262	3,347	3,273	3,244	Continuing	Continuing
2688 Weather Support Technology	2,436	2,203	2,031	1,970	1,858	1,954	1,944	Continuing	Continuing
2781 Weather Radar Technology	459	393	400	400	400	400	400	Continuing	Continuing
4026 Centralized Support Technology	1,883	1,818	975	892	1,089	919	900	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** New technologies for weather support forces and their operational customers are demonstrated and transitioned to the user in this Advanced Technology Development program. Technologies developed include new data management and efficient, more accurate forecasting techniques for use by battlefield commanders and peacetime training operations. The program also provides new technologies to improve centralized space/weather support capabilities at the Air Force's Global Weather Central and Space Forecast Center.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603707F Weather Systems Technology

U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,983	4,577	4,378	Cont
(U) Appropriated Value	5,100	4,577		
(U) Adjustments to Appropriated Value				
a. Congressional General Reductions	-117	-88		
b. SBIR	-95	-75		
c. Below Threshold Reprogramming	-110			
(U) Current Budget Submit	4,778	4,414	3,406	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this PE since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603707F Weather Systems Technology

PROJECT NO. AND NAME: 2688 Weather Support Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2688 Weather Support Technology	2,436	2,203	2,031	1,970	1,858	1,954	1,944	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project improves the Air Force's ability to gather and integrate information for weather forecasts in battle areas where data is denied. This is accomplished through the demonstration of tactical, automated weather observation sensors and techniques to process weather data gathered from different sources at different times and integrated into a single, "best available" analysis.

(U) FY 1995 ($ in Thousands):

- (U) $575 Delivered weather impact decision aid for Night Vision Goggles to Air Force Special Operations Command (AFSOC)/Air Combat Command (ACC).
- (U) $639 Demonstrated weather impact decision aids on mission planning systems at Electronic Systems Center (ESC).
- (U) $302 Developed Tactical Forecast System observation, analysis, and forecast technology
  - (U) Completed stand alone, first-in combat forces, artificial intelligence forecast model.
- (U) $678 Planned and completed design of infrared Scene Visualization System.
- (U) $242 Evaluated new Tactical Forecast System weather observation sensors.
- (U) $2,436 Total

(U) FY 1996 ($ in Thousands):

- (U) $540 Develop Tactical Forecast System observation, analysis, and forecast technology.
  - (U) Complete evaluation of tactical weather observation sensors for Air Weather Service.
- (U) $1,663 Develop weather impact decision aids.
  - (U) Complete requirements analysis for electro-optical weather impact modules for automated mission planning.
  - (U) Incorporate new mission scenarios into Night Vision Goggle Operations Weather Software and deliver to AFSOC.
  - (U) Complete infrared scene visualization system and install at Eglin AFB, FL, for evaluation.
- (U) $2,203 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603707F Weather Systems Technology
PROJECT NO. AND NAME 2688 Weather Support Technology	

(U) FY 1997 ($ in Thousands):

- (U) $317 Develop Tactical Forecast System analysis and forecast technology.
  - (U) Complete integration of automated, theater weather observations into the tactical forecast system and deliver to Electronic Systems Center.
  - (U) Continue development of artificial intelligence forecast model, emphasizing graceful degradation of system in data-denied situation.
- (U) $1,714 Develop weather impact decision aids.
  - (U) Deliver advanced physics Night Vision Goggle Operations Weather Software to Air Force Special Operations Command/Air Combat Command.
  - (U) Develop new target acquisition software and mission impact modules for weather decision aid models.
- (U) $2,031 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,818	2,323	2,209	Cont
(U) Current Budget Submit	2,436	2,203	2,031	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0305160F, Defense Meteorological Satellite Program.
- (U) PE 0305111F, Weather Service.
- (U) PE 0602601F, Phillips Laboratory.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603707F Weather Systems Technology
PROJECT NO. AND NAME 2688 Weather Support Technology	

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603707F Weather Systems Technology

PROJECT NO. AND NAME: 2781 Weather Radar Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2781 Weather Radar Technology	459	393	400	400	400	400	400	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops new technologies to fully exploit the capabilities of new operational DOD Doppler weather radars. These technologies will be used by the Air Force to better observe and forecast severe weather such as windshear, tornadoes, and hail.

(U) FY 1995 ($ in Thousands):
- (U) $209 Developed new algorithm for tornado and hail detection.
- (U) $125 Evaluated relationship between precipitation structures and severe weather.
- (U) $125 Evaluated new severe weather quantification algorithm.
- (U) $459 Total

(U) FY 1996 ($ in Thousands):
- (U) $393 Develop severe weather prediction software.
  - (U) Complete a storm structure algorithm to predict severe weather.
  - (U) Complete an algorithm to determine location/intensity of weather fronts.
  - (U) Continue development of lightning algorithm.
- (U) $393 Total

(U) FY 1997 ($ in Thousands):
- (U) $400 Develop severe weather prediction software.
  - (U) Continue development of hail identification algorithm.
  - (U) Develop three-dimensional storm structure algorithms.
  - (U) Continue development of lightning algorithm.
- (U) $400 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603707F Weather Systems Technology
PROJECT NO. AND NAME 2781 Weather Radar Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	400	400	400	Cont
(U) Current Budget Submit	459	393	400	Cont

(U) Change Summary Explanation:

Funding: Not Applicable.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0305111F, Weather Service.
- (U) PE 0602601F, Phillips Laboratory.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603707F Weather Systems Technology

PROJECT NO. AND NAME: 4026 Centralized Support Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4026 Centralized Support Technology	1,883	1,818	975	892	1,089	919	900	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops models for forecasting conditions in the earth's neutral atmosphere, ionosphere, and magnetosphere which are needed to provide critical support to Air Force surveillance, communications, and other satellite assets. New global and theater weather forecast techniques that improve the Air Force's capability to provide centralized weather data are also developed.

(U) FY 1995 ($ in Thousands):
- (U) $290 Validated ionospheric algorithm for understanding and forecasting communication system outages.
- (U) $200 Delivered a global ionospheric forecast algorithm for space tracking and communication predictions.
- (U) $315 Developed an integrated space environment algorithm to coordinate execution of all space models (ensures information is passed correctly from algorithm to algorithm).
- (U) $510 Developed a neutral atmosphere (near earth environment)/space specification and forecast algorithm for the Air Force Space Command.
- (U) $568 Started development of a global aviation and battlefield weather hazard prediction algorithm.
- (U) $1,883 Total

(U) FY 1996 ($ in Thousands):
- (U) $649 Develop centralized space environmental support technology.
  - (U) Deliver initial cloud layer and surface visibility diagnostic algorithm.
  - (U) Continue development of aviation hazard diagnostic algorithm.
- (U) $1,169 Develop space environmental algorithms.
  - (U) Continue development of advanced space environemental algorithms.
  - (U) Continue development of executive algorithm to integrate space environmental algorithm.
- (U) $1,818 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603707F Weather Systems Technology
PROJECT NO. AND NAME 4026 Centralized Support Technology	

(U) FY 1997 ($ in Thousands):

- (U) $765 Develop centralized weather support technology.
  - (U) Deliver validated cloud layer and surface visibility diagnostic algorithms.
- (U) $210 Close-out development of space environmental algorithms.
  - (U) Close-out space modeling contracts.
- (U) $975 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,765	1,854	1,769	Cont
(U) Current Budget Submit	1,883	1,818	975	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes to this project since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0305160F, Defense Meteorological Satellite Program.
- (U) PE 0305111F, Weather Service.
- (U) PE 0602601F, Phillips Laboratory.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603723F Environmental Engineering Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	9,126	8,478	7,885	8,859	9,129	10,054	11,444	Continuing	Continuing
2103 Environmental Quality Technology	4,843	7,165	6,776	7,704	7,994	8,914	10,294	Continuing	Continuing
2104 Air Base Operability Advanced Technology	2,886	0	0	0	0	0	0	Continuing	Continuing
3037 Noise and Sonic Boom Impact Technology	1,397	1,313	1,109	1,155	1,135	1,140	1,150	Continuing	Continuing

Note: In FY 1996, Project 2104 from this PE was transferred to Wright Laboratory's PE 0603205F, Aerospace Vehicle Technology.

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates advanced technologies to address Air Force-unique environmental problems and determine the effect of aircraft noise and sonic boom stimuli on humans, animals, and structures. Specific projects advance and integrate environmental issues and operating concerns into air base design, support, and maintenance.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603723F Environmental Engineering Technology

(U) **B. Program Change Summary ($ in Thousands)**:

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	9,678	9,835	9,713	Cont
(U) Appropriated Value	9,798	8,835		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-384	-171		
b. SBIR	-184	-186		
c. Omnibus/Other Above Threshhold Reprogrammings	-104			
(U) Current Budget Submit	9,126	8,478	7,885	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions since the previous President's Budget are due to budget constraints within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603723F Environmental Engineering Technology
PROJECT NO. AND NAME 2103 Environmental Quality Technology	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2103 Environmental Quality Technology	4,843	7,165	6,776	7,704	7,994	8,914	10,294	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops and demonstrates advanced technologies to solve environmental restoration problems, reduce hazardous emissions from weapon systems, minimize Air Force industrial waste, and eliminate toxic pollutant releases from Air Force operations.

(U) FY 1995 ($ in Thousands):

- (U) $1,937 Develop and demonstrate technologies and design criteria for improved monitoring, characterization, and treatment of contaminated Air Force sites.
  - (U) Completed critical experiments on use of surfactants to contain a dissolved solvent plume combined with in situ biodegradation to destroy the contaminant; developed and demonstrated in-place physical/chemical technologies to contain and treat dense, nonaqueous phase liquids and other contaminants.
  - (U) Identified sites and specific contaminants for application of bioventing to non-petroleum compounds in unsaturated soils; developed and demonstrated in-place bioremediation technologies to clean up Air Force sites contaminated with fuels and solvents in soil and groundwater.
  - (U) Selected sites, evaluated candidate sensor systems and picked the optimum system for field demonstration of remediation monitoring.
- (U) $2,906 Develop and demonstrate technologies to predict and reduce contamination of the environment by Air Force materials and operations.
  - (U) Completed verifications of solid rocket propellant biodegradation technologies and continued development of cryogenic removal systems for propellants from Minuteman rocket motors to assist in disposal of large rocket motors; developed and demonstrated innovative technologies to treat hazardous wastes from Air Force industrial operations to reduce disposal costs and comply with regulatory limits.
  - (U) Developed advanced monitoring technology for hazardous air pollutants; and planned atmospheric investigation program to enhance risk assessment and model verification for Air Force space launch operations.
  - (U) Conducted verification of a low-back-pressure, Nitrogen Oxide (NOx) control technology for jet engine test cells based on cold-plasma-induced chemical processes; developed and demonstrated affordable technologies to control air pollutant emissions from Air Force industrial processes to comply with Clean Air Act Amendments (CAAA).
- (U) $4,843 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603723F Environmental Engineering Technology
PROJECT NO. AND NAME 2103 Environmental Quality Technology	

(U) FY 1996 ($ in Thousands):

- (U) $2,804 Develop and demonstrate technologies and design criteria for improved monitoring, disposal characterization, and treatment techniques for contaminated Air Force sites.
  - (U) Complete demonstration of bioventing for non-petroleum compounds; continue to develop and demonstrate in-place bioremediation technologies to clean up Air Force sites contaminated with fuels and solvents in soil and groundwater.
  - (U) Continue development and demonstration of a real time in-place laser spectrometer/fiber optic monitoring process; continue to develop and demonstrate in-place sensors and monitoring technologies to locate, identify, and monitor contaminant sources, plumes, and remediation activities.
  - (U) Demonstrate dense solvent detection and monitoring; continue to determine and validate the fate and transport characteristics of contaminants in soils and groundwater to enhance and validate models for development of remediation technologies and treatment plans.
- (U) $4,361 Develop and demonstrate technologies to predict and reduce contamination of the environment by Air Force materials and operations.
  - (U) Develop advanced air monitoring technology; characterize catastrophic space launch aborts and atmospheric diffusion to validate space launch toxic risk assessment models; and begin development of JP-8 fuel emissions testing technology.
  - (U) Evaluate a recirculating paint booth to control Volatile Organic Compounds (VOC) emissions; continue to develop and demonstrate affordable technologies to control air pollutant emissions from Air Force industrial processes to comply with Clean Air Act Amendments; and demonstrate a non-thermal plasma technology to remove nitrogen oxides from exhaust streams.
  - (U) Conduct technology development to treat waste hydraulic fluids, reducing hazardous waste generation and disposal costs; continue to develop cost-effective alternate processes and materials that reduce or eliminate the production of hazardous wastes and the use of hazardous materials.
- (U) $7,165 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603723F Environmental Engineering Technology
PROJECT NO. AND NAME 2103 Environmental Quality Technology	

(U) FY 1997 ($ in Thousands):

- (U) $2,710 Develop and demonstrate technologies and design criteria for improved monitoring, characterization, and treatment techniques for contaminated Air Force sites.
  - (U) Continue demonstration of in situ bioremediation techniques for fuels and solvents in soil and groundwater; continue to develop and demonstrate in-place physical/chemical technologies to contain and treat dense nonaqueous phase liquids and other contaminants.
  - (U) Complete demonstration of a method of direct site characterization by real-time data analysis and visualization of fuel/solvent contamination; continue to develop and demonstrate in-place sensors and monitoring technologies to locate, identify, and monitor contaminant sources, plumes, and remediation activities.
  - (U) Continue to determine and validate the fate and transport characteristics of contaminants in soils and groundwater through research of natural attenuation of fuels to identify key indicators of ongoing remediation; initiate the installation of risk assessment and contaminant fate and transport data into a single risk-based remediation model to facilitate remediation technology selection decisions.
- (U) $4,066 Develop and demonstrate technologies to predict and reduce contamination of the environment by Air Force materials and operations.
  - (U) Demonstrate an advanced air monitoring technology for low parts per billion hazardous air pollutants determination; continue to characterize catastrophic space launch aborts and atmospheric diffusion to validate space launch toxic risk assessment models; and determine the atmospheric chemistry of candidate and new Air Force fuels and chemicals.
  - (U) Demonstrate cost-effective Nitrous Oxides (NOx) emission control for Aerospace Ground Equipment; continue to develop and demonstrate affordable technologies to control air pollutant emissions from Air Force industrial processes to comply with the Clean Air Act Amendments (i.e., recirculating paint booth study with biofiltration) and the Clean Water Act (i.e., aqueous film forming foam treatment technologies).
  - (U) Continue to develop an advanced chemical reactor to treat hazardous/energetic materials and the coupling of multiple technologies to treat complex chemical wastes; continue to develop and demonstrate innovative technologies to treat hazardous wastes (i.e., non-chromium conversion coating of Ion Vapor Deposition aluminum).
  - (U) Demonstrate NOx control from jet engine test cells.
- (U) $6,776 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603723F Environmental Engineering Technology
PROJECT NO. AND NAME 2103 Environmental Quality Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,224	8,469	8,463	Cont
(U) Current Budget Submit	4,843	7,165	6,776	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal changes since the previous President's Budget are due to budget constraints and priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0603211F, Aerospace Structures.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0603716D, Strategic Environmental Research and Development Program.
- (U) PE 0604706F, Life Support Systems.
- (U) PE 0604708F, Other Operational Equipment.
- (U) PE 0708011F, Industrial Base Program.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603723F Environmental Engineering Technology
PROJECT NO. AND NAME 2103 Environmental Quality Technology	

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603723F Environmental Engineering Technology
PROJECT NO. AND NAME 2104 Air Base Operability Advanced Technology	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2104 Air Base Operability Advanced Technology	2,886	0	0	0	0	0	0	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops and demonstrates advanced technologies to build air base facilities and utilities that can survive chemical, biological, and conventional weapons attack. It also develops advanced technologies to: construct and repair runways and air mobile structures; perform damage assessment and repair; perform crash rescue; perform suppression of aircraft and air base post-attack fires; and perform critical peacetime civil engineering construction, maintenance, and repair.

(U) FY 1995 ($ in Thousands):

- (U) $2,170 Demonstrated technologies and design criteria for improved bare-base/fixed-site applications (e.g., power and environmental utilities, survivable air base structures, and durable/repairable airfield surfaces).
- (U) $716 Demonstrated advanced aircraft/air base fire fighting technologies (e.g., clean, environmentally-safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment techniques, and fire fighter training).
- (U) $2,886 Total

(U) FY 1996: Not Applicable.

(U) FY 1997: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603723F Environmental Engineering Technology
PROJECT NO. AND NAME 2104 Air Base Operability Advanced Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,941	0	0	Cont
(U) Current Budget Submit	2,886	0	0	Cont

(U) Change Summary Explanation:

Funding: In FY 1996, this project was transferred to Wright Laboratory's PE 0603205F, Aerospace Vehicle Technology, Project 2104.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE 0603307F, Air Base Operability Advanced Technology Development.
- (U) PE 0604617F, Air Base Operability.
- (U) PE 0604703F, Aeromedical/Chemical Defense Systems Development.
- (U) PE 0604708F, Other Operational Equipment.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603723F Environmental Engineering Technology

PROJECT NO. AND NAME: 3037 Noise and Sonic Boom Impact Technology

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3037 Noise and Sonic Boom Impact Technology	1,397	1,313	1,109	1,155	1,135	1,140	1,150	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops and demonstrates technologies to predict and evaluate the environmental impacts of noise from aircraft operations, as directed by the National Environmental Policy Act. Improving this capability is essential for timely response to public concerns, preparation of accurate environmental impact statements, and minimizing unfavorable legal challenges to Air Force operations.

(U) FY 1995 ($ in Thousands):

- (U) $1,397 Develop and demonstrate noise effects assessment technology.
  - (U) Completed initial version of the assessment system for aircraft noise (ASAN) to assess the environmental impacts of aircraft noise and sonic booms on subsonic Military Training Routes (MTRs) and supersonic Military Operations Areas (MOAs), transitioned the technology to the Air Force Center for Environmental Excellence (AFCEE), and released the technology to the users.
  - (U) Completed development of human and animal noise response monitors designed to collect, process, and store environmental noise exposure levels for assessment of the effects of military aircraft noise on human and animal populations.
  - (U) Developed technology to predict cumulative damage to glass from sonic booms based on flaws in the glass, window mountings, and age of the glass.
- (U) $1,397 Total

(U) FY 1996 ($ in Thousands):

- (U) $1,313 Develop and demonstrate noise effects assessment technologies.
  - (U) Develop technology to expand ability to assess environmental impacts of aircraft noise to flights within subsonic MOAs.
  - (U) Determine the extent of military aircraft overflights of national parks and wilderness areas using Geographic Information System (GIS) technology and existing national digital databases to support environmental airspace planning efforts.
  - (U) Measure and analyze the potential for damage from sonic booms to unconventional and historic structures.
- (U) $1,313 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603723F Environmental Engineering Technology
PROJECT NO. AND NAME 3037 Noise and Sonic Boom Impact Technology	

(U) FY 1997 ($ in Thousands):
- (U) $1,109 Develop and demonstrate noise effects assessment technology.
  - (U) Develop technology to assess effects of environmental noise from military aircraft operations on various endangered species, predator-prey relationships, and selected structures.
  - (U) Demonstrate use of the animal noise monitor with Global Positioning System technology for assessing the effects of military aircraft noise on free-ranging herd animals in Military Operating Areas and on Air Force ranges.
  - (U) Determine the potential for cumulative damage to prestressed plaster from sonic booms.
- (U) $1,109 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,513	1,366	1,250	Cont
(U) Current Budget Submit	1,397	1,313	1,109	Cont

(U) Change Summary Explanation:

Funding: Vertical/horizontal reductions since the previous President's Budget are due to budget constraints within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:
- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0602203F, Aerospace Propulsion.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603726F C3 Subsystem Integration

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	8,214	11,404	8,777	10,334	12,048	12,233	12,562	Continuing	Continuing
2810 Advanced Image/Information Applications	2,649	3,813	3,590	4,091	4,631	4,693	4,816	Continuing	Continuing
2863 Integrated Photonics	3,162	4,103	2,227	2,390	2,982	2,958	3,042	Continuing	Continuing
3192 Advanced Optical Memory Technology	2,403	3,488	2,960	3,853	4,435	4,582	4,704	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates Command, Control, and Communications (C3) technologies in the areas of processing and fusion of digital databases, photonics technology, optical disk storage/processing of digital information, and distributed processing technology for interoperability between dispersed command centers. These technologies provide increased storage, processing, and transmission of digital data that contains unlimited data content. This technology directly supports the Joint Chiefs of Staff Future Joint Warfighting Capability: "To maintain near perfect real-time knowledge of the enemy and communicate that to all forces in near-real-time."

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603726F C3 Subsystem Integration

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	10,814	12,008	10,971	Cont
(U) Appropriated Value	11,050	12,008		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-534	-233		
b. SBIR	-205	-251		
c. Omnibus/Other Above Threshold Reprogrammings	-117	-120		
d. Below Threshold Reprogrammings	-1,980			
(U) Current Budget Submit	8,214	11,404	8,777	Cont

(U) Change Summary Explanation:

Funding: Horizontal increases from FY 1995 to FY 1996 are to address added emphasis on advanced subsystems integration and information warfare technologies to meet future user requirements. Horizontal decreases from FY 1996 to FY 1997 are due to budget constraints. Vertical reductions in this Program Element since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603726F C3 Subsystem Integration

PROJECT NO. AND NAME: 2810 Advanced Image/Information Applications

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2810 Advanced Image/Information Applications	2,649	3,813	3,590	4,091	4,631	4,693	4,816	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This project develops and demonstrates techniques and algorithms to meet weapon systems requirements for processed and fused multi-source information required for mission planning, navigation, targeting, and terrain analysis. This project provides generic language translation processing techniques, as well as standard applications algorithms for Air Force exploitation of digitally processed image and spatial database products. Additionally, it develops an automated capability to reference and display hypermedia information and develops technology for offensive and defensive information warfare.

(U) FY 1995 ($ in Thousands):

- (U) $1,669 Develop and demonstrate advanced imagery information technologies to enhance warfighter mission planning, navigation, targeting, and terrain analysis.
  - (U) Developed methods to automatically maintain the currency and accuracy of databases used by a wide range of advanced weapon systems for planning, navigation, and mission strike purposes.
  - (U) Completed development of a Phase 1 electronic information portable correlator for warfighter use in a tactical environment; developed fusion modules incorporating human-like reasoning to track mobile components of the electronic warfare environment.
  - (U) Developed a rapid access/update techniques for heterogeneous and distributed indications and warning type data bases.
- (U) $800 Develop and demonstrate automated capabilities to assess, process, and display hypermedia (integrated voice, data, and video information) communications which fully exploit the data available to the field commander in a timely manner.
  - (U) Completed and demonstrated Phase 1 hypermedia brassboard; implemented hypermedia interface interim support video/audio and automated linking capability to provide automated integration of video and audio media with text and graphics media.
  - (U) Developed Phase 1 hypermedia analysis and implementation effort for an operational planning and rehearsal system.
- (U) $180 Develop and demonstrate advanced interrogative techniques which fully exploit the information available to the commander.
  - (U) Demonstrated preliminary multilingual, bi-directional voice translation interrogation algorithms; developed an operational user demonstration system for field interrogation.
- (U) $2,649 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603726F C3 Subsystem Integration
PROJECT NO. AND NAME 2810 Advanced Image/Information Applications	

(U) FY 1996 ($ in Thousands):

- (U) $3,113 Develop and demonstrate advanced imagery information sensor fusion and spatial database technologies to enhance warfighter mission planning, navigation, targeting, and terrain analysis.
  - (U) Develop a transportable electronic information correlator and automated message update, filter, and retrieval processes; demonstrate Phase 1 multiple database integration and update capability using information and electronic messages; develop initial query robot for update analysis enhancement demonstration to support battlefield analysis.
  - (U) Develop an all-source fusion capability to locate, identify, and track mobile red, green, and blue military components; complete system design and sensor cueing/cross cueing and information acquisition modules module.
- (U) $600 Develop and demonstrate automated capabilities to access, process, and display hypermedia (integrated voice, data, and video) information which fully exploit the data available to the field commander.
  - (U) Complete integrated hypermedia demonstration of video, audio, and automated linking; assess at operational exercises.
  - (U) Develop Phase 2 hypermedia analysis and implementation effort for an operational planning and rehearsal system.
- (U) $100 Develop and demonstrate advanced interrogative techniques which fully exploit the information available to the warfighter.
  - (U) Complete delivery of expanded language modules for the automated voice translation system; demonstrate to the user automated, multi-language, voice translation for field interrogation.
- (U) $3,813 Total

(U) FY 1997 ($ in Thousands):

- (U) $3,340 Develop and demonstrate advanced imagery information and spatial database technologies to enhance warfighter mission planning, navigation, targeting, and terrain analysis.
  - (U) Conduct Phase 2 demonstration of multiple database integration and update capability to maintain a single uniform and current vector database for real-time access; demonstrate automated update of multiple heterogeneous data bases simultaneously to support interdisciplinary correlation and new information sources.
  - (U) Conduct integration and installation testing of portable electronic information correlator for deployment with tactical communications systems to automatically correlate signal intelligence multisensor inputs on the battlefield; conduct final demonstration at user's site of the enhanced, all-source, sensor fusion capability to locate, identify, and track mobile friend and foe (i.e., threats and targets) battlefield components.
- (U) $250 Develop and demonstrate automated capabilities to access, process, and display hypermedia (integrated voice, data, and video information) communications which fully exploit the data available to the field commander.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603726F C3 Subsystem Integration
PROJECT NO. AND NAME 2810 Advanced Image/Information Applications	

- (U) Complete development of hypermedia algorithms for use with operational databases and navigational aids capabilities.
- (U) Develop advanced hypermedia techniques for video indexing overlaps and links to connect secure information data bases.

- (U) $3,590 Total

(U) B. Program Change Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,215	4,015	4,375	Cont
(U) Current Budget Submit	2,649	3,813	3,590	Cont

(U) Change Summary Explanation:

Funding: Horizontal increases from FY 1995 to FY 1996 are to address added emphasis on advanced image/information technologies to meet future user requirements. Horizontal decreases from FY 1996 to FY 1997 are due to budget constraints. Vertical reductions in this project since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602702F, Command, Control, and Communications (C3).
- (U) PE 0603789F, C3 Advanced Development.
- (U) PE 0603728F, Advanced Computer Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) D. Schedule Profile: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603726F C3 Subsystem Integration
PROJECT NO. AND NAME 2863 Integrated Photonics	

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2863 Integrated Photonics	3,162	4,103	2,227	2,390	2,982	2,958	3,042	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Current electronic systems are susceptible to electromagnetic interference, electromagnetic pulse, and radio frequency (RF) interference. Size constraints, speed, and reliability also limit traditional electronic systems. Photonics-based systems, which process information in the form of light (photonic) signals, will provide major improvements in tactical and strategic Command, Control, and Communications (C3) systems by providing small-size, high-performance, high-capacity, survivable alternatives to electronic-based systems. This project develops and demonstrates advanced hardware technology in optical processing, adaptive transmission, and nonlinear optical processing.

(U) FY 1995 ($ in Thousands):

- (U) $725 Develop and demonstrate analog and digital optical processing technologies to provide real-time data for pre- and post-mission analysis, as well as sensor integration and automatic target identification using multispectral surveillance systems.
  - (U) Developed and demonstrated a residual number system optical processor to provide agile general purpose processor for current and future radars.
  - (U) Designed an integrated, optical processor to provide agile, all optical, general purpose processors for current and future radars.
- (U) $2,437 Develop and demonstrate microwave/millimeter-wave photonics processing and subsystems essential for advanced optically-controlled RF systems at increased frequencies.
  - (U) Conducted design and trade off analyses for super high frequency (SHF) phased array antenna beamformers to provide the optimum design for a new method of steering SHF communications systems.
  - (U) Demonstrated a coherent, optically-controlled phased array for advanced multiband communications and surveillance missions for surveillance radars.
- (U) $3,162 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603726F C3 Subsystem Integration
PROJECT NO. AND NAME 2863 Integrated Photonics	

(U) FY 1996 ($ in Thousands):

- (U) $1,008 Develop and demonstrate analog and digital optical processing technologies to provide the warfighter with real-time data for pre- and post-mission analysis, as well as sensor integration and automatic target identification using multispectral surveillance systems.
  - (U) Develop, fabricate, and integrate photonic Command, Control, and Communications (C3) processor providing reliable, agile, all-optical, general purpose processors for current and future radars.
- (U) $3,095 Develop and demonstrate microwave/millimeter-wave photonics processing and subsystems essential for advanced optically-controlled radio frequency (RF) systems at increased frequencies.
  - (U) Fabricate super high frequency (SHF) optically-controlled phased array antenna demonstrating the agility necessary to steer communications antennas.
  - (U) Conduct first stage development of 100 Giga-Hertz (GHz) RF photonic interconnect system extending the frequency and bandwidth of previous microwave link programs to support communications.
- (U) $4,103 Total

(U) FY 1997 ($ in Thousands):

- (U) $690 Develop and demonstrate analog and digital optical processing technologies to provide real-time data for pre- and post-mission analysis, as well as sensor integration and automatic target identification using multispectral surveillance systems.
  - (U) Develop and integrate a photonic C3 processor into a technology demonstrator; task will demonstrate the advantages of all-optical, high-speed agile processors in a variety of radar and communications functions.
- (U) $1,537 Develop and demonstrate microwave/millimeter-wave photonics processing and subsystems for advanced optically-controlled RF systems at increased frequencies.
  - (U) Fabricate and conduct initial integration testing of SHF, optically-controlled phased array antenna components.
  - (U) Conduct second stage development of a 100 GHz RF photonic interconnect system; conduct preliminary testing of extra high frequency optically-controlled, phased array antenna system, extending the frequency and bandwidth of previous microwave link programs.
- (U) $2,227 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603726F C3 Subsystem Integration
PROJECT NO. AND NAME 2863 Integrated Photonics	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,179	4,320	2,870	Cont
(U) Current Budget Submit	3,162	4,103	2,227	Cont

(U) Change Summary Explanation:

Funding: Horizontal increases from FY 1995 to FY 1996 are to address added emphasis on photonics technologies to meet future user requirements. Horizontal decreases from FY 1996 to FY 1997 are due to budget constraints. Vertical reductions in this project since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602702F, Command, Control, and Communications (C3).
- (U) PE 0603789F, C3 Advanced Development.
- (U) PE 0603728F, Advanced Computer Technology.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603726F C3 Subsystem Integration

PROJECT NO. AND NAME: 3192 Advanced Optical Memory Technology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3192 Advanced Optical Memory Technology	2,403	3,488	2,960	3,853	4,435	4,582	4,704	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Present Command, Control, and Communications (C3) systems lack low-cost, high-density data storage capacity and performance required for advanced operations and near-real-time sensor inputs. This project develops the Strategic/Tactical Optical Disk System (S/TODS) a family of erasable data optical storage systems with high capacity and fast input/output speed. S/TODS includes a single 5.25-inch optical disk recorder/player, a single 14-inch optical disk recorder/player, and a ten-disk automated Optical Jukebox. The 5.25-inch S/TODS is for fighter aircraft operation and provides fast airborne access to mission-oriented data and the digital terrain system. The 14-inch S/TODS is for on-board sensor data recording in electronic surveillance aircraft and will be used to develop a deployable optical Jukebox for operational mission planning requirements. For large storage requirements, the Optical Jukebox will be expanded for Air Combat Command's (ACC) Contingency Airborne Reconnaissance System (CARS). In addition, the Optical Jukebox can be applied to ACC's requirements for high-volume, soft-copy, digital imagery exploitation. Algorithms will be provided to automate the selection, and retrieval, and downloading of information stored on mass storage devices which are distributed across the data network. An array of optical disk drives will be developed for high throughput speed and fault-tolerant requirements. Three-dimensional (3-D) optical memory systems will be developed for volumetric digital data storage. This new mass storage technology will demonstrate ultra-high data density and fast, parallel data access within a low-cost, compact system.

(U) FY 1995 ($ in Thousands):

- (U) $1,291 Develop and demonstrate optical information data handling, storage, and access technologies for strategic and tactical applications.
  - (U) Fabricated an advanced optical disk array using commercial storage items, reducing life cycle costs associated with mass data storage and increased analyst productivity.
  - (U) Conducted preliminary design for optical 3-D computer memory, to store more imagery/information in a smaller package while providing fast, parallel access to large data bases.
- (U) $1,112 Design, develop, and demonstrate optical disk and interface technologies which can be implemented in joint theater operations.
  - (U) Designed high-capacity Optical Jukebox to provide terabytes of data storage and automated, robotics access to hundreds of erasable optical disks, reducing personnel requirements needed to maintain digital storage library holdings.
  - (U) Demonstrated a single ruggedized optical disk drive with an operational mission planning system.
  - (U) Conducted preliminary design for software algorithms to allow the analyst to handle data management functions and eliminate redundant information across a distributed network.
- (U) $2,403 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603726F C3 Subsystem Integration
PROJECT NO. AND NAME 3192 Advanced Optical Memory Technology	

(U) FY 1996 ($ in Thousands):

- (U) $1,238 Develop and demonstrate optical information data handling, storage, and access technologies for strategic and tactical applications.
  - (U) Demonstrate a high-fault-tolerant array of optical disk drives providing ten gigabytes of on-line storage, data access time less than 50 milliseconds, and three megabytes per second data transfer speeds to interface with data bases.
  - (U) Design a three-dimensional (3-D) optical computer memory system, addressing architectural issues and storage media performance; provide needed storage capacity and input/output bandwidth for next-generation aircrew training and data handling.
- (U) $2,250 Design, develop, and demonstrate optical disk and interface technologies which can be implemented in joint theater operations.
  - (U) Develop an automated, high-capacity Optical Jukebox that can store and retrieve several 14-inch diameter, rewritable optical disks; examine large diameter rewritable media capable of storing ten gigabytes/disk and an optical drive capable of high-speed data recording, playback, and erasure as a means of providing critical data storage to meet user's growing requirements.
  - (U) Demonstrate a deployable Optical Jukebox with an operational mission planning
  - (U) Design and develop a mass storage retrieval algorithm-based approach used to query and retrieve information from a large mass storage system; algorithms will control all mass data storage operations and provide user access to multiple terabytes of data.
- (U) $3,488 Total

(U) FY 1997 ($ in Thousands):

- (U) $1,750 Develop and demonstrate optical information data handling, storage, and access technologies for strategic and tactical applications.
  - (U) Fabricate pre-brassboard model of a 3-D optical memory capable of storing 100 gigabytes of information and reconstructing it using a parallel optical readout technique; exploit virtual reality technology using digital data stored and accessed via 3-D optical memories.
- (U) $1,210 Design, develop, and demonstrate optical disk and interface technologies which can be implemented in joint theater operations.
  - (U) Complete the fabrication and demonstration of high-capacity Optical Jukebox interfaced with an information network.
  - (U) Enhance algorithm development and demonstrate capability to select, retrieve, and store digital data from different sources and transfer such data to field units.
- (U) $2,960 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603726F C3 Subsystem Integration
PROJECT NO. AND NAME 3192 Advanced Optical Memory Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,420	3,673	3,726	Cont
(U) Current Budget Submit	2,403	3,488	2,960	Cont

(U) Change Summary Explanation:

Funding: Horizontal increase from FY 1995 to FY 1996 are to address added emphasis on advanced optical memory technologies to meet future user requirements. Horizontal decreases from FY 1996 to FY 1997 are due to budget constraints. Vertical reductions in this project since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0602702F, Command, Control, and Communications (C3).
- (U) PE 0603789F, C3 Advanced Development.
- (U) PE 0603728F, Advanced Computer Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603728F Advanced Computing Technology

	COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	8,485	9,879	8,509	7,866	7,983	8,204	8,275	Continuing	Continuing
2527	Software Life Cycle Tools	3,275	2,445	2,564	2,300	2,335	2,400	2,422	Continuing	Continuing
2530	Distributed Systems Reliability and Survivability	2,000	3,264	2,633	2,420	2,455	2,522	2,543	Continuing	Continuing
2532	Knowledge-Based Systems	3,210	4,170	3,312	3,146	3,193	3,282	3,310	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates technologies needed to control cost, reduce risk, and increase efficiency and effectiveness of software and computers required for Air Force mission critical combat systems. The Air Force has experienced a dramatic escalation in the cost of acquiring and maintaining embedded computer software for increasingly complex military systems which must be reliable and survivable in the battlefield environment. The requirement for survivable tactical and strategic computing systems has driven the need for automatic integration and interoperability of multiple processing elements, automatic redistribution of data and functions, and location-independent access of data. Distributed processing techniques, which can dynamically reconfigure assets to accommodate lost components or nodes, are required to ensure survivable mission critical command and control functions.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728F Advanced Computing Technology

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	9,013	11,005	10,076	Cont
(U) Appropriated Value	9,125	36,605		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-358	-448		
b. SBIR	-171	-464		
c. Omnibus/Other Above Threshold Reprogrammings	-111	-25,814		
(U) Current Budget Submit	8,485	9,879	8,509	Cont

(U) Change Summary Explanation:

Funding: Horizontal increases from FY 1995 to FY 1996 are to address added emphasis on advanced computer technologies to meet future user requirements. Horizontal decreases from FY 1996 to FY 1997 are due to budget constraints. Vertical reductions in this PE since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology (S&T) Program. This technology directly supports the Joint Chiefs of Staff Future Joint Warfighting Capability: "To maintain near perfect real-time knowledge of the enemy and communicate that to all forces in near-real-time." Note: In FY 1996, Congress added/transferred $25.6M for Information Technology to this PE, however, these funds were subsequently reprogrammed into two new PEs to realign funds into the proper programs.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603728F Advanced Computing Technology

PROJECT NO. AND NAME: 2527 Software Life Cycle Tools

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2527 Software Life Cycle Tools	3,275	2,445	2,564	2,300	2,335	2,400	2,422	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** Advanced computer systems in Air Force weapon systems require software life cycle tools and technology to reduce costs, improve quality, and enhance productivity. This project develops, evaluates, and transitions new software technology that reduces cost, while improving software, systems, and productivity factors. It develops software life cycle support environments which incorporate both laboratory and commercial off-the-shelf (COTS) products. This project provides a vehicle for software technology integration, transition, and evaluation under operational and field conditions. Technologies for system requirements analysis, reuse of software components, software quality specification, measurement, assessment, and high performance (parallel) computer software engineering are also produced.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728F Advanced Computing Technology
PROJECT NO. AND NAME 2527 Software Life Cycle Tools	

(U) FY 1995 ($ in Thousands):

- (U) $820 Develop and demonstrate network software support environments which address the system life cycle for parallel and concurrent networks while emphasizing affordability and software reuse certification technologies.
  - (U) Completed development of the process description, simulation, and enactment portions of the Process-Oriented Software Life Cycle Support Environment (ProSLCSE) Enhancements program and transitioned to the user.
  - (U) Completed Phase 2 advanced software analysis automation components, based on industry standards, and integrated them into the software architectural environment.
  - (U) Developed a certification framework for reusable software; demonstrated the capability of reusable software components estimate software size, reliability, maintainability, and flexibility.
- (U) $1,605 Develop and demonstrate advanced software definition technologies to provide the user the means to address total system requirements engineering for large-scale systems.
  - (U) Developed preliminary requirements analysis workstation (Block 1) for requirements specification and assessment.
  - (U) Developed additional technology demonstration applications which will benefit from requirements analysis technology.
- (U) $585 Develop and demonstrate software quality enhancements through automated tools and methods.
  - (U) Expanded development of information on software quality assessment and completed the initial set of software metric baselines.
  - (U) Provided the first increment of software information for a software quality technology demonstration.
- (U) $265 Develop high performance computer software and architecture for weapon system applications.
  - (U) Completed development of testing techniques for parallel software tools for optimal match of test tools to parallel architecture.
  - (U) Developed level one optimized architecture design tools using parallel processing techniques.
  - (U) Conducted Phase 1 effort to optimize software upgrades for the Parallel Assessment Window System (PAWS) to provide a "user friendly" interface for adding new architectures and execution criteria.
- (U) $3,275 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728F Advanced Computing Technology
PROJECT NO. AND NAME 2527 Software Life Cycle Tools	

(U) FY 1996 ($ in Thousands):

- (U) $770 Develop and demonstrate network software support environments which address the network life cycle for parallel and concurrent networks while emphasizing affordability and software reuse certification technologies.
  - (U) Develop Phase 3 advanced software components, based on industry standards, and integrate them into the software architectural environment.
  - (U) Complete the certification framework for reusable software; demonstrate the capability to expand the framework for domain-specific reuse environments.
- (U) $687 Develop and demonstrate advanced software technologies to provide the user the means to analyze operational software requirements.
  - (U) Develop a performance modeling demonstration of advanced requirements analysis workstation (Block 1).
  - (U) Conduct demonstration tests of requirements analysis tools for the user and industry.
- (U) $200 Develop and demonstrate software quality enhancements through automated tools and methods.
  - (U) Develop additional case studies for the software quality technology demonstration; provide second increment of repository software information installation.
- (U) $788 Develop high performance (parallel) computer software and architecture for weapon system applications.
  - (U) Conduct Phase 2 effort to optimize parallel software upgrades to the Parallel Assessment Window System (PAWS) to provide a "user friendly" interface for adding new architectures and execution criteria.
  - (U) Develop level two architecture-independent parallel design tool.
- (U) $2,445 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728F Advanced Computing Technology
PROJECT NO. AND NAME 2527 Software Life Cycle Tools	

(U) FY 1997 ($ in Thousands):

- (U) $765 Develop and demonstrate network software support environments which address the network life cycle for parallel and concurrent networks while emphasizing affordability and software reuse certification technologies.
  - (U) Complete level one advanced software components integration demonstration to provide tool building kit for the automation of specialized analysis tools.
  - (U) Conduct preliminary design development of level two advanced analysis/computational environment.
  - (U) Develop Phase 1 domain-specific reusable software components and integrate into the certification framework as a general reuse capability.
- (U) $853 Develop and demonstrate advanced software technologies to provide the user the means to analyze operational software requirements.
  - (U) Complete the development performance modeling aspect of the Block 1 advanced requirements analysis workstation.
  - (U) Based on industry comments, user feedback, and the need for addressing operational software requirements analysis, conduct a program assessment of the operational requirements analysis/workstation and identify needed improvements.
- (U) $340 Develop and demonstrate software quality enhancements through automated tools and methods.
  - (U) Complete case studies for software quality technology demonstration; provide third increment of repository software information.
- (U) $606 Develop high performance (parallel) computer software and architecture for weapon system applications.
  - (U) Conduct Phase 3 effort to optimize parallel software upgrades to the Parallel Assessment Window System (PAWS) to provide a "user friendly" interface for adding new architectures and execution criteria.
  - (U) Complete development efforts on the architecture-independent parallel design tool.
- (U) $2,564 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728F Advanced Computing Technology
PROJECT NO. AND NAME 2527 Software Life Cycle Tools	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,275	3,160	2,927	Cont
(U) Current Budget Submit	3,275	2,445	2,564	Cont

(U) Change Summary Explanation:

Funding: Horizontal funding changes are due to budget constraints. Vertical reductions in this project since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology (S&T) Program. This technology directly supports the Joint Chiefs of Staff Future Joint Warfighting Capability: "To maintain near perfect real-time knowledge of the enemy and communicate that to all forces in near-real-time."

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0604740F, Computer Resource Management.
- (U) PE 0701112F, Inventory Control Point Operation.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603728F Advanced Computing Technology

PROJECT NO. AND NAME: 2530 Distributed Systems Reliability and Survivability

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2530 Distributed Systems Reliability and Survivability	2,000	3,264	2,633	2,420	2,455	2,522	2,543	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops software technology to provide the distributed computer information handling for future Command, Control, Communications, and Computer (C4) systems which integrate numerous heterogeneous processing networks and provides secure, seamless access to information. The system must be reconfigurable, operate in real-time, and be survivable, as well as capable of integrating the full spectrum of multimedia data. The system will operate in an "information pull" mode where the users' requests for information are filled without explicit action on the part of the user to locate, retrieve, or merge data. An object-oriented architecture will be used to provide a common perspective which will serve as the basis for the merger between the communications control system and the distributed computing environment.

(U) FY 1995 ($ in Thousands):

- (U) $800 Develop and demonstrate heterogeneous, secure, multi-networked distributed computing environments for operability and survivability.
  - (U) Demonstrated use of distributed computing to support elements of a distributed air operations center.
  - (U) Demonstrated a distributed computing infrastructure for developing collaborative planning in the 1995 Joint Warrior Interoperability Demonstration exercise.
  - (U) Demonstrated the first object-based software distributed systems environment that is standards compliant.
- (U) $580 Develop and demonstrate distributed database management system techniques for managing a multimedia database in a distributed information systems.
  - (U) Developed uniform object model for multimedia data management.
  - (U) Developed storage and retrieval capability for multimedia objects.
  - (U) Demonstrated an asynchronous switching-based testbed to support management of text, graphics, and video imagery.
- (U) $620 Develop and demonstrate real-time adaptive distributed computing environments to support crisis management and survivability.
  - (U) Demonstrated artificial intelligent agents to provide adaptive fault management.
  - (U) Demonstrated networked, homogeneous, real-time distributed computing.
  - (U) Demonstrated adaptive resource allocation in an object-based distributed computing environment.
- (U) $2,000 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728F Advanced Computing Technology
PROJECT NO. AND NAME 2530 Distributed Systems Reliability and Survivability	

(U) FY 1996 ($ in Thousands):

- (U) $1,575 Develop and demonstrate heterogeneous, secure, multi-networked distributed computing environments for interoperability and survivability.
  - (U) Demonstrate multi-networked distributed computing environment for a distributed air operations center.
  - (U) Demonstrate an asynchronous-based distributed computing environment.
  - (U) Develop distributed virtual computing architecture and computation model.
- (U) $759 Develop and demonstrate distributed database management techniques for managing multimedia data in distributed information systems.
  - (U) Develop distributed query capability for multimedia database management system.
  - (U) Demonstrate concurrence mechanisms for multimedia database management in a distributed information system.
  - (U) Establish tri-Service testbed for the development of multimedia distributed database management.
- (U) $930 Develop real-time adaptive distributed computing environments to support crisis management and survivability.
  - (U) Demonstrate use of artificial intelligent agents for adaptive distributed resource management.
  - (U) Demonstrate real-time distributed computing across multiple local computers.
  - (U) Develop standard specification for real-time computing in an object-based distributed computing environment.
- (U) $3,264 Total

(U) FY 1997 ($ in Thousands):

- (U) $948 Develop and demonstrate heterogeneous, secure, multi-networked distributed computing environments for interoperability and survivability.
  - (U) Demonstrate the integration of security mechanisms into multi-networked distributed computing environments.
  - (U) Demonstrate the ability to establish a distributed computing environment across a limited bandwidth interconnection.
  - (U) Demonstrate the integration of mobile computing nodes into a heterogeneous distributed computing environment.
- (U) $790 Develop and demonstrate distributed database management techniques for managing multimedia data in distributed information systems.
  - (U) Develop artificial intelligent agents for retrieval of multimedia data across a wide area network.
  - (U) Integrate speech as a managed object in an object-based, distributed, multimedia database management system.
  - (U) Demonstrate multimedia database management across multiple locally netted computers.
- (U) $895 Develop real-time adaptive distributed computing environments to support crisis management and survivability.
  - (U) Demonstrate an adaptive reconfigurable distributed computing environment based upon an application-derived parameter.
  - (U) Demonstrate real-time distributed computing architecture across heterogeneous networks for tracking.
  - (U) Demonstrate dynamic process and data migration across a multi-networked distributed information system.
- (U) $2,633 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728F Advanced Computing Technology
PROJECT NO. AND NAME 2530 Distributed Systems Reliability and Survivability	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,000	3,445	2,999	Cont
(U) Current Budget Submit	2,000	3,264	2,633	Cont

(U) Change Summary Explanation:

Funding: Horizontal increases from FY 1995 to FY 1996 are to address added emphasis on distributed systems reliability and survivability technologies to meet future user requirements. Horizontal decreases from FY 1996 to FY 1997 are due to budget constraints. Vertical reductions in this project since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology (S&T) Program. This technology directly supports the Joint Chiefs of Staff Future Joint Warfighting Capability: "To maintain near perfect real-time knowledge of the enemy and communicate that to all forces in near-real-time."

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0604740F, Computer Resource Management.
- (U) PE 0701112F, Inventory Control Point Operation.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728F Advanced Computing Technology
PROJECT NO. AND NAME 2532 Knowledge-Based Systems	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2532 Knowledge-Based Systems	3,210	4,170	3,312	3,146	3,193	3,282	3,310	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** Knowledge-based computer systems provide the capability to automatically solve reasoning problems. This effort develops computer technologies which automate the problem solving process associated with human thought. It has three major thrusts. The first, knowledge-based analysis, provides software tools and techniques to develop and evaluate knowledge-based software systems. The second, knowledge-based planning, applies artificial intelligence (AI) technology to provide increased cost-effectiveness in diverse planning applications involving decision support to employment and deployment planning, logistics planning, resource allocation, and scheduling processes. The third, Knowledge-Based Software Assistant (KBSA), exploits knowledge-based methods to effect orders of magnitude improvements in software development and support activities.

(U) FY 1995 ($ in Thousands):

- (U) $177 Develop and demonstrate knowledge-based software analysis technologies to support robust, real-time, large-scale information software systems.
  - (U) Extended the architectural framework and demonstrated the capability to "mix and match" intelligent components in a dynamic information integration environment.
- (U) $1,450 Develop and demonstrate knowledge-based technologies to automate labor-intensive tasks to allow rapid, accurate, and efficient planning.
  - (U) Developed initial version of in-theater airlift scheduler, using constraint-based scheduling techniques; demonstrated the scheduler during the Joint Warrior Integrated Demonstration 95 (JWID 95).
  - (U) Developed and integrated case-based force generation capabilities; demonstrated automated plan generation capabilities and end-to-end force and time-phased force deployment data generation.
  - (U) Completed initial demonstration of seamless access to heterogeneous databases in support of deployment and operations planning.
- (U) $1,583 Develop and demonstrate KBSA technologies to effect a ten-fold improvement in software development and support.
  - (U) Developed brassboard KBSA demonstrating a formal method, machine-mediated approach to the full cycle software development process.
- (U) $3,210 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728F Advanced Computing Technology
PROJECT NO. AND NAME 2532 Knowledge-Based Systems	

(U) FY 1996 ($ in Thousands):

- (U) $200 Develop and demonstrate knowledge-based software analysis technologies to support robust, real-time, large-scale information systems.
  - (U) Develop high level tools for rapid composition and integration of large bodies of existing code, data/knowledge bases, and subsystems.
- (U) $2,070 Develop and demonstrate knowledge-based technologies to automate labor-intensive tasks to allow rapid, accurate, and efficient planning.
  - (U) Complete model for mixed initiative planning incorporating computer learning techniques and "intelligent" computer-based agents to support the air campaign planning process.
  - (U) Integrate constraint-based scheduling and modeling capabilities to support in-theater and strategic airlift.
  - (U) Integrate knowledge-based planning technologies into the Joint Forces Air Component Commander planning system; demonstrate the integrated system.
- (U) $1,900 Develop and demonstrate Knowledge-Based Software Assistant (KBSA) technologies to effect a ten-fold improvement in software development and support.
  - (U) Demonstrate final KBSA advanced development model, supporting process representation, configuration management, text generation, instrumentation, and project management.
- (U) $4,170 Total

(U) FY 1997 ($ in Thousands):

- (U) $212 Develop and demonstrate knowledge-based software analysis technologies to support robust, real-time, large-scale information systems.
  - (U) Develop high level tools and methodology facilitating the evolution, evaluation, and integration of information sources and artificial intelligent systems.
- (U) $1,700 Develop and demonstrate knowledge-based technologies to automate labor-intensive tasks to allow rapid, accurate, and efficient planning.
  - (U) Demonstrate generative planning and intelligent automated assistance for both planning and monitoring of joint air campaign.
  - (U) Complete development of the next-generation resource and time schedule planning tool to provide for real-time operational use. Tools will support user modification of the scheduler based on changes in requirements, lift capabilities, and other scheduling parameters; demonstrate for Air Mobility Command strategic airlift.
  - (U) Develop strategies for efficient planning scenario generation in various military domains.
- (U) $1,400 Develop and demonstrate KBSA technologies to effect a ten-fold improvement in software development and support.
  - (U) Extend KBSA integration; demonstrate and evaluate in mission critical application.
- (U) $3,312 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728F Advanced Computing Technology
PROJECT NO. AND NAME 2532 Knowledge-Based Systems	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,738	4,400	4,150	Cont
(U) Current Budget Submit	3,210	4,170	3,312	Cont

(U) Change Summary Explanation:

Funding: Horizontal increases from FY 1995 to FY 1996 are to address added emphasis on knowledge-based technologies to meet future user requirements. Horizontal decreases from FY 1996 to FY 1997 are due to budget constraints. Vertical reductions in this project since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology (S&T) Program. This technology directly supports the Joint Chiefs of Staff Future Joint Warfighting Capability: "To maintain near perfect real-time knowledge of the enemy and communicate that to all forces in near-real-time."

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0604740F, Computer Resource Management.
- (U) PE 0701112F, Inventory Control Point Operation.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603789F C3 Advanced Development

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	9,978	11,969	10,895	12,201	12,700	12,896	14,483	Continuing	Continuing
2335 Advanced C3 Technology	4,701	5,055	4,478	5,400	5,480	5,507	6,349	Continuing	Continuing
4072 Correlation and Fusion	5,277	6,914	6,417	6,801	7,220	7,389	8,134	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** This Advanced Technology Development program develops and demonstrates ground and aerospace Command, Control, and Communications (C3) technology required to maintain Air Force capabilities in a fast-paced, sophisticated, high threat, and intense jamming environment. Enhanced surveillance and communications technology must be developed to counteract an enemy's jamming and to restore critical communications links to the warfighter. The technologies developed in this program include detection, identification, and tracking of hostile targets at long ranges under combat conditions. Additionally, this project develops reliable, secure, jam-resistant communications; and battle management technology that assimilates crucial C3 information into a form which facilitates and supports the military leader's combat decisions in response to the changing dynamics of the battlefield. This technology directly supports the Joint Chiefs of Staff Future Joint Warfighting Capability: "To maintain near perfect real-time knowledge of the enemy and communicate that to all forces in near-real-time."

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Development

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	10,691	12,617	11,179	Cont
(U) Appropriated Value	10,925	12,617		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-528	-268		
b. SBIR	-203	-260		
c. Omnibus/Other Above Threshold Reprogrammings	-116	-120		
d. Below Threshold Reprogrammings	-100			
(U) Current Budget Submit	9,978	11,969	10,895	Cont

(U) Change Summary Explanation:

Funding: Horizontal increases from FY 1995 to FY 1996 are to address added emphasis on Command, Control, and Communications advanced development technologies to meet future user requirements. Horizontal decreases from FY 1996 to FY 1997 are due to budget constraints. Vertical reductions in this project since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:** Not Applicable.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Development
PROJECT NO. AND NAME 2335 Advanced C3 Technology	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2335 Advanced C3 Technology	4,701	5,055	4,478	5,400	5,480	5,507	6,349	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification:** This project develops Command, Control, and Communications (C3) technology for contingency and joint operations focusing on the concepts of force deployment, sustainment, and employment. Dynamic, hostile battlefield environments demand near instantaneous transmission and processing of vast amounts of C3 information for real-time decision making. This project develops and integrates technologies for: low probability of intercept/anti-jam transmission; modular, programmable, multi-level secure communications; secure survivable networks; advanced displays and interfaces; and battle management decision support capabilities for survivable, distributed C2 facilities. Multiband/multimode programmable radios will be enhanced to address the transmission link requirements of joint combat theater communications.

(U) FY 1995 ($ in Thousands):

- (U) $2,900 Develop and demonstrate critical ground and aerospace communications technology advances in programmable devices and monolithic microwave integrated circuits to provide survivable radios and transceivers.
  - (U) Phase I demonstrated SPEAKEASY programmable radio advanced development model programmability, interoperability, and voice bridging with existing legacy radios in the 1995 Joint Warrior Interoperability Demonstration.
  - (U) Developed preliminary Phase 2 SPEAKEASY reprogrammable, multiband, multimode radio design for joint forces application.
- (U) $501 Demonstrate high capacity networking technologies to provide efficient, secure, interoperable, and deployable communications systems.
  - (U) Developed advanced switching technology brassboard with system management/control capabilities for a joint-Service demonstration.
  - (U) Conducted preliminary design study of a survivable high bandwidth switch, focusing on the development of a family of integrated multi-level secure tactical switches.
- (U) $1,300 Demonstrate theater battle management and time-critical air operations technologies to provide field commanders essential operational decision support and rapid response capabilities.
  - (U) Completed operations and surveillance integration concept design plan development.
  - (U) Conducted preliminary configuration design analysis needed for the first operations and surveillance integration brassboard.
  - (U) Developed a concept plan to define approaches for integrating advanced planning tools and processes which employ information management technology for time-critical planning in air operations centers.
- (U) $4,701 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Development
PROJECT NO. AND NAME 2335 Advanced C3 Technology	

(U) FY 1996 ($ in Thousands):

- (U) $2,894 Develop and demonstrate critical ground and aerospace communications technology advances in programmable devices and monolithic microwave integrated circuits to provide survivable radios and transceivers.
  - (U) Perform final test and deliver Phase 1 SPEAKEASY advanced development model.
  - (U) Establish Phase 2 SPEAKEASY programmable radio architecture and modular definition supporting development of a reprogrammable, multiband, multimode capability.
  - (U) Demonstrate Phase 2 SPEAKEASY programmable radio in a four channel unit with limited capability in a mobile vehicle.
- (U) $500 Demonstrate advanced networking technologies to provide efficient, secure, interoperable, and deployable communications networks.
  - (U) Revise the tactical switch low-rate interface module specifications, develop protocols, and test for survivable operation.
  - (U) Complete design and development of translation interface between tactical and commercially compatible switches to support operational voice user requirements.
- (U) $1,661 Demonstrate theater battle management and time-critical air operations technologies to provide field commanders essential operational decision support and rapid response capabilities.
  - (U) Complete the first brassboard operations and surveillance integration design and demonstrate it; develop a concept design for the second operations and surveillance integration brassboard.
  - (U) Develop and demonstrate selected Phase 1 approaches of integrated information management technology for air operations center applications to improve warfighter situational awareness.
- (U) $5,055 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Development
PROJECT NO. AND NAME 2335 Advanced C3 Technology	

(U) FY 1997 ($ in Thousands):

- (U) $2,625 Develop and demonstrate critical ground and aerospace communications technology advances in programmable devices and monolithic microwave integrated circuits to provide survivable radios and transceivers.
  - (U) Demonstrate benefits and capabilities of Phase 2 SPEAKEASY programmable radio's open systems architecture through the use of compatible plug and play modules.
  - (U) Demonstrate voice and data routing between military radios using Phase 2 SPEAKEASY programmable radio module.
- (U) $760 Demonstrate advanced networking technologies to provide efficient, secure, interoperable, and deployable communications systems.
  - (U) Develop, integrate, and test field management system survivability and security features in an existing standards-based management platform system.
  - (U) Establish baseline management system requirements for military quality-of-service, survivability, and performance.
  - (U) Develop a standard management system interface allowing seamless interoperation with other standards-based military and commercial systems.
- (U) $1,093 Demonstrate theater battle management and time-critical air operations technologies to provide field commanders essential operational decision support and rapid response capabilities.
  - (U) Demonstrate the completed operations and surveillance integration brassboard designs; complete preliminary/final acceptance test in an operational environment; and host the operations and surveillance integration brassboard technology demonstration to the user.
  - (U) Develop user coordinated concept plan for developing an air defense advanced planning technology brassboard which integrates the use of air and ground surveillance and weapon systems assets; create brassboard development algorithm design document.
- (U) $4,478 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Development
PROJECT NO. AND NAME 2335 Advanced C3 Technology	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,721	5,311	5,313	Cont
(U) Current Budget Submit	4,701	5,055	4,478	Cont

(U) Change Summary Explanation:

Funding: Horizontal increases from FY 1995 to FY 1996 are to address added emphasis on advanced Command, Control, and Communications technology to meet future user requirements. Horizontal decreases from FY 1996 to FY 1997 are due to budget constraints. Vertical reductions in this project since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology (S&T) Program.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603617F, C3 Applications.
- (U) PE 0603737D, Advanced Research Projects Agency.
- (U) PE 0603006A, C3 Technology.
- (U) PE 0602702F, C3.
- (U) PE 0602232N, C3 Technology.
- (U) PE 0603726F, C3 Subsystems Integration.
- (U) PE 0603728F, Advanced Computer Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Development
PROJECT NO. AND NAME 4072 Correlation and Fusion	

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4072 Correlation and Fusion	5,277	6,914	6,417	6,801	7,220	7,389	8,134	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification:** The Air Force must be able to detect, positively identify, and track hostile targets in combat to gain maximum advantage of all strategic and tactical warning sensors and beyond-visual-range weapons to ensure maximum target engagement ranges and a first-shot, first-kill capability. Effective sensor processing improvements using advanced open architecture processors, spatial coordinate, and time adaptive processing techniques, tracking/fusion algorithms, bistatic sensor technology, and correlation techniques will be pursued to enhance target detection and tracking ranges. Indirect hostile target identification capabilities are essential to achieve high-confidence identification to control the air battle and provide the warfighter with the necessary information to use beyond-visual-range weapons. This project develops and integrates the necessary suite of complementary passive and active hostile target identification capabilities for command and control platforms. These technologies will enhance the performance of identification and threat assessment systems for improved acquisition, tracking, and target engagement ranges for theater operations.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Development
PROJECT NO. AND NAME 4072 Correlation and Fusion	

(U) FY 1995 ($ in Thousands):

- (U) $2,128 Develop high-confidence hostile airborne target identification and tracking technologies and concepts.
  - (U) Completed demonstration of track and identification fusion capability; conducted initial tests using laboratory assets and targets of opportunity; and conducted first stage testing of a multi-sensor integration algorithm on an operational surveillance platform.
  - (U) Developed passive techniques to exploit intelligence data to identify hostile air targets.
  - (U) Developed advanced tracking algorithms for surveillance using advanced radar processing techniques to improve target tracking and new concepts that determine target position, direction, and altitude.
- (U) $200 Develop and demonstrate advanced passive sensor technologies and concepts for increased survivability of fielded systems and assured detection and tracking of combat threats.
  - (U) Conducted first stage development and testing of advanced bistatic recording and measurement control algorithms for integration and operation of a 64 channel ground testbed.
- (U) $2,091 Develop and demonstrate advanced sensor technologies and concepts for assured detection and tracking of hostile ground targets using multiple off-board sensors.
  - (U) Implemented enhanced surveillance algorithms using off-board sensor inputs, in a workstation environment; developed assessment and exit criteria.
  - (U) Tested high performance computer (HPC) parallel processing architectures; defined requirements to incorporate sensor management, enhanced surveillance, and inverse and enhanced synthetic aperture radar algorithm capabilities.
  - (U) Completed Phase 1 real-time on-board sensor allocation management algorithm architecture development for the implementation of advanced HPC architectures.
- (U) $858 Conducted a collaborative Command and Control decision support technology demonstration with a local university.
- (U) $5,277 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Development
PROJECT NO. AND NAME 4072 Correlation and Fusion	

(U) FY 1996 ($ in Thousands):

- (U) $3,370 Develop high-confidence hostile airborne target identification and tracking technologies and concepts.
  - (U) Install multi-sensor integration algorithm on an operational surveillance platform for FY 1997 demonstration testing.
  - (U) Complete advanced surveillance tracking algorithms utilizing advanced radar processing techniques to improve target tracking and the incorporation of new concepts that determine target attitude (position, direction, altitude).
  - (U) Conduct phase one bench testing of installation of active radar identification technology on-board an operational surveillance platform for an FY 1999 demonstration test.
- (U) $893 Develop and demonstrate advanced passive sensor technologies and concepts for increased survivability of fielded systems and assured detection and tracking of combat threats.
  - (U) Integrate and evaluate the hardware and algorithms of a 64 channel bistatic ground testbed which supports passive system performance evaluations and future airborne test risk reduction efforts.
  - (U) Develop design concept for an airborne bistatic testbed.
- (U) $2,651 Develop and demonstrate advanced sensor technologies and concepts for assured detection and tracking of hostile ground targets using multiple off-board sensors.
  - (U) Demonstrate multiple observation and information platform data fusion using enhanced surveillance algorithms (based on off-board sensor inputs) and operating in a workstation environment to detect, track, and identify targets with data from existing surveillance platforms.
  - (U) Assess detection, track, and fusion enhancement gains via real-time laboratory demonstration, defining the radar processing elements and fusion requirements to support real-time parallel processing.
  - (U) Develop and test 20-billion-operations-per-second real-time signal processor enhancement Standard Electronic Module - E format board required to demonstrate real-time high resolution processing.
- (U) $6,914 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Development
PROJECT NO. AND NAME 4072 Correlation and Fusion	

(U) FY 1997 ($ in Thousands):

- (U) $2,694 Develop and demonstrate advanced sensor technologies and concepts for assured detection and tracking of hostile airborne targets using multiple off-board sensors.
  - (U) Complete installation of multi-sensor integration algorithm on an operational surveillance platform and demonstrate on-board and off-board platform sensor fusion and integration.
  - (U) Complete bench testing of active radar identification technology on-board an operational surveillance platform for a FY 1999 demonstration and test.
- (U) $911 Develop and demonstrate advanced passive sensor technologies and concepts for increased survivability of fielded systems and assured detection and tracking of combat threats.
  - (U) Complete ground-based evaluations of the 64 channel bistatic ground testbed capability and identify areas which require further development to reduce technical risks of future airborne bistatic technology demonstrations.
  - (U) Complete design of an airborne bistatic testbed.
- (U) $2,812 Develop and demonstrate advanced sensor technologies and concepts for assured detection and tracking of hostile ground targets using multiple off-board sensors.
  - (U) Complete evaluations of High Performance Computer parallel processing technology applications which employ real-time cueing and correlation techniques to enhance wide area surveillance, time-critical-target detection and tracking.
  - (U) Conduct initial field demonstration tests of real-time signal processor enhancement hardware to perform sensory management, and enhanced/inverse synthetic aperture radar algorithm functions on an operational systems testbed.
- (U) $6,417 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Development
PROJECT NO. AND NAME 4072 Correlation and Fusion	

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,970	7,306	5,866	Cont
(U) Current Budget Submit	5,277	6,914	6,417	Cont

(U) Change Summary Explanation:

Funding: Horizontal increases from FY 1995 to FY 1996 are to address added emphasis on correlation and fusing technologies to meet future user requirements. Horizontal decreases from FY 1996 to FY 1997 are due to budget constraints. Vertical decreases in this project in FY 1995 and FY 1996 since the previous President's Budget are due to balancing budget constraints against priorities within the Science and Technology Program. Vertical increase in this project in FY 1997 since the previous President's Budget is due to increased emphasis on correlation and fusing technologies.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary:**

(U) Related Activities:

- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0602702F, Command, Control, and Communications (C3).
- (U) PE 0603742F, Combat Identification Technology.
- (U) PE 0603726F, C3 Subsystems Integration.
- (U) PE 0603728F, Advanced Computer Technology.
- (U) This project has been coordinated through the Project Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Schedule Profile:** Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603260F Intelligence Advanced Development

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	4,981	4,781	4,878	4,947	4,862	4,875	4,800	Continuing	TBD
3479 Advanced Sensor Exploitation	868	860	846	858	846	845	832	Continuing	TBD
3480 Automated Imagery Exploitation	1,425	1,387	1,365	1,385	1,366	1,365	1,343	Continuing	TBD
3481 Knowledge Based Tech For Intelligence	1,468	1,521	1,496	1,517	1,496	1,495	1,473	Continuing	TBD
3482 Science & Tech Intelligence Methodology	1,220	1,013	1,171	1,187	1,154	1,170	1,152	Continuing	TBD

(U) A. Mission Description and Budget Item Justification

(U) Demonstrates and validates advanced technology intelligence systems capabilities and techniques to support tactical and strategic commanders and National Command Authority needs for timely and all source intelligence information. Intelligence Advanced Development (IAD) is composed of four software projects developed for the Air Force at Rome Lab (RL). IAD's projects expand and improve data storage, retrieval and handling capabilities; satisfy needs for near-real-time data processing, exploitation and dissemination from present and future intelligence systems. RL works directly with users, employing a rapid prototyping evolutionary approach, integrating finished modules directly into the field. The programs are oriented toward specific shortfalls and deficiencies as documented by the major commands (MAJCOMS), unified commands, and intelligence organizations in their mission and function area plans. The goal of this program is to expedite technology transition from the laboratory to operational use via rapid prototyping and simulation. The program is in Demonstration and Validation, Budget Activity 4.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,069	5,109	5,109	TBD
(U) Appropriated Value	5,134	5,109		
(U) Adjustments to Appropriated Value				
a. General Congressional Reductions	-65	-98		
b. SBIR	-1	-116		
c. Omnibus and other Above Threshold Reprogrammings	-87	-114		
(U) Adjustments to Budget Year since PB96			-231	
(U) Current Budget Submit/President's Budget	4,981	4,781	4,878	TBD

(U) Change Summary Explanation:

Funding: FY97 funding reduced to fund higher Air Force priorities

Schedule: N/A

Technical: N/A

(U) **C. Other Program Funding Summary ($ in Thousands)**

(U) Not Applicable

(U) Related RDT&E:

62720F C3I Exploratory Development: optical storage, speech processing, signals exploitation, data handling, sensor exploitation

63789F C3 Advanced Technology Development: correlation, fusion, signal processing

63726F C3 Subsystem Integration: mass storage, hypermedia database, voice translation, mapping and charting

64750F Intelligence Equipment: modeling and simulation

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Intelligence Event Builder Awarded	X											
(U) Open System Message Processor Awarded	X											
(U)AI Data Representation Awarded	X											
(U) Analytical Tools for Targeting Awarded		X										
(U) Secondary Imagery Dissemination Demonstrated		X										
(U) Imagery Exploitation 2000 Awarded		X										
(U) Image Aim Point Graphic Awarded		X										
(U) Mass Storage Awarded		X										
(U) Correlation Fusion Algorithms Delivered			X									
(U) Video Digital Image Exploitation Awarded				X								
(U) Advanced Intelligence System Delivered						X						
(U) Document Analysis System Delivered							X					
(U) Dynamic Modeling Awarded								X				
(U) Analytical Tools for Targeting Delivered									X			
(U) Consistent Operational Picture Awarded										X		
(U) Image Aim Point Graphic Completed										X		
(U) Video Digital Exploitation												X

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603260F Intelligence Advanced Development

PROJECT NO. AND NAME: 3479 Advanced Sensor Exploitation

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3479 Advanced Sensor Exploitation	868	860	846	858	846	845	832	Continuing	TBD

(U) **A. Mission Description and Budget Item Justification**

(U) There is an Air Force and Army need to correlate various sources of intelligence reports (Communications Intelligence - COMINT, Electronic Intelligence - ELINT, Image Intelligence - IMINT) within seconds as opposed to hours with current manual methods. Project includes development of data correlation and predictive intelligence algorithms, target analysis and prioritization, air order of battle updates and tactical analysis techniques. This computerized approach will speed up the correlation of data from diverse sources of intelligence information, including COMINT, ELINT, and IMINT; providing faster situational awareness and threat assessment and replace manual systems with automated capabilities. The program is in Demonstration and Validation, Budget Activity 4.

(U) FY 1995 ($ in Thousands)
- (U) $ 606 Continue Analytical Tools for Targeting.
- (U) $ 144 Initiated Advanced Techniques for C2 Node Target Identification.
- (U) $ 118 Completed Tactical Intelligence Fusion Prototype.
- (U) $ 868 Total

(U) FY 1996 ($ in Thousands)
- (U) $ 400 Continue Analytical Tools for Targeting.
- (U) $ 460 Continue Advanced Techniques for C2 Node Target Identification.
- (U) $ 860 Total

(U) FY 1997 ($ in Thousands)
- (U) $ 71 Continue Analytical Tools for Targeting.
- (U) $ 113 Complete Advanced Techniques for C2 Node Target Identification.
- (U) $ 391 Initiate Consistent Operational Picture via Distributed Fusion.
- (U) $ 271 Initiate Enhancements to Analytical Tools
- (U) $ 846 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3479 Advanced Sensor Exploitation	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	868	886	886	TBD
(U) Appropriated Value	911	886		
(U) Adjustments to Appropriated Value				
a. General Congressional Reductions	-22	-17		
b. SBIR				
c. Omnibus and other Above Threshold Reprogrammings	-21	-9		
(U) Adjustments to Budget Year since PB96			-40	
(U) Current Budget Submit/President's Budget	868	860	846	TBD

(U) Change Summary Explanation:

Funding: FY97 funding reduced to fund higher Air Force priorities.

Schedule: N/A

Technical: N/A

(U) **C. Other Program Funding Summary ($ in Thousands)**

(U) Not Applicable

(U) Related RDT&E:

62720F C3I Exploratory Development: optical storage, speech processing, signals exploitation, information handling, sensor exploitation
63789F C3 Advanced Technology Development: correlation, fusion, signal processing
63726F C3 Subsystem Integration: advanced image/information, advanced optical memory technology
64750F Intelligence Equipment: modeling and simulation

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3479 Advanced Sensor Exploitation	

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Correlation Fusion Algorithms Delivered			X									
(U) Analytical Tools for Targeting Delivered								X				
(U) Advanced Techniques for C2 Node Target ID Awarded				X								
(U) Consistent Operational Picture Awarded										X		
(U) Analytical Tools for Targeting Delivered								X				

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3479 Advanced Sensor Exploitation	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Analytical Tools	606	200	
(U) Enhanced Correlation & Fusion	144	200	
(U) Consistent Operational Picture	118	460	380
(U) Analytical Tools			251
(U) Enhanced Analytical Tools			215
(U) Total	868	860	846

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

(U) Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603260F Intelligence Advanced Development

PROJECT NO. AND NAME: 3480 Automated Imagery Exploitation

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3480 Automated Imagery Exploitation	1,425	1,387	1,365	1,385	1,366	1,365	1,343	Continuing	TBD

(U) A. **Mission Description and Budget Item Justification**

(U) This project demonstrates and validates the capability to more accurately and quickly interpret digital imagery by evaluating computer assisted techniques to manipulate and overlay imagery, cartographic data, signal intelligence (SIGINT), and on line intelligence data. The result of this effort will be more precise target locations and identifications, precise target reference scenes, and more accurate damage assessments; all development for easily supportable, low cost commercially available computer workstations. This project will also develop data links which can be used to provide digital imagery to theater and tactical units. The program is Demonstration and Validation, Budget Activity 4.

(U) FY 1995 ($ in Thousands)

- (U) $ 375 Continue IE 2000 Configuration Management and Application in support of imagery exploitation.
- (U) $ 411 Continue Image Aim Point Graphic in support of producing high quality target materials.
- (U) $ 290 Continue Mass Storage in support of ACC's Mass Digital Storage Concept.
- (U) $ 349 Initiate Video Digital Exploitation.
- (U) $1,425 Total

(U) FY 1996 ($ in Thousands)

- (U) $ 350 Continue IE 2000 Configuration Management and Application in support of imagery
- (U) $ 25 Complete Image Aim Point Graphic in support of producing high quality target materials.
- (U) $ 290 Initiate Video Digital Exploitation.
- (U) $ 50 Initiate collateral image server
- (U) $ 260 Initiate multi-processor for automated image exploitation
- (U) $ 204 Initiate georegistered range imagery algorithm
- (U) $ 208 Continue Bomb Damage Assessment techniques
- (U) $1,387 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3480 Automated Imagery Exploitation	

(U) FY 1997 ($ in Thousands)

- (U) $ 476 Continue Image Exploitation (IE) 2000 Application.
- (U) $ 50 Complete Bomb Damage Assessment techniques.
- (U) $ 145 Complete Video Digital Image Exploitation.
- (U) $ 50 Continue collateral image server
- (U) $ 375 Continue multi-processor for automated image exploitation
- (U) $ 160 Continue georegistered range imagery algorithm
- (U) $ 109 Initiate visualization applications
- (U) $1,365 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,425	1,430	1,430	TBD
(U) Appropriated Value	1,459	1,430		
(U) Adjustments to Appropriated Value				
a. General Congressional Reductions	-12	-28		
b. SBIR				
c. Omnibus and other Above Threshold Reprogramming	-22	-15		
(U) Adjustments to Budget Year since PB96			-65	
(U) Current Budget Submit/President's Budget	1,425	1,387	1,365	TBD

(U) Change Summary Explanation:

Funding: N/A

Schedule:. N/A

Technical: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3480 Automated Imagery Exploitation	

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Not Applicable

(U) Related RDT&E:

62720F C3I Exploratory Development: optical storage, speech processing, signals exploitation, information handling, sensor exploitation
63789F C3 Advanced Technology Development: correlation, fusion, signal processing
63726F C3 Subsystem Integration: advanced image/information applications, advanced optical memory technology
64750F Intelligence Equipment: modeling and simulation

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Image Aim Point Graphic Completed										X		
(U) Imagery Exploitation (IE) 2000 Awarded							X					
(U) Mass Storage Awarded			X				X					
(U) Video Digital Image Exploitation Awarded									X			
(U) Bomb Damage Assessment Awarded			X									
(U) Bomb Damage Assessment Completed							X					
(U) Multi processors for Auto Image Exploitation Awarded						X						
(U) Georegistered Range Image Algo Awarded						X						
(U) Visualization Application Awarded										X		

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3480 Automated Imagery Exploitation	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Imagery Exploitation 2000	375	350	476
(U) Image Aim Point Graphic	411	25	
(U) Mass Storage	290		
(U) Video Digital Image Exploitation		290	50
(U) Bomb Damage Assessment Techniques	349	208	145
(U) Collateral Image Server		50	50
(U) Multi Processor for Auto Image Exploit		260	375
(U) Georegistered Range Imagery Algo		204	160
(U) Visualization Applications			109
(U) Total	1,425	1,387	1,365

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

(U) Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3481 Knowledge Based Tech For Intelligence	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3481 Knowledge Based Tech For Intelligence	1,468	1,521	1,496	1,517	1,496	1,495	1,473	Continuing	TBD

(U) A. **Mission Description and Budget Item Justification**

(U) This project will reduce manpower and warning times for respective Strategic Command (STRATCOM), Air Combat Command (ACC), Air Force Space Command (AFSPC), Air Intelligence Agency (AIA), and 497th Intelligence Group data handling systems. The development of the analytical aids is based on artificial intelligence techniques. The increased timeliness, efficiency and effectiveness derived will provide warning time and accuracy, allowing national/military authorities a greater range of options to avert, diminish or control a crisis. The program is Demonstration and Validation, Budget Activity 4.

(U) FY 1995 ($ in Thousands)

- (U) $ 600 Continue Electronic Warfare (EW) Flagging Expert System in support of the Air Force Electronic Warfare Center (AFEWC) Electronic Warfare Flagging mission.
- (U) $ 368 Completed Prototype Intelligence Event Builder which represents icons on a timeline in support of multiple commands
- (U) $ 500 Completed information process effort to transition hardcoded "stovepipe" message processing subsystems into system client/server environment.
- (U) $1,468 Total

(U) FY 1996 ($ in Thousands)

- (U) $ 70 Complete EW Flagging Expert System.
- (U) $ 455 Initiate Intelink development for Image Product Archive in support of ACC
- (U) $ 471 Initiate Machine learning Prototype, expert system and neural network technologies to support real-time analysis of timelines
- (U) $ 125 Initiate Enhanced Mass Storage System to satisfy the growing need to store and retrieve large digital files representing imagery, charts, maps, text, etc.
- (U) $ 400 Initiate the Vision Pointer application which analyzes collected signals and characterizes signals to differentiates between specific platforms.
- (U) $1,521 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3481 Knowledge Based Tech For Intelligence	

(U) FY 1997 ($ in Thousands)

- (U) $ 400 Continue Intelink development for Image Product Archive in support of ACC and AIA.
- (U) $ 400 Continue Machine Learning Prototype, expert system and neural network technologies to support real-time analysis of timeliness.
- (U) $ 337 Continue Enhanced Mass Storage System to satisfy the growing need to store and retrieve large digital files representing imagery, charts, maps, text, etc.
- (U) $ 359 Continue the Vision Pointer application which analyzes collected signals and characterizes signals to differentiates between specific platforms.
- (U) $1,496 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,556	1,567	1,567	TBD
(U) Appropriated Value	1,598			
(U) Adjustments to Appropriated Value				
a. General Congressional Reduction	-19	-30		
b. SBIR				
c. Omnibus and other Above Threshold Reprogrammings	-111	-16		
(U) Adjustments to Budget Year since PB96			-71	
(U) Current Budget Submit/President's Budget	1,468	1,521	1,496	TBD

(U) Change Summary Explanation:

Funding: N/A

Schedule: N/A

Technical: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3481 Knowledge Based Tech For Intelligence	

(U) C. **Other Program Funding Summary ($ in Thousands)**

(U)Not Applicable

(U) Related RDT&E:

62720F C3I Exploratory Development: optical storage, speech processing, signals exploitation, data handling, sensor exploitation
63789F C3 Advanced Technology Development: correlation, fusion, signal processing
63726F C3 Subsystem Integration: mass storage, hypermedia database, voice translation, mapping and charting
64750F Intelligence Equipment: modeling and simulation

(U) D. **Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Intelligence Event Builder Delivered				X								
(U) Open System Message Processor Delivered				X								
(U) EW Flagging Expert System Delivered						X						
(U) InteLink for Image Product Archive Awarded						X						
(U) Machine Learning Prototype Awarded							X					
(U) Enhanced Mass Storage System Awarded							X					
(U) Vision Pointer Awarded							X					

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3481 Knowledge Based Tech For Intelligence	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) EW Flagging Expert System	600	70	
(U) Prototype Event Builder	368		
(U) Message Handling Open System	500		
(U) InteLink for Image Product Archive		455	400
(U) Machine Learning Prototype		471	400
(U) Enhanced Mass Storage System		125	337
(U) Vision Pointer		400	359
(U) Total	1,468	1,521	1,496

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

(U) Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603260F Intelligence Advanced Development

PROJECT NO. AND NAME: 3482 Science & Tech Intelligence Methodology

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3482 Science & Tech Intelligence Methodology	1,220	1,013	1,171	1,187	1,154	1,170	1,152	Continuing	TBD

(U) **A. Mission Description and Budget Item Justification**

(U) Demonstrates and validates intelligence methodologies and techniques for operational employment of simulation models in support of Air Force Intelligence Agency (AIA) requirements. The methods and techniques will help AIA improve their analysis of current and future foreign weapon systems, and prevent technological surprises with regard to the capabilities of these systems. The program is Demonstration and Validation, Budget Activity 4.

(U) FY 1995 ($ in Thousands)

- (U) $ 324 Completed Baseline Prototype of Advance Intelligence Information System to aid in development of digital intelligence products.
- (U) $ 184 Completed Intelligence Analyst Associate (Build 1) for automated information extraction from text using natural language understanding.
- (U) $ 46 Complete AI Data Representation effort for automated signal data analysis
- (U) $ 424 Continued Document Content Analysis and Retrieval System (DCARS) text retrieval system.
- (U) $ 157 Awarded option for operational development of the Advanced Intelligence Information System.
- (U) $ 85 Awarded Information Warfare Integration to Sensor Ace analysis program.
- (U) $1,220 Total

(U) FY 1996 ($ in Thousands)

- (U) $ 313 Complete Document Content Analysis and Retrieval System (DCARS) text retrieval system.
- (U) $ 181 Complete option for operational development of the Advanced Intelligence Information System.
- (U) $ 320 Continue Information Warfare Integration to Sensor Ace.
- (U) $ 143 Award Applied Deception Techniques for manipulation deception of foreign signal collection systems.
- (U) $ 56 Award Intelligence Analyst Associate (Build 2) for automated information extraction from text using natural language understanding.
- (U) $1,013 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3482 Science & Tech Intelligence Methodology	

(U) FY 1997 ($ in Thousands)

- (U) $ 128 Complete Information Warfare Integration to Sensor Ace.
- (U) $ 350 Continue Applied Deception Techniques for manipulative deception of foreign signal collection systems.
- (U) $ 430 Continue Intelligence Analyst Associate (Build 2) for automated information extraction from text using natural language understanding.
- (U) $ 263 Award Information Warfare Model Abstraction Techniques
- (U) $1,171 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,220	1,226	1,226	TBD
(U) Appropriated Value	1,254			
(U) Adjustments to Appropriated Value				
a. General Congressional Reductions	-12	-23		
b. SBIR		-116		
c. Omnibus and other Above Threshold Reprogrammings	-22	-74		
(U) Adjustments to Budget Year since PB96			-55	
(U) Current Budget Submit/President's Budget	1,220	1,013	1,171	TBD

(U) Change Summary Explanation:

Funding: N/A

Schedule: N/A

Technical N/A

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3482 Science & Tech Intelligence Methodology	

(U) Related RDT&E:

62720F C3I Exploratory Development: optical storage, speech processing, signals exploitation, data handling, sensor exploitation
63789F C3 Advanced Technology Development: correlation, fusion, signal processing
63726F C3 Subsystem Integration: mass storage, hypermedia database, voice translation, mapping and charting
64750F Intelligence Equipment: modeling and simulation

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Advanced Intelligence (AI) Information System Delivered					X							
(U) Document Content Analysis and Retrieval System Delivered							X					
(U) Intel Analyst Associate Delivered				X								
(U) Intel Analyst Associate (Build 2) Awarded							X					
(U) Applied Deception Techniques Awarded						X						
(U) Information Warfare Abstraction Techniques Awarded										X		

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603260F Intelligence Advanced Development
PROJECT NO. AND NAME 3482 Science & Tech Intelligence Methodology	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Advanced Intelligence Information System	324	181	
(U) Intelligence Analyst Associate (Build 1)	184		
(U) AI Data Representation	46		
(U) Document Content Analysis Retrieval System	424	313	
(U) Information Warfare for Sensor Ace	157	320	128
(U) Applied Deception Techniques	85	143	350
(U) Intelligence Analysts Associate (Build 2)		56	430
(U) Information Warfare Model Abstraction Techniques			263
(U) Total	1,220	1,013	1,171

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

(U) **Not Applicable**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603319F Airborne Laser Technology

PROJECT NO. AND NAME: 4269 Airborne Laser

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4269 Airborne Laser	19,086	18,986	56,828	96,654	215,404	219,417	94,358	0	TBD

(U) A. Mission Description and Budget Item Justification. **The Airborne Laser (ABL) Program is an ACAT 1D program which will demonstrate all necessary technologies required for acquiring, tracking and killing Theater Ballistic Missiles (TBMs) in the boost phase.** The Concept Design phase resulted in the award of two competing contracts (FY94-FY97) which were awarded in May 1994. The program will award the ABL Demonstration/Validation contract to a single contractor team in FY 1997 who will build and test the winning ABL design. The Demonstration/Validation phase begins in January 1997 and culminates with lethality demonstrations against boosting TBMs. The Demonstration/Validation phase must demonstrate all key technologies for a fully operational system, allowing the Air Force to advance to EMD in the FY 2003 time frame should the Air Force decide to proceed with an operational fleet of ABLs. Demonstration/Validation will begin only if results of concept design allow the program to pass exit criteria dealing with physics and engineering related issues. During concept design, the ABL leverages off laser and imaging technologies in PE 0603605F as well as the High Altitude Balloon Experiment, which will validate key fire control and tracking technologies. Deliverables from Concept Design are full operational capability ABL designs, scaleable/traceable ABL Demonstrator detailed designs; contractor risk mitigation demonstrations to decrease Demonstration/Validation phase engineering/aircraft integration risk; simulations in the Air Combat Command's Theater Air Command and Control Simulation Facility (TACCSF); and ABL adjunct missions studies for (a) cruise missile defense, (b) protection of high value assets, (c) defensive counter-air, (d) BMC4I, (e) suppression of enemy air defenses, and (f) surveillance

(U) Acquisition Strategy

(U) Phase I competing Contractors include: (1) Boeing, Seattle WA (prime); Lockheed-Martin, Sunnyvale CA; TRW, Redondo Beach CA; and ITEK, Lexington MA (subcontractors) and (2) Rockwell, Conoga Park CA (prime); Hughes, Los Angeles CA; North American Aircraft, EL Segundo CA; Strategic defense Centers, Seal Beach CA; E-Systems, Greenville TX; IBM, Boulder CO and Gaithersburg MD; Unisys, Salt Lake City UT and Eagan MN; and Parsons, Pasadena CA (subcontractors). Government Integrated Product Teams (IPT) include Philips Laboratory ABL SPO, Laser and Imaging Directorate, and Advanced Weapons and Survivability Directorate; Aeronautical Systems Center; Rome Laboratory; Lincoln Laboratory; Sandia National Laboratory; Electronics Systems Center; Wright Laboratories ; Air Combat Command; and US Army White Sands Missile Range.

(U) Demonstration / Validation contractor will be determined as a result of the downselection competition.

(U) FY 1995 ($ in Thousands):

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603319F Airborne Laser Technology
PROJECT NO. AND NAME 4269 Airborne Laser	

- (U) $4400 Initiate contractor hardware/software demonstration to reduce engineering/aircraft integration risk for Dem/Val. Results are factor in Dem/Val downselect decision in FY 1997.
- (U) $200 Begin contractor modeling/simulation of their ABL design in TACCSF. Results are factor in Dem/Val downselect decision in FY 1997.
- (U) $180 Begin ABL adjunct mission studies.
- (U) $6800 Conduct Operational Concept and Preliminary Requirements Reviews.
- (U) $3403 Continue design and conduct first incremental Demonstrator Concept Design Reviews.
- (U) $475 Continue government Dem/Val environmental impact studies.
- (U) $675 Begin government Dem/Val test planning.
- (U) $470 Support ACC in boost phase intercept COEA study development and requirements definition.
- (U) $2103 Provide government participation in Contractors' IPTs for Integrated Product Development of all contract tasks.
- (U) $380 Provide government system security engineering and facility utilization planning support to contractors.
- (U) $19,086 Total

(U) FY 1996 ($ in Thousands):

- (U) $6500 Continue hardware/software risk mitigation demonstrations for Dem / Val downselect decision.
- (U) $200 Continue contractor modeling/simulation efforts at the TACCSF.
- (U) $3200 Deliver final Dem/Val specifications for downselection evaluation.
- (U) $4500 Prepare for final concept design review in FY 1997.
- (U) $200 Complete majority of ABL adjunct mission studies.
- (U) $700 Continue detailed test planning for Dem / Val
- (U) $1000 Continue environmental impact study for Dem / Val.
- (U) $200 Complete facility utilization planning for Dem / Val
- (U) $2486 Participate in IPTs with contractors to accomplish all tasks described above, provide SPO operational support and prepare for a milestone I decision.
- (U) $18,986 Total

(U) FY 1997 ($ in Thousands):

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603319F Airborne Laser Technology
PROJECT NO. AND NAME 4269 Airborne Laser	

–	(U) $6600	Complete and deliver final Demonstrator designs.
–	(U) $2000	Conduct final Concept Design Reviews.
–	(U) $3300	Complete all remaining contractor risk mitigation demonstrations.
–	(U) $100	Complete ABL adjunct mission studies.
–	(U) $500	Complete environmental impact study for Dem /Val.
–	(U) $350	Complete evaluation of modeling/simulation efforts at the TACCSF.
–	(U) $250	Complete detailed test planning for Dem / Val.
–	(U) $4000	Participate in IPTs with contractors to accomplish all tasks.
–	(U) $2528	Complete evaluation of competing Dem / Val proposals and complete active tracking experiments for concept design effort.
–	(U) $26100	Winning contractor continues effort from Concept Design leading to Preliminary Design Review .
–	(U) $3200	Begin incorporation of ACC defined residual operational capability into ABL design.
–	(U) $7900	Participate in IPTs with contractor to accomplish all tasks, provide SPO operational support, conduct test planning, and conduct simulations & analyses.
–	(U) $56,828	Total
–		

(U) **B. Program Change Summary ($113,656 in Thousands)**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603319F Airborne Laser Technology

PROJECT NO. AND NAME: 4269 Airborne Laser

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	19671	20000	20000	TBD
(U) Appropriated Value	20000	19954	19954	
(U) Adjustments to Appropriated Value				
a. Congressional/ General Reductions	-323	-425	-1727	
b. SBIR	-374	-388		
c. Omnibus or Other Above Threshold Reprogram		-155		
d. Below Threshold Reprogramming	-217			
(U) FY97 Air Force POM Increases			38601	
(U) Current Budget Submit/President's Budget	19086	18986	56828	TBD

(U) Change Summary Explanation:

Schedule: The Air Force's decision to enter into the Dem/Val phase extends the program from concept design to the ABL lethality demonstrations in FY03.

Technical: None

(U) C. **Other Program Funding Summary ($113,656 in Thousands)**

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603319F Airborne Laser Technology

PROJECT NO. AND NAME: 4269 Airborne Laser

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Comp	Total Cost
(U) PE 0603605F Advance Weapons Technology									
Project 3647 - Hi Energy Laser Technologies	12426	8350	11750	10392	8011	7786	8008	TBD	
(U) PE 0603217C	7800$11	7300							
	3,656								

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) ABL Concept Design Contract Award												
(U) Preliminary Reqts Review (PRR)	*											
(U) Ops Concept Review (ACC/Rockwell)			*									
(U) Ops Concept Review (ACC/Boeing)				*								
(U) Concept Design Review 1						*						
(U) Dem/Val Request for Proposal Release							X					
(U) Concept Design Review 2									X			
(U) Downselct Winning Dem/Val Contractor										X		
(U) Preliminary Design Review												

* = complete

(U) A. Project Cost Breakdown ($ in Thousands)

	FY 1995	FY 1996	FY 1997
(U) Major Contracts	15400	14600	41300
(U) Support Contracts	1620	2345	3730
(U) In-House/Misc Support/Salaries	2066	2041	11798
(U) Total	19086	18986	56828

(U) B. Budget Acquisition History and Planning Information ($ in Thousands)

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603319F Airborne Laser Technology

PROJECT NO. AND NAME: 4269 Airborne Laser

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Rockwell Int Conoga Park, CA	CPFF	9 May 94	21400	21400	400	7700	7300	6000		21400
Boeing Defense & Space Group Seattle, WA	CPFF	9May 94	21400	21400	400	7700	7300	6000		21400
Winning Phase II Contractor (TBD)	CPAF	31 Jan 97								
Support and Management Organizations										
Support Contracts						1620	2525	4460		
In-House/Misc Support/Salaries						2780	2829	6395		
Test and Evaluation Organizations										

1.(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property: NA

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603430F Advanced MILSATCOM (Space)

PROJECT NO. AND NAME: 4050 Advanced MILSATCOM

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4050 Advanced MILSATCOM	21,674	29,143	31,643	43,311	109,238	225,998	573,310	7,156,157	8,190,474

(U) A. Mission Description and Budget Item Justification

Develop and acquire advanced Military Satellite Communications (MILSATCOM) satellites with necessary modifications to the mission control segment, and develop terminal technology for survivable, jam-resistant, world-wide, secure, high capacity communications for the strategic and tactical warfighter. This system provides the basis for the next generation military communications satellite system. Advanced MILSATCOM satellites will replenish existing Extremely High Frequency/Ultra High Frequency (EHF/UHF) (Milstar II) and Super high Frequency (SHF) (DSCS III) systems. It will use standardized spacecraft components and modular payloads which will be launched on a Medium Launch Vehicle (MLV). The Advanced EHF capability will be available for first launch not later than 2006. The Advanced SHF capability will be available for first launch in 2007. This consolidated replenishment will make maximum use of commercial bus developments and reduce orbital support and launch integration costs. The activities funded under this program element implement the Secretary of Defense's 1993 MILSATCOM Bottom Up Review decision to field a lower cost, advanced MILSATCOM satellite. This program is in Budget Activity Research Category Demonstration and Validation based on direction from the FY95 Defense Planning Guidance. Acquisition streamlining approaches are being considered for implementation on the Advanced MILSATCOM Program. The Advanced MILSATCOM Program will implement the architecture defined by the DoD Space Architect in FY 96.

(U) FY 1995

- (U) MILSATCOM Technology Validation Program
- (U)$ 17,074 Industry contracted projects in support of advanced technology studies and development.
- (U)$ 4,200 Laboratory study and analysis support for technology program.
- (U)$ 400 Basic Program Office support activities for advanced technology program.
- (U)$ 21,674 Total

(U) FY 1996

- (U) MILSATCOM Technology Validation Program
- (U)$ 23,404 Continue validation of advanced EHF technologies.
- (U)$ 930 Continue basic Program Office support activities for advanced technology program.
- (U)$ 4,809 Develop architecture and requirements documentation for the Advanced MILSATCOM system.
- (U)$ 29,143 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603430F Advanced MILSATCOM (Space)
PROJECT NO. AND NAME 4050 Advanced MILSATCOM	

(U) FY 1997

- (U) MILSATCOM Technology Validation Program
- (U)$ 15,543 Continue validation of advanced EHF technologies.
- (U)$ 1,000 Continue basic Program Office support activities for advanced technology program.
- (U)$ 15,100 Initiate Processing Subsystem Engineering Model Program.
- (U)$ 31,643 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997
(U) Previous President's Budget	22,095	30,038	34,816
(U) Appropriated Value	22,095		
(U) Adjustments to Appropriated Value			
a. Congressional General Reductions	-44	-895	
b. SBIR	-377		
c. Omnibus and Other Above Threshold Reprogram			
d. Below Threshold Reprogram			
(U) Adjustments to Budget Years Since FY96 PB			-3173
(U) Current Budget Submit/President's Budget	21,674	29,143	31,643

(U) Change Summary Explanation:

Funding: Funding changes in FY96 and FY97 reflect program share of general RDT&E cuts (FY97: inflation savings ($3000) plus overhead reduction ($173))

Schedule: Not Applicable.

Technical: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603430F Advanced MILSATCOM (Space)
PROJECT NO. AND NAME 4050 Advanced MILSATCOM	

(U) C. Other Program Funding Summary ($ in Thousands)

Related RDT&E

(U) PE #604479F, Milstar LDR/MDR Satellite Communications
(U) PE #604577N, EHF Satellite Communications
(U) PE #303142A, Tactical Communications Ground Environment
(U) PE #303110F, Defense Satellite Communications System
(U) PE#603432F, Polar Satellite Communications Program (Polar Adjunct)

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Technology Project Awards		*										
(U) Technology Project Awards/Renewals						*				x		
(U) Start Processing Subsystem Engineering Model										x		
(U) DAE MILSATCOM Status Review				*								
(U) Milestone II - Mid FY00												
(U) EHF program EMD Start - Mid FY00												
(U) SHF program EMD Start - Late FY01												
(U) EHF - First Delivery - Early FY06												
(U) SHF - First Delivery - Early FY07												

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603430F Advanced MILSATCOM (Space)

PROJECT NO. AND NAME: 4050 Advanced MILSATCOM

(U) A. Project Cost Breakdown ($ in Thousands)

	FY 1995	FY 1996	FY 1997
(U) MILSATCOM Technology Validation Program	21,674	24,334	16,543
(U) Processing Subsystem Engineering Model	0	0	15,100
(U) Architecture & Requirements Documentation	0	4,809	0
(U) Total	21,674	29,143	31,643

(U) B. Budget Acquisition History and Planning Information ($ in Thousands)

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
MIT/LL	MIPR	Feb 95	6,500	6,500	0	1,900	2,400	1,500	700	6,500
Lockheed	CPFF	Jan 95	7,604	7,604	0	1,549	3,787	2,268	0	7,604
Hughes	CPFF	Jan 95	2,486	2,486	0	1,870	616	0	0	2,486
TRW	CPFF	Jan 95	4,850	4,850	0	1,505	1,903	1,442	0	4,850
TRW	CPFF	Feb 95	1,071	1,071	0	1,071	0	0	0	1,071
HSC/Loral	CPFF	Jan 95	4,777	4,777	0	1,398	1,798	1,581	0	4,777
Boeing	CPFF	Jan 95	3,648	3,648	0	1,272	1,507	869	0	3,648
TRW	CPFF	Feb 95	2,998	2,998	0	1,446	1,126	426	0	2,998
Texas Instruments	CPFF	Jan 95	3,215	3,215	0	1,043	1,409	763	0	3,215
MIT/LL	MIPR	Feb 95	3,800	3,800	0	1,000	1,400	1,200	200	3,800
Various Tech Proj	Various	Jan 95	29,886	29,886	0	7,220	7,458	5,494	9,714	29,886
System Analysis	Various	Jan 96	4,809	4,809	0	0	4,809	0	0	4,809
Engineering Model	Various	TBD	106,400	106,400	0	0	0	15,100	91,300	106,400
Future EMD	TBD	TBD	TBD	TBD	0	0	0	0	7,848,430	7,848,430

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603430F Advanced MILSATCOM (Space)

PROJECT NO. AND NAME: 4050 Advanced MILSATCOM

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Support and Management Organizations										
Various	Various	2 Qtr 95	N/A	N/A	0	400	930	1,000	157,670	160,000
Test and Evaluation Organizations										
TBD										
Government Furnished Property:										
Product Development Property										
None.										
Support and Management Property										
None										
Test and Evaluation Property										
None										
Subtotal Product Development						21,274	28,213	30,643	7,950,344	8,030,474
Subtotal Support and Management						400	930	1,000	157,670	160,000
Subtotal Test and Evaluation										
Total Project						21,674	29,143	31,643	8,108,014	8,190,474

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603432F Polar Adjunct (Space)

PROJECT NO. AND NAME: 4052 Polar Satellite Communications

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4052 Polar Satellite Communications	14,999	55,615	62,387	0	0	0	0	0	137,249

(U) A. Mission Description and Budget Item Justification

The Program will provide protected communications services to U.S. forces operating in the northern polar region. In 1992, the Milstar program was restructured, and the requirement for Milstar to provide polar coverage was deleted. The Air Force was directed to find a more cost-effective solution to polar requirements. In Oct 94, the DoD identified an immediate need for protected polar communications, and the Air Force began to evaluate options to satisfy that need. The Military Communications Electronics Board (MCEB) and the Joint Warfighting Capability Assessment (JWCA) endorsed the need for an interim polar system. In Jul 95, the JROC validated the Polar MILSATCOM ORD which contained the interim requirements. Also in July, the DAE reviewed the Polar program and approved execution of a interim program to place a modified EHF payload from the UFO system onto a host satellite to provide limited requirements satisfaction while pursuing a long term solution. The Polar Satellite Communications Program is in budget activity 4 - Demonstration and Validation based on a 30 Mar 95 USD(A&T) Memorandum to pursue the interim hosted solution.

(U) FY 1995
- (U) $6,999 Procured long lead parts and continued design for modifications to host satellite to accommodate EHF payload
- (U) $8,000 Procured long lead parts for EHF payload
- (U) $14,999 Total

(U) FY 1996
- (U) $27,615 Continue design, parts procurement, and payload integration efforts for interim payload
- (U) $13,000 Modify host satellite to accommodate the communications payload
- (U) $15,000 Fund for launch delay of host satellite caused by addition of the communications payload
- (U) $55,615 Total

(U) FY 1997
- (U) $22,137 Complete design, satellite modification, and payload integration and test for the interim payload.
- (U) $40,250 Fund for launch delay of host satellite.
- (U) $62,387 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603432F Polar Adjunct (Space)
PROJECT NO. AND NAME 4052 Polar Satellite Communications	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Previous President's Budget	0	0	0
(U) Appropriated Value	0	58,000	
(U) Adjustments to Appropriated Value	14,999		
a. Congressional General Reductions		-1136	
b. SBIR		-1249	
(U) Adjustments to Budget Years Since FY96 PB			62,387
(U) Current Budget Submit/President's Budget	14,999	55,615	62,387

(U) Change Summary Explanation:

Funding: Program was not funded in FY96 PB. Funds were reprogrammed in FY95 to start the Polar program. Congress appropriated funds in FY96 based on the program established by the FY95 reprogramming. Air Force funded ($64,250) program in FY97 budget cycle to continue polar effort. Reduction (-1,863) reflects inflation savings adjustments applied across the DOD.

Schedule: The current program supports launches of two interim polar communications payloads on classified host satellites in FY97 and FY02.

Technical: N/A.

(U) **C. Other Program Funding Summary ($ in Thousands)**

PE 0302109N Navy SATCOM Ship Terminals - $3,000 in FY96 and $13,000 in FY97 for Navy terminal, gateway, and satellite control modifications.

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Launch interim payload												X

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603432F Polar Adjunct (Space)
PROJECT NO. AND NAME 4052 Polar Satellite Communications	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Total Funding Required			
(U) Interim Payload & Integration	14,999	27,615	22,137
(U) Host Modifications		13,000	
(U) Launch Delays		15,000	40,250
(U) Total	14,999	55,615	62,387

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Classified Host	Sent Via BA	June 95	Continuing	Continuing	0	14,999	55,615	62,387	4,714	137,715

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603432F Polar Adjunct (Space)

PROJECT NO. AND NAME: 4052 Polar Satellite Communications

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Support and Management Organizations	N/A									
Test and Evaluation Organizations	N/A									

Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property	N/A								
Support and Management Property	N/A								
Test and Evaluation Property	N/A								
Subtotal Product Development					14,999	55,615	62,387	4,714	137,715
Subtotal Support and Management									0
Subtotal Test and Evaluation									0
Total Project					14,999	55,615	62,387	4,714	137,715

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603434F National Polar-orbiting Operational Environmental Satellite System (NPOESS) (Space)

PROJECT NO. AND NAME: 4056 National Polar-orbiting Operational Env. Sat. Syst.

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4056 National Polar-orbiting Operational Env. Sat. Syst.	7,374	17,691	34,024	53,320	184,669	199,164	176,491	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification**

Vice President Gore's National Performance Review (NPR) and subsequent Presidential Decision Directive/NSTC-2 (May 1994) direct the Departments of Defense (DoD) and Commerce (DoC) and the National Aeronautics and Space Administration to establish a converged national weather satellite program. The converged program, called the National Polar-Orbiting Operational Environmental Satellite System (NPOESS), will combine the follow-on to the DoD's DMSP program and the DoC's Polar-Orbiting Operational Environmental Satellite (POES) program. An integrated tri-agency program office was established on 1 Oct 94 to manage the acquisition and operations of the converged satellite. PE #603434F funding reflects the DoD's share of the converged program funding. NPOESS will provide operational military commanders and civilian leaders timely, quality weather information to effectively employ weapon systems and protect national resources. The converged program will be the nation's single source of global weather data for operational DoD and DoC use. It will provide visible and infrared cloud cover imagery and other meteorological, oceanographic, and solar-geophysical information. At least three satellites will be required in sun synchronous 450 nm polar orbit at all times (sun synchronous means the satellites cross the equator at the same local sun time on each of their 14 orbits/day). This PE is in Budget Activity 4 (Demonstration and Validation) because it currently supports preparation for DoD/DoC convergence Program Definition and Risk Reduction efforts.

(U) FY 1995

- (U) $ 373 Prepared a converged system requirements summit and Milestone I review.
- (U) $ 6,540 Prepared for and conducted a System Requirements Review (SRR) 1.
- (U) $ 461 Prepared for Program Definition and Risk Reduction contract award.
- (U) $7,374 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY **4 - Demonstration and Validation**	PE NUMBER AND TITLE **0603434F National Polar-orbiting Operational Environmental Satellite System (NPOESS) (Space)**
PROJECT NO. AND NAME **4056 National Polar-orbiting Operational Env. Sat. Syst.**	

(U) FY 1996

- (U) $3,061 Conduct Milestone I review; support Program Definition and Risk Reduction contract award.*
- (U) $4,830 Conduct Government led risk reduction and technology development efforts.
- (U) $5,000 Conduct/evaluate preliminary system development efforts.
- (U) $4,800 Converge command, control and communications at Suitland, MD.
- (U)$17,691 Total

(U) FY 1997*

- (U) $ 5,400 Continue to support Program Definition and Risk Reduction efforts.
- (U) $28,624 Continue Program Definition and Risk Reduction contracts and conduct a System Requirements Review (SRR) 2.
- (U) $34,024 Total

Department of Commerce (DoC) Share of NPOESS Funding:

FY95	FY96	FY97	FY98	FY99	FY00	FY01
16,000	39,500	78,200	131,400	146,500	162,500	140,400

* Milestone 1 review postponed; in the process of developing a revised program focusing on early sensor development and risk reduction. DoD savings associated with restructure will begin in FY99. Program review planned for July 1996.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY **4 - Demonstration and Validation**	PE NUMBER AND TITLE **0603434F National Polar-orbiting Operational Environmental Satellite System (NPOESS) (Space)**
PROJECT NO. AND NAME **4056 National Polar-orbiting Operational Env. Sat. Syst.**	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996*	FY 1997
(U) Previous President's Budget	7,601	23,861	41,550
(U) Appropriated Value	7,601	18,861	
(U) Adjustments to Appropriated Value			
a. Cong Gen Reductions	-97	-505	
b. SBIR	-128	-434	
c. Omnibus or Other Above Threshold Reprogram	-2	-231	
d. Below Threshold Reprogramming			
(U) Adjustments to Budget Years Since FY96 PB			-7,526
(U) Current Budget Submit/President's Budget	7,374	17,691	34,024

(U) Change Summary Explanation:

Funding: * The FY96 PB amount does not reflect funding reductions that are reserved for other DoD reprogramming needs ($197)
Adjustments have been made in 1997 due to inflation rate change.

Schedule: Schedule adjustments for PDRR and subsequent milestones were made to allow the newly established Integrated Program Office (IPO) to focus on sensor and ground system development early in phase I. Increases in separate government led efforts combined with evaluation to reduce risk and better define user requirements, system alternatives and architecture options will allow the IPO to better execute the overall program. A restructure has been proposed which has caused the postponement of Milestone 1 - originally planned for April 1996. New approach to be briefed at Program Review in July 1996. DoD savings associated with the restructure will begin in FY99.

Technical: No changes.

(U) **C. Other Program Funding Summary ($ in Thousands)**

Not Applicable.

Related RDT&E:

(U) PE #305160F, Defense Meteorological Satellite Program (DMSP)
(U) PE #305160N, DMSP (Navy funds, provided for Service specific studies)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY **4 - Demonstration and Validation**	PE NUMBER AND TITLE **0603434F National Polar-orbiting Operational Environmental Satellite System (NPOESS) (Space)**
PROJECT NO. AND NAME **4056 National Polar-orbiting Operational Env. Sat. Syst.**	

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Preliminary Draft Integrated Operational Requirements Document (IORD) Approved		X										
(U) Systems Requirements Review (SRR) 1				X								
(U) Integrated Operational Requirements Document I (IORD-1) Approval							X					
(U) Milestone 1 Review							X*					
(U) Request for Proposal							X*					
(U) Program Definition and Risk Reduction Contract Award								X*				
(U) Systems Requirements Review (SRR) 2										X*		

* Milestone 1 review postponed; in the process of developing a revised program focusing on early sensor development and risk reduction. DoD savings associated with restructure will begin in FY99. Program review planned for July 1996.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603434F National Polar-orbiting Operational Environmental Satellite System (NPOESS) (Space)
PROJECT NO. AND NAME 4056 National Polar-orbiting Operational Env. Sat. Syst.	

(U) A. **Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Concept Studies	7,374	0	0
(U) Government Studies and C3 Convergence		10,800	
(U) Program Definition and Risk Reduction contracts/ Program Support*	0	6,891	34,024
(U) Total	7,374	17,691	34,024

* Milestone 1 review postponed; in the process of developing a revised program focusing on early sensor development and risk reduction. DoD savings associated with restructure will begin in FY99. Program review planned for July 1996.

(U) B. **Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Martin-Marietta (DoC funded)	C/CPAF/Allo	2QFY95	TBD	TBD	0				Cont	Cont
Lockheed	C/CPAF/Allo	2QFY95	TBD	TBD	0	4,489			Cont	Cont

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY
4 - Demonstration and Validation

PE NUMBER AND TITLE
0603434F National Polar-orbiting Operational Environmental Satellite System (NPOESS) (Space)

PROJECT NO. AND NAME
4056 National Polar-orbiting Operational Env. Sat. Syst.

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Program Definition and Risk Reduction Contractors	TBD						5,000	28,624	Cont	Cont
Gov't studies and C3 Convergence	TBD						9,630		Cont	Cont
Support and Management Organizations										
Integrated Program Office (IPO)					0	1,285	3,061	5,400	Cont	Cont
Studies/Admin										
FFRDC Support						1,600			Cont	Cont
Test and Evaluation Organizations										
TBD							0	0	Cont	Cont
Subtotal Product Development						4,489	14,630	28,624	Cont	Cont
Subtotal Support and Management						2,885	3,061	5,400	Cont	Cont
Project Total						7,374	17,691	34,024	Cont	Cont

(U) B. **Budget Acquisition History and Planning Information Continued ($ in Thousands)**

Government Furnished Property:
Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603441F Space Based IR Arch (Dem/Val) (Space)

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	115,418	199,663	120,151	122,212	131,254	85,889	85,961	Continuing	Continuing
0007 Space & Missile Tracking System (SMTS)	110,418	184,052	113,221	119,227	131,254	85,889	85,961	Continuing	Continuing
0008 Cobra Brass	5,000	15,611	6,930	2,985	0	0	0	0	30,526

(U) **A. Mission Description and Budget Item Justification**

(U) The purpose of the Space Based InfraRed System (SBIRS) program is to develop a system which replaces the existing Defense Support Program (DSP) system and meets the requirements stated in the USSPACECOM Capstone Requirements Document (CRD). The systems's missions are Missile Warning, Missile Defense, Technical Intelligence and Battlespace Characterization. SBIRS will incorporate new technologies that would enhance detection, provide direct reporting of ICBM/SLBM and tactical ballistic missile launches, and provide critical mid-course tracking and discrimination data for national and theater missile defense. The integrated system architecture consists of sensors located in Geosynchronous Orbits (GEO), Highly Elliptical Orbits (HEO) and Low Earth Orbits (LEO) and an integrated, centralized ground station serving all space elements of the SBIR System, as well as DSP. PE #604441F funds SBIRS Engineering and Manufacturing Development activities.

(U) This PE funds the SBIRS Demonstration/Validation activities: Space and Missile Tracking System (SMTS) and Cobra Brass (CB). SMTS is the Dem/Val effort for the LEO component of SBIRS, CB will provide data for the GEO and HEO components. This program is in the demonstration and validation Budget Activity Research Category because it funds the risk reduction and an advanced technology demonstration system.

(U) **Acquisition Strategy:**

(U) The SBIRS program is managed through a single consolidated System Program Office (SPO) at the Space and Missile Systems Center, Los Angeles Air Force Base, CA. The SMTS Flight Demonstration System (FDS) acquisition plan was approved in Aug 92. The Flight Demonstration System (FDS) contract was awarded in May 95, and the two FDS satellites are scheduled to be launched into a low earth orbit by 3QFY99.

(U) CB is currently being developed by Sandia National Laboratory, Albuquerque, NM. CB is planning to launch in FY98.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603441F Space Based IR Arch (Dem/Val) (Space)

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996*	FY 1997	Total Cost
(U) Previous President's Budget (FY96 PB)	111,838	130,744	126,369	Continuing
(U) Appropriated Value	117,000	265,744		
(U) Adjustments to Appropriated Value				
a. Cong Gen Reductions	- 2,968	-6,232		
b. SBIR	- 2,165	-5,584		
c. Omnibus or Other Above Threshold Reprogram		-54,265		
d. Below Threshold Reprogramming	3,551			
(U) Adjustments to Budget Years Since FY96 PB			-6,218	
(U) Current Budget Submit/President's Budget	115,418	199,663	120,151	Continuing

(U) Change Summary Explanation:

Funding: Congress added $135,000 in FY96 to accelerate the SMTS operational deployment. The Air Force and DoD are developing acceleration strategies to accelerate the operational deployment by as much as 4 years. An additional ~$2,000,000 is required in FY97-03 to accelerate the program and begin deployment/operations. FY96 decreases due to undistributed cuts, SBIR and Bosnia I reductions. $6,218 reduction in FY97 due to inflation adjustments and O&M reductions.

* The FY96 PB amount does not reflect funding reductions that are reserved for other DoD reprogramming needs ($2,776)

Schedule: No Changes.

Technical: No Changes.

(U) **C. Other Program Funding Summary ($ in Thousands)**

Not Applicable.

Related RDT&E:

(U) PE #604441F - Space Based InfraRed System (SBIRS) - EMD
(U) PE #305915F - SBIRS Operations & Deployment
(U) PE #305911F - Defense Support Program (DSP)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603441F Space Based IR Arch (Dem/Val) (Space)

(U) PE #603871C - Advanced Tech. Dev. - National Missile Defense
(U) PE #604856C - Patriot PAC-3 EMD
(U) PE #603861C - THAAD Dem/Val
(U) PE #603867C - Navy Lower Tier Development
(U) PE #603868C - Navy Upper Tier Development

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) SBIRS Pre-EMD Review				X								
(U) SMTS FDS Authority To Proceed			X									
(U) SMTS FDS Preliminary Design Review (PDR)					X							
(U) SMTS FDS Critical Design Review (CDR)									X			
(U) Cobra Brass Launch (FY98)												
(U) SMTS FDS Launch (3QFY99)												

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603441F Space Based IR Arch (Dem/Val) (Space)

PROJECT NO. AND NAME: 0007 Space & Missile Tracking System (SMTS)

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
0007 Space & Missile Tracking System (SMTS)	110,418	184,052	113,221	119,227	131,254	85,889	85,961	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification**

(U) The Space and Missile Tracking System (SMTS) represents the Low Earth Orbit (LEO) component of the Space Based InfraRed System (SBIRS). The objective SBIRS LEO constellation of low-earth orbiting satellites will provide global, below- and above-the-horizon access to strategic and tactical ballistic missiles in boost, post-boost, and midcourse phases of flight, and also track missile targets during reentry. LEO will support the four SBIRS mission areas of Missile Warning, Missile Defense, Technical Intelligence, and Battle Space Characterization.

(U) FY 1995 ($ in Thousands)

- (U) Award SMTS FDS supplemental agreement for space and ground segment development (May 95).
- (U) $68,246 Continue design & develop of the FDS satellite and ground segment.
- (U) $1,976 Non-flying contractor conduct ground experiments.
- (U) $12,890 Program office activities.
- (U) Complete ABM Treaty compliance review (May 95).
- (U) $5,400 Continue technology efforts in cryocoolers, focal plane arrays and 32 bit RAD hard processors.
- (U) $13,906 Simulation, Discrimination, and computer support.
- (U) $7,800 Data Analysis for Midcourse Space Experiment (MSX) and Support for RAMOS.
- (U) Conduct Preliminary Design Review (PDR) (Nov 95).
- (U) $200 Funds to be moved from BPAC 0007 to 0008 with this PE
- (U) $110,418 Total

(U) FY 1996 ($ in Thousands)

- (U) $79,690 Continue SMTS FDS satellite and ground segment development.
- (U) $5,000 Continue work for non-flying contractor.
- (U) $20,000 Add LWIR to FDS
- (U) $65,000 Schedule Recovery
- (U) $10,000 LEO Tech Risk Mitigation

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603441F Space Based IR Arch (Dem/Val) (Space)
PROJECT NO. AND NAME 0007 Space & Missile Tracking System (SMTS)	

- (U) $24,919 RI Low Cost Experiment
- (U) $19,643 Program office activities.
- (U) $10,800 Simulation, Discrimination, and computer support.
- (U) Conduct Critical Design Review (CDR) (Dec 96).
- (U) $-51,000 Current funding on Recission
- (U) $184,052 Total

(U) FY 1997 ($ in Thousands)

- (U) $86,865 Continue SMTS FDS satellite and ground segment development.
- (U) $5,000 Continue work for non-flying contractor.
- (U) $12,206 Program office activities.
- (U) $9,150 Simulation, Discrimination, and computer support.
- (U) $113,221 Total

(U) **Acquisition Strategy:**

(U) The GEO component of the SBIRS program is a pilot for acquisition streamlining. For the GEO component the traditional Defense Acquisition Board (DAB) documentation for an ACAT ID program was consolidated into a Single Acquisition and Management Plan (SAMP).

(U) While SMTS and Cobra Brass are part of the overall SBIRS, there are on-going contracts for each of these efforts. The SMTS Flight Demonstration System (FDS) acquisition plan was approved in Aug 92. The streamlined acquisition program established by the SBIRS GEO component pre-EMD phase will be used by SMTS when it enters EMD, after a successful deployment decision in FY00.

(U) The developing organization for the SMTS FDS satellites is the Air Force Space and Missile Center, Los Angeles AFB, CA. On 2 May 95, the FDS flyer contract was awarded to TRW, Redondo Beach, CA to design and build two FDS satellites to be launched in 3QFY99. Rockwell International, Space Systems Division, Downey, CA was awarded an FDS non-flyer contract. There is a two year test period leading up to an FY00 DoD deployment decision for the deployment of an operational SMTS constellation for SBIRS. The non-flyer will participate with the FDS flying contractor in ground experiments to mitigate overall program technical risk as well as to maintain competition.

(U) Pre-EMD activities would begin in late FY99 with approximately three pre-EMD study contracts. The purpose of pre-EMD would be to develop specifications and designs for the objective SMTS. This period would also be used to re-optimize the SBIRS HEO, GEO, LEO constellations, and to revalidate the AFSPACECOM Operational Requirements Document. If a decision is made to deploy an operational SMTS in FY00, pre-EMD contractors would compete for an EMD contract - to

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603441F Space Based IR Arch (Dem/Val) (Space)
PROJECT NO. AND NAME 0007 Space & Missile Tracking System (SMTS)	

be awarded in FY02. The same streamlined acquisition approach being used currently for the GEO EMD would be used as a baseline for the LEO EMD as well. First launch of the operational constellation would occur in FY06.

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	114,824	119,404	Continuing
(U) Appropriated Value	112,000	249,824		
(U) Adjustments to Appropriated Value				
a. Cong Gen Reductions	- 2,968	-5922		
b. SBIR	- 1,935	-5586		
c. Omnibus or Other Above Threshold Reprogram		-54,265		
d. Below Threshold Reprogramming	3,321		-6,183	
(U) Adjustments to Budget Years Since FY96 PB				
(U) Current Budget Submit/President's Budget	110,418	184,052	113,221	Continuing

(U) Change Summary Explanation:
Funding: Congress added $135,000 in FY96 to accelerate the SMTS operational deployment. The Air Force and DoD are developing acceleration strategies to accelerate the operational deployment by as much as 4 years. An additional ~$2,000,000 is required in FY97-03 to accelerate the program and begin deployment/operations.

FY96: $51,000 has been proposed for recission

FY97: Funding was reduced by $3,588 for non-pay inflation.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) **C. Other Program Funding Summary ($ in Thousands)**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603441F Space Based IR Arch (Dem/Val) (Space)
PROJECT NO. AND NAME 0007 Space & Missile Tracking System (SMTS)	

Not Applicable.

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) SMTS FDS Downselect			X									
(U) SMTS FDS PDR					X							
(U) SMTS FDS CDR									X			
(U) FDS Launch (3Q FY99)												

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603441F Space Based IR Arch (Dem/Val) (Space)

PROJECT NO. AND NAME: 0007 Space & Missile Tracking System (SMTS)

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) FDS satellite and ground segment	68,246	79,690	86,865
(U) Non-flying contractor	1,976	5,000	5,000
(U) Add LWIR to FDS	0	20,000	0
(U) Schedule Recovery	0	65,000	0
(U) LEO Tech Risk Mitigation	0	10,000	0
(U) RI Low Cost Experiment	0	24,919	0
(U) Program office activities	12,890	19,643	15,794
(U) Technology efforts	5,400	0	0
(U) Sim., Discrim., & computer support	13,906	10,800	5,562
(U) Data Analysis for MSX and Support for RAMOS	7,800	0	0
(U) Adjustment	200	-51,000	
(U) Total	110,418	184,052	113,221

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
FDS Contract	CPAF	TBD	TBD	TBD	See Note	70,222	169,690	91,865	Continued	Continued
Misc.	Various	Various	Continued	Continued	See Note	31,303	32,443	12,156	Continued	Continued
RI Low Cost Exp.	TBD	TBD	TBD	TBD	See Note	0	24,919	0	TBD	TBD
Support and Management Organizations										
Aerospace		Various	Continued	Continued	See Note	8,693	8,000	6,740	Continued	Continued

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603441F Space Based IR Arch (Dem/Val) (Space)
PROJECT NO. AND NAME 0007 Space & Missile Tracking System (SMTS)	

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Test and Evaluation Organizations										
Not Applicable										

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property: Not Applicable.

Subtotal Product Development	See Note	227,052	106,481	Continued	Continued
Subtotal Support and Management	See Note	8,000	6,740	Continued	Continued
Subtotal Test and Evaluation (Not Applicable)	See Note				
Adjustment		-51,000			
Total Project	See Note	184,052	113,221	Continued	Continued

Note: FY94 was accomplished with funds from PE 63440F.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603441F Space Based IR Arch (Dem/Val) (Space)

PROJECT NO. AND NAME: 0008 Cobra Brass

COST (*In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
0008 Cobra Brass	5,000	15,611	6,930	2,985	0	0	0	0	30,526

(U) **A. Mission Description and Budget Item Justification**

(U) The Cobra Brass (CB) Program was a DIA/CMO (Central MASINT Office) Research and Development program to explore the utility of staring, fast framing, multi-spectral electro-optical sensors. CB has been combined into the SBIRS program as a result of the Feb 95 DAE review. This approach represents a significant departure from the traditional approach of scanning, slow framing, single band sensors which have traditionally been used for Tactical Warning and Attack Assessment (TW/AA).

(U) Previous CB sensors have demonstrated the ability of this technology to contribute to both the Theater Missile Defense (TMD), Technical Intelligence (TI), and Battlespace Characterization (BC) missions. A major emphasis of this program will be to increase the timeliness of sensor tasking and reporting. This will allow CB data to be processed in real-time through the existing theater infrastructure. CB will support the GEO and HEO component of the SBIRS.

(U) FY 1995 ($ in Thousands)

- (U) System Concept Review (Feb 95).
- (U) $500 Payload Design Review.
- (U) $3,700 Ground Station Design Review.
- (U) $1,000 Test Unit.
- (U) $-200 Funds to be moved from BPAC 0007 to 0008 within this PE
- (U) $5,000 Total

(U) FY 1996 ($ in Thousands)

- (U) $10,011 Payload.
- (U) $1,000 Test Unit.
- (U) $4,100 Ground Station Build 1.
- (U) $500 Satellite (I&CO).
- (U) $15,611 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603441F Space Based IR Arch (Dem/Val) (Space)
PROJECT NO. AND NAME 0008 Cobra Brass	

(U) FY 1997 ($ in Thousands)

- (U) $2,400 Payload.
- (U) $1,500 Satellite Inspection & Checkout.
- (U) Payload delivered (Dec 96).
- (U) $3,030 Ground Station Build 1 & 2.
- (U) Ground Station testing complete (Mar 97).
- (U) $6,930 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,000	15,920	6,963	Continuing
(U) Appropriated Value	5,000			
(U) Adjustments to Appropriated Value				
a. Cong Gen Reductions		-309		
b. SBIR				
c. Omnibus or Other Above Threshold Reprogram				
d. Below Threshold Reprogramming			-35	
(U) Adjustments to Budget Years Since FY95 PB				
(U) Current Budget Submit/President's Budget	5,000	15,611	6,930	Continuing

(U) Change Summary Explanation:

Funding: 200K was reprogrammed form BPAC 0007 to 0008 to correct an allocation error, not yet reflected in data base.

Schedule: Not Applicable.

Technical: Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603441F Space Based IR Arch (Dem/Val) (Space)
PROJECT NO. AND NAME 0008 Cobra Brass	

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) System Concept Review		X										
(U) Payload Design Review				X								
(U) Ground Station Design Review				X								
(U) Payload Consent to Ship Decision					X							
(U) Grd Station Build 1 Testing Complete at Sandia						X						
(U) Grd Station Build 1 Installed at Ground Site										X		
(U) CB Launch (FY98)												

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603441F Space Based IR Arch (Dem/Val) (Space)
PROJECT NO. AND NAME 0008 Cobra Brass	

(U) A. **Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Payload	500	10,011	2,400
(U) Ground Station	3,700	4,100	3,030
(U) Test Unit	1,000	1,000	0
(U) Satellite I&CO	0	500	1,500
(U) Adjustment	-200		
(U) Total	5,000	15,611	6,930

(U) B. **Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Sandia Nat'l Labs	Various	Various	31,035	31,035	0	5,200	15,611	6,930	2,985	30,726

Support and Management Organizations
Not Applicable

Test and Evaluation Organizations
Not Applicable

(U) B. **Budget Acquisition History and Planning Information Continued ($ in Thousands)**

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603441F Space Based IR Arch (Dem/Val) (Space)
PROJECT NO. AND NAME 0008 Cobra Brass	

Government Furnished Property: Not Applicable

Subtotal Product Development	15,611	6,930	2,985	30,726
Subtotal Support and Management	0	0	0	0
Subtotal Test and Evaluation				
Adjustment				-200
Project Total	15,611	6,930	2,985	30,726

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603617F Command Control & Communications Applications

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	5,217	6,037	4,378	7,941	8,164	8,403	8,522	Continuing	TBD
2314 Tactical Air Surveillance	951	998	1,057	810	461	474	479	Continuing	TBD
2317 Tactical Air Information Production & Distribution	1,163	1,383	569	2,844	3,188	3,282	3,329	Continuing	TBD
2321 Tactical Battle Information Management	2,859	3,394	2,485	3,926	4,156	4,278	4,339	Continuing	TBD
3804 Tactical Air Forces Systems Integration	244	262	267	361	359	369	375	Continuing	TBD

(U) A. **Mission Description and Budget Item Justification :** This program is designed to rapidly transition development efforts in the science and technology base directly to warfighting commands. Projects are directly responsive to operational requirements for improved battle management, communications, theater missile defense, and surveillance capability. Takes advantage of advanced technology developments throughout the services and industry as well as off-the-shelf technology. This research is in Category 4, Demonstration and Validation. Its products are primarily advanced development models, rapid prototype efforts, and software developed through evolutionary acquisition methods. The program also defines system architectures and develops communications technology for modernization and improving the Air Force portion of the Tri-Service communications networks which the Defense Information Systems Agency (DISA) oversees. Beginning in FY 1994, the Tactical Air Information Production and Distribution project has included funding and tasks from PE 0303126F, Long Haul Communications, including the Secure Survivable Communications Network (SSCN).

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603617F Command Control & Communications Applications

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY 1996)	5,217	6,437	7,902	Continuing
(U) Appropriated Value	5,402	6,437		
(U) Adjustments to Appropriated Value				
a. General Congressional Reductions	(94)	(161)		
b. SBIR	(91)	(110)		
c. Omnibus and other Above Threshold Reprogramming		(129)		
d. Below Threshold Reprogramming				
(U) Adjustments to Budget Years Since FY96 PB			(3,524)	
(U) Current Budget Submission	5,217	6,037	4,378	Continuing

(U) Change Summary Explanation:

Funding: FY97 $39,000 General reductions
$185,000 OSD reduction due to Non-Pay Inflation.
$3.3 million reduction in Project 2317 to offset Bosnia peacekeeping costs.

Schedule: N/A

Technical: N/A

(U) **C. Other Program Funding Summary ($ in Thousands)** See individual projects.

Related RDT&E: See individual projects.

(U) **D. Schedule Profile** See individual projects.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603617F Command Control & Communications Applications

PROJECT NO. AND NAME: 2314 Tactical Air Surveillance

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2314 Tactical Air Surveillance	951	998	1,057	810	461	474	479	Continuing	TBD

(U) A. Mission Description and Budget Item Justification Develops advanced technology and demonstrates equipment improvements to the Theater Air Control System (TACS) ground surveillance radars. Investigates non-radar and/or adjunct radar sensors to address the Combat Air Forces (CAF) surveillance, detection, and tracking requirements not satisfied by an active radar.

(U) FY 1995 ($ in Thousands)
- (U) 135 Completed near-term availability assessment of solid state high power devices for the AN/TPS-75 Solid State Transmitter.
- (U) 500 Completed multiple sidelobe canceller (MSLC)/mainlobe noise canceller (MNC) development for AN/TPS-75 radar.
- (U) 116 Continued solid state transmitter panel performance and R&M testing.
- (U) 200 Completed design for distributed tube based transmitter for AN/TPS-75.
- (U) 951 Total

(U) FY 1996 ($ in Thousands)
- (U) 998 Initiate development of tube based transmitter panel for AN/TPS-75.
- (U) 998 Total

(U) FY 1997 ($ in Thousands)
- (U) 232 Complete tube based transmitter panel for AN/TPS-75.
- (U) 125 Initiate and complete tube based transmitter panel performance evaluation.
- (U) 700 Initiate waveform and signal processor design and evaluation.
- (U) 1,057 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603617F Command Control & Communications Applications
PROJECT NO. AND NAME 2314 Tactical Air Surveillance	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY 1996)	935	1,039	1,108	Continuing
(U) Appropriated Value	951	1,039		
(U) Adjustments to Appropriated Value				
a. General Congressional Reductions		(20)		
b. SBIR				
c. Omnibus and other Above Threshold Reprogramming		(21)		
d. Below Threshold Reprogramming				
(U) Adjustments to Budget Years since FY96 PB			(51)	
(U) Current Budget Submit/President's Budget	951	998	1,057	Continuing

(U) Change Summary Explanation:
Funding: FY97: $51,000 General reductions.
Schedule: N/A
Technical: N/A

(U) **C. Other Program Funding Summary ($ in Thousands): N/A**

Related Activities:
(U) PE 0602702F, Command, Control, and Communications
(U) PE 0603789F, C3I Advanced Development
(U) PE 0207412F, Tactical Air Control System Improvements
(U) PE 0603260F, Intelligence Advanced Development
(U) PE 0208010F, Joint Tactical Communications
(U) PE 0207438F, Theater Battle Management C4I
(U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603617F Command Control & Communications Applications
PROJECT NO. AND NAME 2314 Tactical Air Surveillance	

(U) **D. Schedule Profile**

		FY 1995				FY 1996				FY 1997			
		1	2	3	4	1	2	3	4	1	2	3	4
(U)	Multiple Sidelobe Canceller/Mainlobe Noise Canceller development and demonstration				X								
(U)	Solid state transmitter panel performance and R&M testing				X								
(U)	Tube-based transmitter development			*									X
(U)	Tube based versus solid state eval									*			X
(U)	Develop waveform signal processor						*						
(U)	Waveform signal processor development												*

* Indicates the start of a milestone.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603617F Command Control & Communications Applications

PROJECT NO. AND NAME: 2317 Tactical Air Information Production & Distribution

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2317 Tactical Air Information Production & Distribution	1,163	1,383	569	2,844	3,188	3,282	3,329	Continuing	TBD

(U) A. Mission Description and Budget Item Justification: Transitions advanced communications to the Theater Deployable Communications (TDC) program in support of Theater Battle Management (TBM) command and control enhancements. Capabilities include Multi-Level Security (MLS), survivability, deployability, interoperability, and control for communications networks ranging from base communications to the global Defense Information System Network (DISN). Project includes funding and tasks consolidated from PE 0303126F, Long Haul Communications, beginning in FY94.

(U) FY 1995 ($ in Thousands)
- (U) 574 Completed SSCN development and prepare for joint demonstration.
- (U) 122 Completed cooperative intelligent system for communications management and transition to networking.
- (U) 467 Initiated SSCN Phase II for fielding and complete transition plan into Theater Deployable Comm Program.
- (U) 1,163 Total

(U) FY 1996 ($ in Thousands)
- (U) 1,383 Continue SSCN Phase II.
- (U) 1,383 Total

(U) FY 1997 ($ in Thousands)
- (U) 596 Complete SSCN Phase II/Conduct Joint Demonstration.
- (U) 596 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603617F Command Control & Communications Applications

PROJECT NO. AND NAME: 2317 Tactical Air Information Production & Distribution

(U)

B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY1996)	1,143	1,581	3,912	Continuing
(U) Appropriated Value	1,174	1,581		
(U) Adjustments to Appropriated Value				
a. General Congressional Reductions	(11)	(56)		
b. SBIR		(110)		
c. Omnibus and other Above Threshold Reprogramming		(32)		
d. Below Threshold Reprogramming				
(U) Adjustments to Budget Years Since FY96 PB			(3,343)	
(U) Current Budget Submit/President's Budget	1,163	1,383	569	Continuing

(U) Change Summary Explanation:

Funding: FY96 Absorbed $110,000 SBIR assessment

FY97 19,000 General reductions

24,000 reduction due to inflation rate change

3.3 million reduction to offset Bosnia peacekeeping cost

Schedule: N/A

Technical: N/A

(U) **C. Other Program Funding Summary ($ in Thousands): N/A**

Related Activities: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603617F Command Control & Communications Applications
PROJECT NO. AND NAME 2317 Tactical Air Information Production & Distribution	

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Secure Survivable Comm Net Phase 1												
Transition Plan		X										
Development	X											
Joint Demonstration (On-going)			X									
(U) International Policy Gateway	X											
(U) Cooperative Intel System for Mgt			X									
(U) Secure Survivable Comm Net Phase II												
Transition Plan		*	X									
Development			*								X	
Joint Demonstration									*		X	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603617F Command Control & Communications Applications

PROJECT NO. AND NAME: 2321 Tactical Battle Information Management

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2321 Tactical Battle Information Management	2,859	3,394	2,485	3,926	4,156	4,278	4,339	Continuing	TBD

(U) **A. Mission Description and Budget Item Justification:** Field automated decision support systems for the Air Operations Center (AOC). Initial capability was the Advanced Planning System (APS) decision aid. APS supplies combat planners with an automated capability to pull together the information on resources, weaponeering options, and the current battle situation that will reduce time to generate the Air Tasking Order (ATO) by a factor of ten. Current development focus is the Force Level Execution (FLEX) system in support of the Combat Operations Division of the AOC. FLEX will provide automated execution management and control of operations.

(U) FY 1995 ($ in Thousands)
- (U) 2,444 Continued FLEX development.
- (U) 200 Continued TBM systems integration evaluations.
- (U) 215 Initiated planning for Operations-Intelligence integration development.
- (U) 2,859 Total

(U) FY 1996 ($ in Thousands)
- (U) 2,967 Continue FLEX development.
- (U) 198 Initiate Operations-Intelligence integration development.
- (U) 229 Continue TBM systems integration evaluations.
- (U) 3,394 Total

(U) FY 1997 ($ in Thousands)
- (U) 252 Complete FLEX development and initiate integration into TBM Core Systems.
- (U) 2,033 Continue Operations-Intelligence integration development.
- (U) 200 Continue TBM systems integration evaluations.
- (U) 2,485 Total

(U) **B. Program Change Summary ($ in Thousands)**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603617F Command Control & Communications Applications

PROJECT NO. AND NAME: 2321 Tactical Battle Information Management

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY 1996)	2,901	3,533	2,603	Continuing
(U) Appropriated Value	2,992	3,533		
(U) Adjustments to Appropriated Value				
a. General Congressional Reductions	(42)	(69)		
b. SBIR	(91)			
c. Omnibus and other Above Threshold Reprogramming		(70)		
d. Below Threshold Reprogramming				
(U) Adjustments to Budget Years Since FY96 PB			(118)	
(U) Current Budget Submit/President's Budget	2,859	3,394	2,485	Continuing

(U) Change Summary Explanation:

Funding: FY95: Project absorbed $91,000 SBIR assessment
FY97 $13,000 General reduction
$105,000 reduction due to inflation rate change.

Schedule: N/A

Technical: N/A

(U) C. **Other Program Funding Summary ($ in Thousands): N/A**

Related Activities: See Project 2314

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603617F Command Control & Communications Applications
PROJECT NO. AND NAME 2321 Tactical Battle Information Management	

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) FLEX Development										X		
(U) OPS-INTEL Integration Development												
Advanced Technology Transition Planning			*	X								
Integration and Development							*				X	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603617F Command Control & Communications Applications

PROJECT NO. AND NAME: 3804 Tactical Air Forces Systems Integration

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3804 Tactical Air Forces Systems Integration	244	262	267	361	359	369	375	Continuing	TBD

(U) A. Mission Description and Budget Item Justification: Project provides systems engineering and integration support to the Combat Air Forces (CAF). Project addresses integration and interoperability issues associated with TBM General Officers Steering Group (GOSG) directed efforts, makes recommendations, identifies deficiencies, or establishes requirements for development efforts. Although the focus of this effort is combat integration and interoperability, no capability is fielded through this effort. Project transitions products either to the CAF or to other development efforts.

(U) FY 1995 ($ in Thousands)
- (U) 125 Continued support of TBM Core Systems integration.
- (U) 54 Completed operations/intelligence interface analysis and expand to Defensive Planning functions.
- (U) 65 Expanded TBM force level system prototype evaluations to joint arena.
- (U) 244 Total

(U) FY 1996 ($ in Thousands)
- (U) 105 Continue support of TBM core systems integration.
- (U) 60 Complete analysis of Defensive Planning and expand to Management of Aggregated Sensors.
- (U) 97 Continue evaluation of Force Level joint interoperability issues.
- (U) 262 Total

(U) FY 1997 ($ in Thousands)
- (U) 107 Prepare for AOC Defensive Planning Development.
- (U) 160 Complete Sensor Management analysis.
- (U) 267 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603617F Command Control & Communications Applications
PROJECT NO. AND NAME 3804 Tactical Air Forces Systems Integration	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY 1996)	239	284	279	Continuing
(U) Appropriated Value	285	284		
(U) Adjustments to Appropriated Value				
a. General Congressional Reductions	(41)	(16)		
b. SBIR				
c. Omnibus and other Above Threshold Reprogramming		(6)		
d. Below Threshold Reprogramming				
(U) Adjustments to Budget Years Since FY96 PB			(12)	
(U) Current Budget Submit/President's Budget	244	262	267	Continuing

(U) Change Summary Explanation:
Funding: FY97: $12,000 General reduction
Schedule: N/A
Technical: N/A

(U) **C. Other Program Funding Summary ($ in Thousands)**: N/A

Related Activities: See Project 2314

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603617F Command Control & Communications Applications
PROJECT NO. AND NAME 3804 Tactical Air Forces Systems Integration	

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Analysis of TBM Core Systems theater integration	X				X				X			
(U) Defensive Planning												
Analysis	*				X							
Develop Plan									*		X	
(U) Sensor Management												
Analysis					*				X			
Develop Plan											*	
(U) TBM Force Level System prototype Evaluations												
AOC Combat Operations									X			
Joint Operations	*								X			

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603742F Combat Identification Technology

PROJECT NO. AND NAME: 2597 Noncooperative Identification Subsystems

COST ($ In Thousands)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2597 Noncooperative Identification Subsystems	0	14,134	4,291	4,225	6,356	6,461	6,650	6,745	Continuing	Continuing

(S) A. Mission Description and Budget Item Justification

(S) This program supports the U.S. Combat Air Forces have a critical requirement to positively identify enemy, friendly, and neutral aircraft. Timely and reliable identification [a ,] reduces fratricide, and enables the battlefield commander to effectively manage and control the air battle. [P .] Such consequences have fostered the following operational requirements for combat ID systems: (This program is in budget activity 4 - Demonstration and Validation.)

- High confidence of ID
- High probability of ID (friend, foe, & neutral)
- [• t]
- Worldwide ops capable
- [• e]
- All weather capable
- Day/night capable

(S/NF) Acquisition Strategy: The Combat ID Technologies program element develops, demonstrates, and transitions promising target identification technologies to meet the requirements cited above. [P .] **Current and planned accomplishments by Fiscal Year are as follows:**

(U) FY 1995 ($ in Thousands):

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603742F Combat Identification Technology
PROJECT NO. AND NAME 2597 Noncooperative Identification Subsystems	

- (U) $11000 Continued HAVE CENTAUR algorithm development, completed system development and installed test hardware in Hughes roofhouse facility
- (U) $1500 Completed ground-to-air roofhouse testing on UHRR capability at contractor facility
- (U) $400 Funded CID program management and low cost, high leverage demonstrations to increase CID capability-CID IMT
- (U) $1234 Began initial air-to-air UHRR hardware flight testing
- (U) $14,134 Total

(S) FY 1996 ($ in Thousands):
- (S) $1900 Complete air-to-air [U O]
- (U) $2039 Continue combat ID classifier development for UHRR radar and continue ground-to-air ID classifier qualitative testing
- (U) $352 Supports CID IMT for program management and low cost, high leverage CID demos
- (U) $4,291 Total

(U) FY 1997 ($ in Thousands):
- (U) $2922 Complete UHRR ground-to-air ID classifier testing and begin airborne testing
- (U) $300 Twenty-five target database library expansion continues
- (U) $1003 Supports CID IMT for CID program management
- (U) $4,225 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603742F Combat Identification Technology
PROJECT NO. AND NAME 2597 Noncooperative Identification Subsystems	

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY1996)	12,834	4571	4425	
(U) Appropriated Value	12,834	4571		
(U) Adjustments to Appropriated Value				
a. Cong Gen Reductions		-144		
b. SBIR		-101		
c. Omnibus or Other Above Threshold Reprogram		-35		
d. Below Threshold Reprogramming	+1300			
(U) Adjustments to Budget Years Since FY 1996 PB			-200	
(U) Current Budget Submit/President's Budget	14,134	4291	4225	Cont.

(U) Change Summary Explanation:

Funding: FY96 funding reductions due to SBIR, Congressional, Inflation and Bosnian Operation (-$35K).
FY97 funding reductions due to SBIR, Congressional, Inflation ($178K), RDT&E ($22K).

Schedule: No Changes.

Technical: No Changes.

(U) C. Other Program Funding Summary ($ in Thousands) **No procurement funding. HAVE CENTAUR is a technology insertion program for the APG-63V1 radar upgrade program (funded under PE27134F and PE27130F).**

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U)										

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603742F Combat Identification Technology
PROJECT NO. AND NAME 2597 Noncooperative Identification Subsystems	

(U) **D.** **Schedule Profile:** **(Item 2 of schedule reflects F-15 APG-63V1 schedule, other categories refer to Have Centaur)**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
1. (U) H/W Dev/Qual **(WL Activity)**												
Design & Development Complete		X										
Ground-to-Air Test #1 (Roofhouse)		X	X									
Airborne Hardware Qual				X	X							
Target Signature Library					X							
2. (U) H/W EMD/Production *(APG-63V1)*			PDR			CDR						
EMD			X			X						
LRIP & Production (1QFY98-1QFY02)								X				
3. (U) Classifier Dev/Qual												
Ground-to-Air Test#2 (Tyndall RTF)					X				X			
Airborne Data Collection									X		X	
Classifier/Target Library (Ends 4QFY98)						X						
4. (U) Radar OFP Build (Dev, Test)									X			

(U) Other: H/W EMD complete:1QFY00
LRIP start: 1QFY98 Finish: 2QFY99
Production Complete: 4QFY02

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603790F NATO Cooperative Research & Development

PROJECT NO. AND NAME: NATO NATO Cooperative Research & Development*

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
NATO NATO Cooperative Research & Development*	0	0	10,233	10,533	7,733	8,367	9,067	Continuing	Continuing

***This program element was previously funded under OSD PE 0603790D which will be used to fund DoD-wide priority agreements.**

(U) A. Mission Description and Budget Item Justification

These funds will be used to help implement international cooperative research, development, and acquisition (ICRD&A) agreements with NATO and major non-NATO allies (Australia, Egypt, Israel, Japan, and Korea). The program implements the provisions of Title 10 U.S. Code, Section 2350a on NATO Cooperative R&D. The program was established to improve what Congress perceived as inadequate cooperation among NATO nations, and later major non-NATO allies, in research, development, and production. The legislation authorized funds to significantly improve US and allied conventional defense capabilities by leveraging the world's best defense technologies, eliminating costly duplication of research and development efforts, accelerating the availability of defense systems, and promoting US and allied interoperability or commonality. Candidate projects are reviewed and approved by the USD(A&T). An international agreement defining project objectives, responsibilities and costs is required prior to release of funds. These funds will help implement Air Force priority agreements that directly support the Air Force and DoD Science and Technology community, Major Commands, and Future Joint Warfighting capabilities.

Justification for Budget Activity Assignment

This program element funds the implementation of Air Force ICRD&A agreements in (1) Basic Research (2) Applied Research (3) Advanced Technology Development (4) Demonstration and Validation and (5) Engineering and Manufacturing Development.

(U) Acquisition Strategy:

A principal goal of the NATO Cooperative R&D program is to effectively utilize the aggregate resources invested by the US and its allies in conventional defense R&D. This program element provides the critical funding incentive needed to pursue ICRD&A agreements and helps to (a) leverage USAF and allied resources through cost sharing and economies of scale; (b) exploit the best US and allied technologies for equipping coalition forces; (c) demonstrate areas of commonality or interoperability with our allies; and (d) accelerate the availability of defense technology and systems. To obtain these funds and ensure service commitment, projects are based on existing or new RDT&E programs funded in the Future Years Defense Plan (FYDP). Project offices must show matching funds and contributions from associated program elements and equitable allied funding. As appropriate, funding responsibility for out-year requirements and follow-on efforts are transferred to the project office and associated program elements.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603790F NATO Cooperative Research & Development
PROJECT NO. AND NAME NATO NATO Cooperative Research & Development*	

(U) FY 1997 ($ in Thousands):

- (U) 1,500 **Image Information Reformatter (IIR)** (Rome Laboratory/France) - Cooperative project to develop, test, and evaluate an Advanced Development Model IIR for the purpose of establishing interoperability among allied tactical imagery reconnaissance systems.
- (U) 2,900 **Experimental Air Operations Center (EAOC)** (Electronics Systems Center/United Kingdom) - Cooperative research and advanced development project into an EAOC using the US Contingency Theater Automated Planning System (CTAPS) as a baseline.
- (U) 2,600 **VISTA Warrior - Improved Air Combat Effectiveness Through Integrating Aircrew Performance Enhancing Technologies** (Armstrong Laboratory/United Kingdom) - Cooperative project to develop and evaluate advanced helmet-mounted tracker and display (HMT/D) technologies, multi-sensory virtual interface concepts, and virtual display and control devices for incorporation into advanced aircraft.
- (U) 700 **Effects of the Ionosphere on Command, Control, Communications, and Intelligence (C3I) Systems** (Phillips Laboratory/United Kingdom) - Cooperative project to develop capabilities required to provide reliable and timely global warning and forecasts of ionospheric disturbances that seriously disrupt C3I systems.
- (U) 700 **Future Multiband, Multiwaveform Modular Tactical Radio (FM3TR)** (Rome Laboratory/France, Germany, United Kingdom) - Cooperative project to provide international capabilities in the area of interoperable and quickly reconfigurable communication systems using the US Speakeasy system as the baseline.
- (U) 100 **Single Mode Optical Fibers for Array Imaging** (Phillips Laboratory/United Kingdom) - Cooperative project to enhance the performance of single mode optical fibers for ultra-high angular resolution imaging in support of space surveillance needs.
- (U) 200 **Very High Resolution Imaging by Interferometry** (Phillips Laboratory/France) - Cooperative project to combine optical interferometric arrays with low-light-level adaptive optics for deep space high resolution imaging up to geostationary altitude.
- (U) 1,533 **Dense Metal Case Penetrating Weapons (DMCPW)** (Wright Laboratory/United Kingdom) - Cooperative project to develop and demonstrate DMCPWs with improved tungsten alloys for enhanced hard target defeat capability that are compatible with current and future guidance kits such as PAVEWAY III, Conventional Air-Launched Cruise Missile (CALCM), AGM-130, and Joint Deep Attack Munition (JDAM).
- (U) 10,233 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603790F NATO Cooperative Research & Development
PROJECT NO. AND NAME NATO NATO Cooperative Research & Development*	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY 1996)				
(U) Appropriated Value			0	
(U) Adjustments to Appropriated Value			10,233	
a. Cong Gen Reductions				
b. SBIR				
c. Omnibus or Other Above Threshold Reprogram				
d. Below Threshold Reprogramming				
(U) Adjustments to Budget Years Since FY 1995 PB				
(U) Current Budget Submit/President's Budget			10,233	

(U) Change Summary Explanation:

Funding: OSD funded previous NATO Cooperative R&D agreements under PE 0603790D. In FY97, responsibility for funding the NATO Cooperative R&D agreements will be shared with the Services. This program element will fund the Air Force priority ICRD&A agreements certified by the USD(A&T).

Schedule: N/A

Technical: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603790F NATO Cooperative Research & Development
PROJECT NO. AND NAME NATO NATO Cooperative Research & Development*	

(U) C. Other Program Funding Summary ($ in Thousands)

Related RDT&E:
(U) This program element complements the OSD NATO Cooperative R&D PE 0603790D which funds DoD-wide priority agreements. It also provides ICRD&A agreement support for 6.1 through 6.3 programs for USAF Laboratories and for 6.4 through 6.5 programs for USAF Product and Logistics Centers. Management support for Air Force NATO Cooperative R&D PE 0603790F is funded in Air Force International Activities PE 1001004F.

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) **Image/Information Reformatter (IIR)**												
(U) Agreement signed		X										
(U) Concept definition activities			X	X	X	X	X	X				
(U) Draft program implementation plan								X	X			
(U) Development and fabrication of model IIR and interfaces										X	X	X

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603790F NATO Cooperative Research & Development

PROJECT NO. AND NAME: NATO NATO Cooperative Research & Development*

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) **Experimental Air Operations Center (EAOC)**												
(U) Agreement signed							X					
(U) Project definition, database development, configuration management							X	X				
(U) Research and advanced development into key command and control (C2) areas of Combined Air Operations Center (CAOC) functionality									X	X	X	X
(U) **VISTA Warrior**												
(U) Agreement signed							X					
(U) Develop and demonstrate advanced technologies and interface concepts in labs and simulators							X	X	X	X	X	X

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603790F NATO Cooperative Research & Development
PROJECT NO. AND NAME NATO NATO Cooperative Research & Development*	

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) **Effects of the Ionosphere on C3I Systems**												
(U) Agreement signed						X						
(U) Provide the UK the US Parameterised Ionospheric-specification Model (PIM)								X				
(U) Provide the US the UK Jamming and Interception Evaluation (JIVE) System								X				
(U) Provide the US the latest UK ray-tracing algorithms for use with the PIM												
(U) US will assess UK oblique sounder system												
(U) **Future Multiband, Multi-waveform Modular Tactical Radio (FM3TR)**												
(U) Agreement signed							X					
(U) Waveform description completed						X						
(U) Waveform definition completed							X	X				
(U) Demonstration plan completed							X	X				
(U) Waveform hosting												X
(U) US demonstration												
(U) International demos												

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603790F NATO Cooperative Research & Development

PROJECT NO. AND NAME: NATO NATO Cooperative Research & Development*

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) **Single Mode (SM) Optical Fibers for Array Imaging**												
(U) Agreement signed							X					
(U) SM fiber optical signal demonstration, identification of key parameters, development of control loops							X	X	X	X		
(U) Evaluation of Wavefront Sensing (WFS) techniques											X	X
(U) Test and evaluation of Multi-Core SM fiber												
(U) **Very High Resolution Imaging by Interferometry**												
(U) Agreement signed								X				
(U) Conceptual design of low light level (LLL) WFS, exchange of data, development of software								X	X	X	X	
(U) Development, integration, and test of LLL WFS. Conceptual design of Optical Phase Difference (OPD) Tracker, WFS, optical delay lines												X
(U) Field tests and evaluation of software												

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603790F NATO Cooperative Research & Development

PROJECT NO. AND NAME: NATO NATO Cooperative Research & Development*

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) **Dense Metal Case Penetrating Weapons**												
(U) Agreement signed								X				
(U) Concept definition								X	X			
(U) Preliminary design										X		
(U) Sub System design and development										X	X	X
(U) Sub System integration, development, and tests												
(U) UK Penetrator tests												X
(U) Analysis and material tests										X	X	X

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603800F Joint Adv Strike Tech Program

PROJECT NO. AND NAME: 2025 Joint Advanced Strike Technology (JAST)

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2025 Joint Advanced Strike Technology (JAST)	83,780	81,154	263,836	431,057	458,527	238,860	18,800	0	1,576,014

(U) A. Mission Description and Budget Item Justification

The JAST Program is the focal point for defining affordable next generation strike aircraft weapon systems for the USN, USMC, USAF, and allies. Program emphasis is on facilitating the evolution of fully validated and affordable joint operational requirements, and demonstrating cost leveraging technologies and concepts to lower risk prior to Engineering and Manufacturing Development (E&MD) of the Joint Strike Fighter (JSF) in FY 2001. The JAST Program is a joint program with no executive service. Navy and Air Force each provide approximately equal shares of annual funding for the program effective in FY 1995. The Advanced Research Projects Agency (ARPA) and the United Kingdom (UK) contribute funding effective in FY 1996. This program is in budget activity 4 - Demonstration and Validation - because it integrates hardware for test related to specific ship or aircraft applications.

(U) FY 1995 ($ in Thousands): (Breakout reflects combined Navy and Air Force funding.)

- (U) $ 54,822 Commenced Concept Development Phase with electronic award of multiple contracts for concept definition and design research, including contractor cost and performance trades, for weapon system concepts for a family of aircraft that meets the needs of the USN, USAF, and USMC affordably; and commenced affordability assessments.
- (U) $ 72,317 Commenced technology maturation concept definition and design research; conducted demonstrations and assessments in the areas of structures and materials, flight systems, manufacturing/producibility, propulsion, avionics, weapons integration and supportability.
- (U) $ 7,053 Continued strategy-to-task analysis and strike warfare demonstrations and assessments to facilitate the Services' joint requirements definition; activity culminated in Joint Initial Requirements Document (JIRD) endorsed by USN, USAF and USMC and briefed to the Joint Requirements Oversight Council (JROC).
- (U) $ 37,653 Continued ASTOVL Phase II risk mitigation efforts begun by ARPA, integrated with JAST Program Concept Development tasks.
- (U) $ 3,284 Conducted modeling and simulation activities to support strike warfare mission area analysis.
- (U) $ 6,923 Supported program operations, including program office functions.
- (U) $182,052 Total

(U) FY 1996 ($ in Thousands): (Breakout reflects Navy, Air Force, ARPA and UK funding)

- (U) $ 60,830 Complete concept definition and design research for weapon system concepts for a tri-service family of aircraft; receive contractors' preferred weapon system concepts and recommended development and demonstration plans; and continue affordability assessments.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603800F Joint Adv Strike Tech Program
PROJECT NO. AND NAME 2025 Joint Advanced Strike Technology (JAST)	

–	(U) $119,440	Complete technology maturation concept definition and design research; continue demonstrations and assessments in the areas of structures and materials, flight systems, manufacturing/producibility, propulsion (includes competitive engine efforts), avionics, weapons integration and supportability.
–	(U) $ 6,201	Continue strategy-to-task analysis and strike warfare demonstrations and assessments to facilitate the Services' joint requirements definition.
–	(U) $ 3,438	Continue modeling and simulation activities to support strike warfare mission area analysis.
–	(U) $ 5,502	Complete ASTOVL risk mitigation efforts, integrated with JAST Program Concept Development tasks.
–	(U) $ 6,391	Support program operations, including program office functions.
–	(U) $ 4,348	USN portion of program reserved for Small Business Innovative Research (SBIR) assessment in accordance with 15 U.S.C. 638 (f)(1) and USN/ARPA General Reductions.
–	(U) $206,150	Total

(U) FY 1997 ($ in Thousands): (Breakout reflects Navy, Air Force, ARPA and UK funding)

–	(U) $ 461,642	Commence Concept Demonstration Phase including flying aircraft concept demonstrators as well as concept unique ground and flight demonstrations. This phase commences with the competitive award of two contracts for ground and flight demonstrations and continued concept refinement for a tri-service family of aircraft that meets the Services' needs and optimizes commonality among the variants to minimize life cycle costs (LCC); award contract for supporting propulsion efforts; and continue affordability assessments..
–	(U) $ 6,700	Continue strategy-to-task analysis and strike warfare demonstrations and assessments to facilitate the Services' joint requirements definition.
–	(U) $ 6,500	Continue modeling and simulation activities to support strike warfare mission area analysis.
–	(U) $ 178,839	Continue technology maturation demonstrations and assessments in the areas of structures and materials, flight systems, manufacturing/producibility, propulsion (includes competitive engine efforts), avionics, weapons integration and supportability.
–	(U) $ 6,388	Support program operations, including program office functions.
–	(U) $660,069	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603800F Joint Adv Strike Tech Program
PROJECT NO. AND NAME 2025 Joint Advanced Strike Technology (JAST)	

(U) **B. Program Change Summary ($ in Thousands) (Reflects restructured program.)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY96/97 Pres Budg)	83,801	151,186	199,831	1,349,664
(U) Appropriated Value	86,354	85,686		
(U) Adjustments to Appropriated Value				
a. Cong Gen Reductions	-1,096	-1,678		
b. SBIR	-1,457	-1,649		
c. Omnibus or Other Above Threshold Reprogram		-1,205		
d. Below Threshold Reprogramming	-21			
(U) Adjustments to Budget Years Since FY 1996 PB			64,005	226,350
(U) Current Budget Submit/President's Budget (FY97 Pres Budg)	83,780	81,154	263,836	1,576,014

(U) Change Summary Explanation:

Funding: The FY 1996 decrease reflects FY 1996 Appropriations Conference action due to program restructure (-$65,500) and various undistributed reductions (-$4,532). The FY 1997 increase reflects FY 1996 Appropriations Conference action due to program restructure (+$65,000) and various undistributed reductions (-$995).

Schedule: Commencement of the Concept Demonstration Phase was delayed from FY96 to early FY97 due to restructure of the program.

Technical: Not applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603800F Joint Adv Strike Tech Program
PROJECT NO. AND NAME 2025 Joint Advanced Strike Technology (JAST)	

(U) C. **Other Program Funding Summary ($ in Thousands):** This is a joint program with no executive service. The United Kingdom is a full collaborative partner in the JAST Program. A Memorandum of Understanding (MOU) was signed in December 1995.

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) RDT&E 0603800N (Navy)	98,272	81,215	246,833	421,848	457,300	238,979	18,892	0	1,563,339
(U) RDT&E 0603800E (ARPA)	0	29,781	78,400	23,922	0	0	0	0	132,103
(U) United Kingdom	0	14,000	71,000	55,000	20,000	20,000	20,000	0	200,000

(U) **Related RDT&E ($ in Thousands):** Milestone II for a joint follow-on E&MD program for the Joint Strike Fighter (JSF) is planned in FY 2001. The follow-on program will develop a tri-service family of aircraft from concepts proven under the JAST Program, incorporating affordable technologies transitioned from the JAST Program.

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) RDT&E 0604800F (Air Force)	0	0	0	0	0	0	436,314	TBD*	TBD*
(U) RDT&E 0604800N (Navy)	0	0	0	0	0	281	439,000	TBD*	TBD*

* Total E&MD cost will be determined prior to the start of Milestone II (FY2000).

(U) D. **Schedule Profile:** Not applicable; this is not an acquisition program.

Dec 94 Commenced Concept Development Phase
Mar 96 Released RFP for Concept Demonstration Phase
Fall 96 Planned award of Concept Demonstration Phase contracts

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603800F Joint Adv Strike Tech Program
PROJECT NO. AND NAME 2025 Joint Advanced Strike Technology (JAST)	

(U) A. Project Cost Breakdown ($ in Thousands)

	FY 1995	FY 1996	FY 1997
(U) Strike Warfare Systems Design Development	54,822	60,830	
(U) Weapon System Concept Demonstrations (including flying demonstrations)			461,642
(U) ASTOVL	37,653	5,502	
(U) Structures and Materials	5,384	10,927	34,100
(U) Flight Systems	11,258	31,377	38,400
(U) Manufacturing and Producibility	5,077	5,620	5,000
(U) Propulsion	19,099	42,907	57,000
(U) Avionics	17,958	21,049	32,309
(U) Weapons Integration	7,606	3,030	3,480
(U) Supportability	4,744	3,501	6,350
(U) Technology Integration Planning Support	1,191	1,029	2,200
(U) Requirements Analysis	7,053	6,201	6,700
(U) Modeling, Simulation and Affordability Analyses	3,284	3,438	6,500
(U) Program Operations	6,923	6,391	6,388
(U) USN SBIR Assessment and USN/ARPA Gen Reductions		4,348	
(U) Total	182,052	206,150	660,069

(U) Funding Resources ($ in Thousands) (Based on restructure program.)

PE#0603800F (Air Force)	83,780	81,154	263,836
PE#0603800N (Navy)	98,272	81,215	246,833
PE#0603800E (ARPA)	0	29,781	78,400
United Kingdom	0	14,000	71,000
Total	182,052	206,150	660,069

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603800F Joint Adv Strike Tech Program
PROJECT NO. AND NAME 2025 Joint Advanced Strike Technology (JAST)	

(U) B. **Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor/ Government Performing Activity	Contract Method/ Fund Type Vehicle	Award/ Oblig Date	Perform Activity EAC	Project Office EAC	Total FY 1993 & Prior	FY 1994 Budget	FY 1995 Budget	FY 1996 Budget	FY 1997 Budget	To Complete	Total Program
PRODUCT DEVELOPMENT (This is a technology demonstration program, not an acquisition program.)											
Strike Warfare Systems Design Development (94-2)											
Boeing	C/CPFF	Dec 94	32,770	32,770			14,140	18,630			32,770
McAIR	C/CPFF	Dec 94	23,708	23,708			14,393	9,315			23,708
Northrop Pico Rivera, CA	C/CPFF	Dec 94	21,358	21,358			12,043	9,315			21,358
Lockheed	C/CPFF	Dec 94	28,580	28,580			9,950	18,630			28,580
Contracts Less Than $1.0M											
Various	CPFF	Oct 94-Sep 95	821	821			821				821
Fld Activ.	Various	Oct94-Sep95	7,915	7,915			3,475	4,440			7,915
Weapon System Concept Demonstrations (including flying demonstrators)											
Concept X	C/CPFF	Oct 96	--	1,100,000*					207,739	CONT.	CONT.
Concept Y	C/CPFF	Oct 96	--	1,100,000*					207,739	CONT.	CONT.
Fld Activ.	Various	Oct96-Sep97	--	--					45,559	CONT.	CONT.
ASTOVL											
McAIR	SS/CPFF	Oct 94	9,350	9,350			9,350				9,350
Lockheed	SS/CPFF	Oct 94	16,416	16,416			14,067	2,349			16,416
Boeing	SS/CPFF	Jan 95	11,200	11,200			8,047	3,153			11,200

* includes government-managed equipment.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)							DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation				PE NUMBER AND TITLE 0603800F Joint Adv Strike Tech Program			
PROJECT NO. AND NAME 2025 Joint Advanced Strike Technology (JAST)							
ARPA	MIPR	Jan 95	3,664	3,664		3,664	3,664
Fld. Activ.	Various	Oct94-Sep95	2,525	2,525		2,525	2,525

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603800F Joint Adv Strike Tech Program

PROJECT NO. AND NAME: 2025 Joint Advanced Strike Technology (JAST)

Contractor/ Government Performing Activity	Contract Method/ Fund Type Vehicle	Award/ Oblig Date	Perform Activity EAC	Project Office EAC	Total FY 1993 & Prior	FY 1994 Budget	FY 1995 Budget	FY 1996 Budget	FY 1997 Budget	To Complete	Total Program
Technology Maturation Concept Development and Demonstration Phases											
Structures and Material											
Boeing	C/CPFF	Dec 94	1,757	1,757			887	870			1,757
McAIR	SS/CPFF	Dec 94	5,740	5,740			3,300	2,440			5,740
McAIR	SS/CPFF	Apr 96	78,000	78,000				6,660	32,817	CONT.	CONT.
Fld Activ.	Various	Oct96-Sep97	--	--			1,137	957	1,223	CONT.	CONT.
Flight Systems											
Northrop	SS/CPFF	Feb 95	1,270	1,270			1,270				1,270
Lockheed	C/CPFF	Oct 96	47,992	47,992			740	13,750	16,600	16,902	47,992
McAir	C/CPFF	Oct 96	64,821	64,821			1,186	13,515	16,600	33,520	64,821
Boeing	C/CPFF	Oct 96	1,966	1,966			50	500	400	1,016	1,966
Contracts Less Than $1.0M											
Various	CPFF	Various	5,077	5,077			5,077				5,077
Fld Activ.	Various	Oct96-Sep97	--	--			2,655	3,512	4,700	CONT.	CONT.
Manufacturing & Producibility											
Lockheed	C/CPFF	Oct 96	5,632	5,632			1,397	1,500	2,100	635	5,632
McAir St. Louis, MO	C/CPFF	Jan 97	9,751	9,751			1,581	1,270	1,300	5,600	9,751
Gen Res Corp Huntsville, AL	C/CPFF	Jan 96	1,955	1,955			465	1,490			1,955
Contracts Less Than $1.0M											
Various	CPFF	Various	--	--			555	275	690	CONT.	CONT.
Fld Activ.	Various	Oct96-Sep97	--	--			1,069	985	810	CONT.	CONT.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603800F Joint Adv Strike Tech Program

PROJECT NO. AND NAME: 2025 Joint Advanced Strike Technology (JAST)

Contractor/ Government Performing Activity	Contract Method/ Fund Type Vehicle	Award/ Oblig Date	Perform Activity EAC	Project Office EAC	Total FY 1993 & Prior	FY 1994 Budget	FY 1995 Budget	FY 1996 Budget	FY 1997 Budget	To Complete	Total Program
Propulsion											
GE	SS/CPFF	Dec 94	3,807	3,807			2,731	1,076			3,807
Cincinnati, OH											
GE	SS/CPFF	Jan 95	5,845	5,845			5,808	37			5,845
Pratt/Whit.	C/CPFF	Dec 94	5,448	5,448			4,212	1,236			5,448
West Palm Beach, FL											
Pratt/Whit.	SS/CPFF	Jan 95	5,681	5,681			4,331	1,350			5,681
GE	SS/CPFF	Oct 96	65,000	65,000				7,000	15,000	CONT.	CONT.
Pratt/Whit	SS/CPFF	Nov 95	30,000	30,000				30,000			30,000
Pratt/Whit	SS/CPFF	Oct 96	88,550	88,550					40,000	CONT.	CONT.
Contracts Less Than $1.0M											
Various	CPFF	Various	1,919	1,919			1,343	576			1,919
Fld Activ.	Various	Oct96-Sep97	--	--			674	1,607	1,975	CONT.	CONT.
Avionics											
Northrop	C/CPFF	Dec 94	1,913	1,913			1,609	304			1,913
Boeing	C/CPFF	Dec 94	2,288	2,288			1,517	771			2,288
TI	C/CPFF	Dec 94	2,464	2,464			1,413	1,051			2,464
Plano, TX											
Melbourne, FL											
Lockheed	SS/CPFF	Oct 96	7,340	7,340			740	2,100	2,250	2,250	7,340
Lockheed	C/CPFF	Dec 94	2,016	2,016			2,016				2,016
TRW	C/CPFF	Dec 94	2,004	2,004			1,220	784			2,004
Beavercreek, OH											
McAir	SS/CPFF	Oct 96	7,340	7,340			740	2,100	2,250	2,250	7,340
Hughes	C/CPFF	Oct 96	54,618	54,618				4,653	8,619	41,346	54,618
Los Angeles, CA											

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603800F Joint Adv Strike Tech Program

PROJECT NO. AND NAME: 2025 Joint Advanced Strike Technology (JAST)

Contractor/ Government Performing Activity	Contract Method/ Fund Type Vehicle	Award/ Oblig Date	Perform Activity EAC	Project Office EAC	Total FY 1993 & Prior	FY 1994 Budget	FY 1995 Budget	FY 1996 Budget	FY 1997 Budget	To Complete	Total Program
Avionics (CONT.)											
Westinghouse Baltimore, MD	C/CPFF	Oct 96	48,164	48,164				4,288	7,660	36,216	48,164
(ICP)	C/CPFF	Jan 97	65,400	65,400					7,709	CONT.	CONT.
Contracts Less Than $1.0M											
Various	CPFF	Oct94-Sep95	7,184	7,184			5,725	1,459			7,184
Fld Activ.	Various	Oct96-Sep97	--	--			2,978	3,474	3,756	CONT.	CONT.
Weapons Integration											
Hughes Los Angeles, CA	C/CPFF	Oct 96	4,228	4,228			1,019	1,609	1,600		4,228
Loral Orlando, FL	C/CPFF	Mar 95	636	636			636				636
Marietta Orlando, FL	C/CPFF	Mar 95	545	545			545				545
Northrop	C/CPFF	Mar 95	426	426			426				426
Westinghouse Baltimore, MD	C/CPFF	Mar 95	1,011	1,011			1,011				1,011
Contracts Less Than $1.0M											
Various	CPFF	Oct96-Sep97	--	--			901	93	80	CONT.	CONT.
Fld Activ.	Various	Oct96-Sep97	--	--			3,068	1,328	1,800	CONT.	CONT.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603800F Joint Adv Strike Tech Program

PROJECT NO. AND NAME: 2025 Joint Advanced Strike Technology (JAST)

Contractor/ Government Performing Activity	Contract Method/ Fund Type Vehicle	Award/ Oblig Date	Perform Activity EAC	Project Office EAC	Total FY 1993 & Prior	FY 1994 Budget	FY 1995 Budget	FY 1996 Budget	FY 1997 Budget	To Complete	Total Program
Supportability and Training											
Classified											
Project 3	C/CPFF	Jan 97	9,370	9,370			770	1,600	3,000	4,000	9,370
Project 4	C/CPFF	Jan 97	4,800	4,800			800	600	2,000	1,400	4,800
Contracts Less Than $1.0M											
Various	CPFF	Oct94-Sep95	2,314	2,314			1,914	400			2,314
Fld Activ.	Various	Oct96-Sep97	--	--			1,012	901	1,350	CONT.	CONT.
Technical Maturation Technical Support											
Fld Activ.	Various	Oct 96	--	--			1,191	1,029	2,200	CONT.	CONT.
Requirements Analysis											
Dynamic Research Arlington, VA	C/CPFF	Dec 96	1,010	1,010				660	350	CONT.	CONT.
Contracts Less Than $1.0M											
Various	CPFF	Oct96-Sep97	--	--			4,647	3,153	3,050	CONT.	CONT.
Fld Activ.	Various	Oct96-Sep97	--	--			2,405	1,888	2,800	CONT.	CONT.
Modeling, Simulation and Affordability Analyses											
Contracts Less Than $1.0M											
Various	CPFF	Oct96-Sep97	--	--			2,384	824	2,425	CONT.	CONT.
Fld Activ.	Various	Oct96-Sep97	--	--			900	2,614	4,075	CONT.	CONT.
Program Operations											
Fld Activ.	Various	Oct96-Sep97	--	--			2,241	2,494	2,408	CONT.	CONT.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603800F Joint Adv Strike Tech Program

PROJECT NO. AND NAME: 2025 Joint Advanced Strike Technology (JAST)

Contractor/ Government Performing Activity	Contract Method/ Fund Type Vehicle	Award/ Oblig Date	Perform Activity EAC	Project Office EAC	Total FY 1993 & Prior	FY 1994 Budget	FY 1995 Budget	FY 1996 Budget	FY 1997 Budget	To Complete	Total Program
SUPPORT AND MANAGEMENT (CS)											
ANSER Arlington, VA	SS/CPFF	Jul 94	9,532	9,532			4,092	3,340			
New Contract	C/CPFF	Jan 97	--	--					3,410	CONT.	CONT.
Contracts Less Than $1.0M											
Various	CPFF	Oct96-Sep97	--	--			1,179	1,847	2,025	CONT.	CONT.

TEST AND EVALUATION: Not applicable.

(U) Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program

Product Development Property
Not applicable.

Support and Management Property
Not applicable.

Test and Evaluation Property
Not applicable.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)				DATE March 1996	
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603800F Joint Adv Strike Tech Program				
PROJECT NO. AND NAME 2025 Joint Advanced Strike Technology (JAST)					
Subtotal Product Development	176,781	196,615	654,634	CONT.	CONT.
Subtotal Support and Management	5,271	5,187	5,435	CONT.	CONT.
Subtotal Test and Evaluation					
Subtotal USN SBIR Assessment and USN/ARPA General Reductions		4,348			

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603851F ICBM Modernization Dem/Val

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	48,182	19,533	30,644	37,279	40,505	42,138	42,383	Continuing	Continuing
1020 ICBM Guidance Applications	12,284	11,032	15,998	19,075	18,814	19,278	18,982	Continuing	Continuing
1021 ICBM Propulsion Applications	301	195	191	194	191	191	188	Continuing	Continuing
1022 ICBM Reentry Vehicle Applications	2,500	5,531	10,123	15,299	18,910	20,137	20,579	Continuing	Continuing
1023 Rocket System Launch Program (RSLP)	23,827	28	1,031	31	32	34	36	Continuing	Continuing
1024 ICBM Command & Control Applications	301	195	1,103	194	191	191	188	Continuing	Continuing
4209 Long Range Planning (LRP)	8,969	2,552	2,198	2,486	2,367	2,307	2,410	Continuing	Continuing

NOTES:

- RSLP FY95 funds [FY95 Appropriation ($23,827)] plus LRP Omnibus Reprogramming ($3,000) and Below Threshold Reprogramming ($3,991)—for a total of $30,818—reported and executed under PE 0605860F, Rocket Systems Launch Program.
- Project/program funding for FY95 and FY96 does not accurately reflect adjustments to appropriated value for all projects. See individual project Program Change Summary for details/explanation.

(U) **A. Mission Description and Budget Item Justification**

(U) Efforts identify methods to reduce life cycle costs, to improve nuclear safety and surety, to support international arms control agreements, and to ensure continued ICBM viability. Program includes demonstration and validation projects for ICBM guidance options, to support reentry vehicles beyond original design life, to provide an assessment of ICBM post-boost system, and develop enhancements to survivable command and control capabilities. These programs are in Budget Activity/Research Category Demonstration and Validation and integrate existing technologies.

(U) **Acquisition Strategy:** Not applicable; only studies and analyses will be performed under this program element. Limited engineering and pre-prototype hardware development may be accomplished in support of these studies and analyses.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996*	FY 1997	Total Cost
(U) Previous President's Budget	41,704	20,265	30,638	Continuing
(U) Appropriated Value	43,206	31,765		
(U) Adjustments to Appropriated Value*				
a. Congressional/General	-603	-846		
b. SBIR	-899			
c. Below Threshold Reprogramming	3,478	-11,386		
c. Omnibus and other Above Threshold	3,000			
(U) Adjustments to Budget Years Since FY96 PB			6	
(U) Current Budget Submit/President's Budget	48,182	19,533	30,644	Continuing

* See individual projects for details.

(U) Change Summary Explanation:

Funding: See individual projects
* The FY96 amount does not reflect funding reductions that are reserved for other DoD reprogramming needs ($27)

Schedule: See individual projects

Technical: See individual projects

(U) **C. Other Program Funding Summary ($ in Thousands):** None

Related RDT&E:
(U) PE 0604851F, ICBM Modernization EMD
(U) PE 0605860F, Rocket System Launch Program (RSLP)
(U) PE 0303131F, Minimum Essential Emerging Communications Network (MEECN)

(U) **D. Schedule Profile:** See individual projects.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603851F ICBM Modernization Dem/Val

PROJECT NO. AND NAME: 1020 ICBM Guidance Applications

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1020 ICBM Guidance Applications	12,284	11,032	15,998	19,075	18,814	19,278	18,982	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification**

(U) ICBM Guidance Application efforts implement the JROC-validated Mission Need Statement for Future Guidance Systems for Intercontinental Ballistic Missiles. The program focuses on disengagement strategies, significantly reducing guidance system life cycle cost, increasing nuclear surety, and evaluating/demonstrating the guidance instrument options that will keep ICBMs viable. This program also implements the Nuclear Posture Review recommendations to preserve guidance instrument technologies. The guidance applications project will demonstrate the utility and/or cost reduction potential of technologies applied to ICBM guidance systems.

(U) FY 1995

- (U) $10,000 Supported the Advanced Inertial Measurement System (AIMS) through the completion of dem/val of brassboard testing.
- (U) $1,870 Initiated alternatives and effectiveness study of inertial measurement unit (IMU) viability for dormant operations including start-up reliability
- (U) $414 Payment of remainder of General Reductions/SBIR adjustments
- (U) $12,284 Total

(U) FY 1996

- (U) $2,778 Perform Gyro Stabilized Platform Phase 0 activities including a cost options analysis
- (U) $1,429 Assess integration of most promising advanced IMU designs into the Minuteman weapon system
- (U) $5,740 Develop advanced IMU concept prototype and begin sled test planning
- (U) $907 Develop advanced instrument technology prototypes
- (U) $400 Perform radiation hard parts design options study to determine risk areas and potential process improvements
- (U) -$222 Partial payment of General Reductions assessed Guidance Applications Project but paid by RSLP Project (BPAC 1023, this PE). This credit is reflected in this task description funding profile.
- (U) $11,032 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1020 ICBM Guidance Applications	

(U) FY 1997

- (U) $2,120 Develop Gyro Stabilized Platform acquisition documents
- (U) $2,175 Continue integration assessment of advanced IMU design into Minuteman weapon system
- (U) $8,800 Conduct advanced IMU concept prototype sled test and evaluate results
- (U) $2,245 Conduct advanced instrument prototype integration tests
- (U) $1,200 Continue radiation hard parts design options study and implementation of results
- (U) -$542 FY97 adjustments to be paid by RSLP Project (BPAC 1023, this PE). This credit is reflected in this task description funding profile.
- (U) $15,998 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	11,870	11,544	17,216	Continuing
(U) Appropriated Value	12,650	11,544		
(U) Adjustments to Appropriated Value				
a. Congressional/General	-380	-448**		
b. SBIR	-400			
c. Omnibus and other Above Threshold	414	-64		
(U) Adjustments to Budget Years Since FY96 PB			-1218***	
(U) Current Budget Submit/President's Budget	12,284*	11,032	15,988	Continuing

* Includes $414 in pending payments for FY95 Adjustments to Appropriated Value.
** Includes $222 in Adjustments to Appropriated Value paid by RSLP Project (BPAC 1023, this PE).
*** Includes $500 FY97 Offset and $42 nonpay inflation adjustment to be paid by RSLP Project (BPAC 1023, this PE).

(U) Change Summary Explanation:

Funding: FY97-01 reflects nonpay inflation adjustments.
Schedule: No significant impact.
Technical: No significant impact.

(U) C. Other Program Funding Summary ($ in Thousands): None

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1020 ICBM Guidance Applications	

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) AIMS Demonstration/Validation	X*			X*								
(U) Gyro Stabilized Platform Phase 0 Activities					X*							
(U) Advanced IMU Integration Assessments					X*							
(U) Alternate IMU Prototype Development/Integration						X						
(U) Advanced Instrument Technology Prototyping							X*					
(U) Radiation Hardened Parts Analysis							X*					

* Complete

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1020 ICBM Guidance Applications	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Program Management Support	505	284	385
(U) Contract Systems Engineering	11,365	10,970	16,155
(U) Administrative Adjustments*	414	-222	-542
(U) Total	12,284	11,032	15,988

* See explanation notes accompanying Program Change Summary. Adjustment is reflected in Project Cost Breakdown.

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

(U) **Performing Organizations:** Not applicable

(U) **Government Furnished Property:** Not applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603851F ICBM Modernization Dem/Val

PROJECT NO. AND NAME: 1021 ICBM Propulsion Applications

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1021 ICBM Propulsion Applications	301	195	191	194	191	191	188	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification**

(U) The Minuteman post boost system (Propulsion System Rocket Engine (PSRE)), a major component required throughout the life of the weapon system, is presently out of production. Reuse studies and/or development of replacement hardware will be required including feasibility evaluations, technology improvements, material processing validation, and manufacturing validation.

(U) FY 1995

- (U) $197 Began fired PSRE reuse study.
- (U) $104 Conducted assessment of PSRE and study options to meet Minuteman post boost vehicle requirements.
- (U) $301 Total

(U) FY 1996

- (U) $93 Continue assessment of PSRE and study of options to meet Minuteman post boost vehicle requirements.
- (U) $52 Continue fired PSRE reuse study on components such as low thrust bipropellent valves.
- (U) $50 Conduct ordnance component reuse studies.
- (U) $195 Total

(U) FY 1997

- (U) $191 Continue fired PSRE reuse study on components such as attitude control engines/axial engines.
- (U) $191 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1021 ICBM Propulsion Applications	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	301	200	200	Continuing
(U) Appropriated Value	301	200		
(U) Adjustments to Appropriated Value				
a. Congressional/General		-4		
b. Omnibus and other Above Threshold		-1		
(U) Adjustments to Budget Years Since FY96 PB			-9	
(U) Current Budget Submit/President's Budget	301	195	191	Continuing

(U) Change Summary Explanation:

Funding: FY97-01 adjusted for non-pay inflation adjustment

Schedule: No significant impact

Technical: No significant impact

(U) **C. Other Program Funding Summary ($ in Thousands):** None

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) PSRE: Conduct Assessment Studies				X*				X				
(U) PSRE: Conduct Reuse Studies					X*							
(U) Ordnance: Conduct Reuse Studies						X*		X				

* Complete

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1021 ICBM Propulsion Applications	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Contract Engineering Support	301	180	176
(U) Program Management Support	0	15	15
(U) Total	301	195	191

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

(U) **Performing Organizations:** Not applicable

(U) **Government Furnished Property:** Not applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1022 ICBM Reentry Vehicle Applications	

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1022 ICBM Reentry Vehicle Applications	2,500	5,531	10,123	15,299	18,910	20,137	20,579	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification

(U) ICBM Reentry Vehicle (RV) Applications efforts are required to support a Minuteman force of 500 missiles, arms control treaties/initiatives directing the Minuteman force be downloaded to a single RV configuration, the need to ensure Minuteman force contains the safest, most reliable RV, and CINCSTRATCOM guidance that we should continue to invest in this area not as an element of industrial policy, but as a necessary ingredient to ensure the continuing readiness for our strategic deterrent. ICBM RV Applications efforts will support RVs beyond their original design life through addressing problems with operational reentry systems, meeting real on-going needs, and ensuring the availability of long-lead components/materials. This project will develop methods to better predict aging phenomena, and identify life cycle cost reduction methods. Additionally, these efforts will maintain a minimum level of technical engineers and capability to respond to aging phenomena and future requirements. RV work conducted under this program will leverage the Science & Technology community and coordinate with Navy RV efforts to eliminate duplication and realize synergistic cost savings.

(U) FY 1995

- (U) $1,688 Identified and assessed critical attributes unique to ICBM requirements.
- (U) $500 Conducted Safety Enhanced Reentry Vehicle (SERV) Phase 0 Study.
- (U) $312 Payment of General Reductions/SBIR adjustments
- (U) $2,500 Total

(U) FY 1996

- (U) $2,025 Evaluate existing RV material subsystems and identify potential material replacements.
- (U) $915 Identify and evaluate options for improved aging prediction testing/measurement techniques.
- (U) $667 Identify and evaluate options for improved sensors/instrumentation to better analyze operational RVs and materials.
- (U) $589 Identify and evaluate options for improved fuze assessment/measurement methodologies.
- (U) $472 Identify and evaluate supportability for critical RV components.
- (U) $622 Develop necessary SERV acquisition documentation.
- (U) $241 Identify options to better measure/analyze accuracy contributors.
- (U) $5,531 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1022 ICBM Reentry Vehicle Applications	

(U) FY 1997

- (U) $3,044 Continue to evaluate existing RV material subsystems and potential material replacements by performing applicable ground and flight tests.
- (U) $1,429 Design, develop, and conduct prototype testing of selected aging prediction techniques and tools.
- (U) $1,850 Design, develop, and conduct prototype testing of selected fuze assessment/measurement methodologies.
- (U) $1,650 Design, develop, and conduct prototype testing of selected sensors/instruments.
- (U) $500 Identify and ground test potential replacement options for critical RV components.
- (U) $1,300 Conduct initial evaluation of improved accuracy assessment measurement methodology.
- (U) $350 Conclude development of necessary SERV acquisition documentation.
- (U) $10,123 Total

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,200	5,673	10,549	Continuing
(U) Appropriated Value	2,500	5,673		
(U) Adjustments to Appropriated Value				
a. Congressional/General		-111		
b. SBIR				
c. Below Threshold Reprogramming				
d. Omnibus and other Above Threshold		-31		
(U) Adjustments to Budget Years Since FY96			-426	
(U) Current Budget Submit/President's Budget	2,500*	5,531	10,123	Continuing

* Includes $312 in pending payments for FY95 Adjustments to Appropriated Value.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1022 ICBM Reentry Vehicle Applications	

(U) Change Summary Explanation:

Funding: FY97-01 adjusted for non-pay inflation adjustment

Schedule: No significant impact

Technical: No significant impact

(U) C. Other Program Funding Summary ($ in Thousands): None

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Conduct Critical Attributes Study	X*	———		X*								
(U) Conduct Phase 0 SERV Study	X*	———		X*								
(U) Develop SERV Acquisition Documentation					X*	———	———	———	———	———	———	X
(U) Evaluate Materials, Identify Replacements					X*	———	———	———	———	———	———	
(U) Plan/Perform Ground/Flight Tests						X*	———	———	———	———	———	X
(U) Aging Prediction Methodologies												
(U) Identify Improved Prediction Techniques					X*	———	———	X				
(U) Design/Develop/Test Selected Techniques									X	———	———	———
(U) Sensor/Instrumentation Integration												
(U) Identify Options for Improved Sensors/Instrumentation					X*	———	———	X				
(U) Design/Develop/Test Selected Sensors/Instruments									X	———	———	———
(U) Assessment Methodology												
(U) Identify Options to Measure Accuracy Contributors					X*	———	———	X				
(U) Conduct Evaluation of Accuracy Measurement Techniques									X	———	———	———

* Complete

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603851F ICBM Modernization Dem/Val

PROJECT NO. AND NAME: 1022 ICBM Reentry Vehicle Applications

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Fuze Assessment												
(U) Identify Options for Improved Measurement Tools					X*	———	———	X				
(U) Design/Develop/Test Selected Measurement Tools									X	———	———	———
(U) Critical Components												
(U) Identify Supportability					X*	———	———	X				
(U) Identify, Design, & Test Potential Replacement Options									X	———	———	———

* Complete

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1022 ICBM Reentry Vehicle Applications	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Contract Engineering Support	2,188	5,531	10,123
(U) Administrative Adjustment*	312		
(U) Total	2,500	5,531	10,123

* See explanation notes accompanying Program Change Summary. Adjustment is reflected in Project Cost Breakdown.

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

(U) **Performing Organizations:** Not applicable

(U) **Government Furnished Property:** Not applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603851F ICBM Modernization Dem/Val

PROJECT NO. AND NAME: 1023 Rocket System Launch Program (RSLP)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1023 Rocket System Launch Program (RSLP)	23,827	28	1,031	31	32	34	36	Continuing	Continuing

NOTE: RSLP FY95 funds ($23,827) reported and executed under PE 0605860F, Rocket Systems Launch Program

(U) A. Mission Description and Budget Item Justification

(U) This task supports studies/analysis on hardware for cost effective use on excess missile assets. This project begins in FY 1996.

(U) FY 1995 - See PE 0605860F, RSLP for detailed Budget Item Justification

- (U) $23,827 Total

(U) FY 1996

- (U) $28 Conduct studies/analysis for the adoption of MSLS or similar low cost front-end systems for use on deactivated missile assets.
- (U) $28 Total

(U) FY 1997

- (U) $31 Continue studies/analysis for the adoption of MSLS or similar low cost front-end systems for use on deactivated missile assets.
- (U) $458 Initiate studies/analysis to support storage of excess Peacekeeper-unique handling equipment.
- (U) $542 FY97 Offset and nonpay inflation adjustment incorrectly assessed against Guidance Applications Project (BPAC 1020, this PE).
- (U) $1,031 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1023 Rocket System Launch Program (RSLP)	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	23,827	30	31	Continuing
(U) Appropriated Value	23,827	11,530		
(U) Adjustments to Appropriated Value				
a. Congressional Reductions		-227*		
b. Omnibus and other Above Threshold		-11,275		
(U) Adjustments to Budget Years Since FY96 PB			1,000**	
(U) Current Budget Submit/President's Budget	23,827	28	1,031	Continuing

* Includes $222 to pay partial Adjustments to Appropriated Value incorrectly assessed to Guidance Applications Project (BPAC 1020, this PE).

** Includes $542 to pay $500 FY97 Offset and $42 nonpay inflation adjustment incorrectly assessed to Guidance Applications Project (BPAC 1020, this PE).

(U) Change Summary Explanation:

Funding: $11,275 of FY96 appropriated funds reprogrammed to PE 0605860F (RSLP). FY97 funding increased by $1,000K to initiate studies/analysis to support storage of excess Peacekeeper-unique handling equipment but subsequently reduced by $500 for FY97 Offset and $42 nonpay inflation adjustment.

Schedule: No impact.

Technical: See above.

(U) **C. Other Program Funding Summary ($ in Thousands):** None

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Multiservice Launch System Applications Studies/Analysis					X*	_____		X	X	_____		X
(U) Handling Equipment Analysis									X	_____		X

* Complete

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1023 Rocket System Launch Program (RSLP)	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Studies/Analysis	23,827	28	489
(U) Administrative Adjustment*			542
(U) Total	23,827	28	1,031

* See notes accompanying Program Change Summary.

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

(U) **Performing Organizations:** Not applicable

(U) **Government Furnished Property:** Not applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603851F ICBM Modernization Dem/Val

PROJECT NO. AND NAME: 1024 ICBM Command & Control Applications

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1024 ICBM Command & Control Applications	301	195	1,103	194	191	191	188	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification**

(U) The deMIRVing of ICBMs and overall cutbacks in the number of nuclear weapons reduces the incentive to attack individual ICBM silos. Therefore, the incentive to attack Minuteman launch control centers will increase unless steps are taken to lessen an aggressor's confidence in being able to prevent missile launch by simultaneously destroying all launch control centers. This program funds efforts to identify existing technologies (Ground Launch Cruise Missile, Small ICBM, Airborne Launch Control Centers, etc.) to increase the uncertainty of destroying Minuteman launch control center capabilities. The identification and use of existing military hardware, software, and system designs/documentation are principle concerns. Additionally, it is critical to explore ways of continuing assured connectivity to strategic forces. Study efforts will be conducted to ensure reliable and standardized communication links are maintained to the ICBM forces. Testing existing low cost technology (fiber optic cable, telescoping antennas, etc.) under a generation scenario will be stressed. Methods to further disengagement strategies and cost savings will also be pursued.

(U) FY 1995

- (U) $301 Performed study to identify from previous ICBM Long Range Planning, System Program Office, and Air Force Space Command studies candidate command and status methodologies. Refined analysis and downselected to a singe study candidate.
- (U) $301 Total

(U) FY 1996

- (U) $193 Identify technical and cost options for providing a MILSTAR extremely high frequency (EHF) capability to Minuteman launch control centers.
- (U) $2 Other
- (U) $195 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1024 ICBM Command & Control Applications	

(U) FY 1997

- (U) $169 Accomplish an in depth analysis for the Fiber Optic Link/Hardened Intersite Cable System (HICS) upgrade and continue EHF studies.
- (U) $934 Identify technical and cost options for providing future command, control, communications, and computer (C4) elements and alternatives (e.g., Defense IEMATS (Improved Emergency Message Automated Transmission System) Replacement Command and Control Terminal (DIRECT) Program).
- (U) $1,103 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	301	200	200	Continuing
(U) Appropriated Value	301	200		
(U) Adjustments to Appropriated Value				
a. Congressional/General		-4		
b. Omnibus and other Above Threshold		-1		
(U) Adjustments to Budget Years Since FY96 PB			903	
(U) Current Budget Submit/President's Budget	301	195	1,103	Continuing

(U) Change Summary Explanation:

Funding: Funding increase in FY97 ($950) to support C4 technical and cost options development (e.g., Modified Miniature receive Terminals (MMRT) in launch control centers (LCCs) and DIRECT) less FY97-01 non-pay inflation adjustment ($46 in FY97) and overhead reduction ($1).

Schedule: No significant impact.

Technical: See above.

(U) C. Other Program Funding Summary ($ in Thousands): None

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1024 ICBM Command & Control Applications	

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Command and status methodology.			X*	X*								
(U) MILSTAR EHF						X*		X				
(U) Fiber optic link/HICS upgrade									X			X
(U) Future C4 studies/analyses									X			X

* Complete

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 1024 ICBM Command & Control Applications	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Contract Engineering Support	301	195	1,103
(U) Total	301	195	1,103

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

(U) **Performing Organizations:** Not applicable

(U) **Government Furnished Property:** Not applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603851F ICBM Modernization Dem/Val

PROJECT NO. AND NAME: 4209 Long Range Planning (LRP)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4209 Long Range Planning (LRP)	8,969	2,552	2,198	2,486	2,367	2,307	2,410	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification**

(U) The Long Range Planning (LRP) task analyzes ICBM systems to identify potential modifications required to meet user objectives relative to long term sustainment, technology insertion, employment, and force structure. The primary focus of the studies centers on system supportabilitiy, operability, reliability, and maintainability. Options/concepts generated by these studies are evaluated for feasibility, system impacts, and cost.

(U) FY 1995

- (U) $960 Performed technology insertion studies such as Minuteman system dormancy, gyrocompass assembly technology insertion options, and future ICBM applications.
- (U) $687 Performed command signal decoder (missile) (CSD(M))/remote code change study in response to Nuclear Posture Review (NPR)/Presidential Decision Directive (PDD) 30 requirements.
- (U) $345 Performed life extension and feasibility studies such as Launch Facility LF) Electronics Life Extension and Minuteman Backup Ocean Area Targeting concept.
- (U) $602 Supported Long Range Planning tasks, developed the Systems Options Report, updated the Logistics Program Management Plan, and updated the ICBM Master Plan.
- (U) $6,375 Funds tasks accomplished and reported in RSLP Program (PE 0605860F). See notes accompanying this project's Program Change Summary and Budget Item Justification in PE 0605860F.
- (U) $8,969 Total

(U) FY 1996

- (U) $634 Support Long Range Planning tasks, develop the Systems Options Report, and update the Logistics Program Management Plan and the ICBM Master Plan.
- (U) $1,136 Perform feasibility and life extension studies
- (U) $757 Perform technology insertion studies in support of changing ICBM environments
- (U) $25 Other
- (U) $2,552 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 4209 Long Range Planning (LRP)	

(U) FY 1997

- (U) $637 Support Long Range Planning tasks, develop the Systems Options Report, and update the Logistics Program Management Plan and the ICBM Master Plan.
- (U) $879 Perform technology insertion studies in support of changing ICBM environments
- (U) $682 Perform feasibility studies in direct support of Minuteman life extension
- (U) $2,198 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,205	2,618	2,442	Continuing
(U) Appropriated Value	3,627	2,618		
(U) Adjustments to Appropriated Value				
a. Congressional/General	-223	-52		
b. SBIR	-199			
c. Below Threshold Reprogramming	2,764*			
d. Omnibus and other Above Threshold	3,000**	-14		
(U) Adjustments to Budget Years Since FY96 PB			-244	
(U) Current Budget Submit/President's Budget	8,969	2,552	2,198	Continuing

* Consists of BTR ($3,991) incorrectly credited to LRP instead of RSLP Project (BPAC 1023, this PE) less BTRs ($1,226) assessed against LRP. Tasks funded by this BTR ($3,991) reported in RSLP Program (PE 0605860F). See that PE for Budget Item Justification.

** Omnibus Reprogramming ($3,000) incorrectly credited to Long Range Planning Project instead of RSLP Project (BPAC 1023, this PE). Tasks funded by this Omnibus Reprogramming ($3,000) reported in RSLP Program (PE 0605860F). See that PE for Budget Item Justification.

(U) Change Summary Explanation:

Funding: FY97 funding decreased as part of APOM review and non-pay inflation adjustment.

Schedule: No significant impact.

Technical: Minor adjustments made to studies/analyses to absorb reduction.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 4209 Long Range Planning (LRP)	

(U) **C. Other Program Funding Summary ($ in Thousands):** None

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Contract Award	X*					X*			X			
(U) Program Reviews		X*	X*	X*		X*	X			X	X	
(U) Deliverable Reports				X*				X				X

* Complete.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603851F ICBM Modernization Dem/Val
PROJECT NO. AND NAME 4209 Long Range Planning (LRP)	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Contractor Engineering Support	1,992	1,857	2,056
(U) Program Management Support	602	695	142
(U) Administrative Adjustment*	6,375		
(U) Total	8,969	2,552	2,198

* See notes accompanying Program Change Summary.

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

(U) **Performing Organizations:** Not applicable

(U) **Government Furnished Property:** Not applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603853F Evolved Expendable Launch Veh (EELV) (Space)

PROJECT NO. AND NAME: 0006 EELV Dem/Val

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
0006 EELV Dem/Val	29,046	37,147	44,457	0	0	0	0	0	134,868

(U) A. Mission Description and Budget Item Justification:

The Evolved Expendable Launch Vehicle (EELV) program is a space launch vehicle development program. The purpose of this program is to replace the current fleet of medium to heavy lift class expendable launch vehicles (Titan II, Delta II, Atlas II, and Titan IV) with a more affordable, lower costing family of space launch vehicles. Program content includes the development of the system design, demonstrations of key technologies, modifications to industrial capability and launch facilities, and demonstration launches of both medium and heavy lift EELV variants. The EELV family of vehicles must be capable of meeting the Government's spacelift needs (DoD, intelligence, and other government missions) through 2020, as defined in the National Mission Model. Initial Operational Capability (IOC) for the Medium Lift Variant (MLV) is required by FY02 at both Vandenberg AFB (VAFB) and Cape Canaveral Air Station (CCAS); Heavy Lift Variant (HLV) IOC is required by FY05 at VAFB and FY06 at CCAS. Funding for FY95-FY98 is in this Budget Activity Research Category because it supports risk reduction, and demonstration and validation of technologies, and concept verifications leading to lower cost expendable launch vehicles.

(U) Acquisition Strategy:

The EELV concept of a family of launch vehicles emphasizes commonality of hardware and infrastructure and economies of scale to enhance production, operations, and support efficiencies. Cost improvements will be achieved through consolidation, reduction of supporting infrastructure (launch pads, manufacturing facilities, workforce), and optimization of production and launch operations, processes, and rates. All development contracts will be competitively awarded. Downselect to a single EELV contract/concept is planned at the EMD decision point (third quarter FY98). Production contracts will be sole source to a single spacelift provider. The detailed EELV acquisition strategy is outlined in the DoD's Report to Congress, April 1995.

(U) FY 1995

- (U) $20,000 Awarded first increment of funds for four $30 million, firm fixed price (FFP), Low Cost Concept Validation (LCCV) module development contracts (Alliant TechSystems Inc., Boeing Defense & Space Group, Lockheed Martin Technologies Inc., and McDonnell Douglas Aerospace) in Aug 1995. LCCV module will span a total of 15 months.
- (U) $5,805 Started modifications to AF high altitude rocket engine test facilities at Arnold Engineering & Development Center (AEDC), Arnold AFB TN.
- (U) $3,241 Mission Support.
- (U) $29,046 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603853F Evolved Expendable Launch Veh (EELV) (Space)
PROJECT NO. AND NAME 0006 EELV Dem/Val	

(U) **FY 1996**

- (U) $32,000 Continue four LCCV module contracts through Nov 96, leading to Tailored Preliminary Design Review (PDR) in Aug 96, and culminating in the downselect to two contracts to continue concept development into the Pre-EMD module (beginning Nov 96). Balance of LCCV contractual obligation ($68 million) to be funded by a classified user.
- (U) $5,147 Mission Support.
- (U) $37,147 Total

(U) **FY 1997**

- (U) $41,000 Award two $60 million, Pre-EMD module contracts in Nov 96 from the four LCCV contractors. Pre-EMD module will span 17 months.
- (U) $3,457 Mission Support.
- (U) $44,457 Total

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996*	FY 1997
(U) Previous President's Budget	29,046	37,147	57,035
(U) Appropriated Value	30,000	39,226	
(U) Adjustments to Appropriated Value			
a. Congressional General Reductions	-328	-916	
b. Small Business Innovative Research	-626	-605	
c. Omnibus or other above threshold reprogramming		-558	
d. Below Threshold Reprogramming			
(U) Adjustments to Budget Years Since FY96 PB			-12,578
(U) Current Budget Submit/President's Budget	29,046	37,147	44,457

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603853F Evolved Expendable Launch Veh (EELV) (Space)
PROJECT NO. AND NAME 0006 EELV Dem/Val	

(U) Change Summary Explanation:

- Funding: The FY96 reductions are for normal Congressional general reductions and an additional $558 to support higher military requirements. FY97 reductions stem from three sources: One is associated with a non-pay inflationary adjustment ($2,294), another is for overhead reduction ($284), and the other is for higher priority military requirements ($10,000).
  * The FY96 PB amount does not reflect funding reductions that are reserved for other DoD reprogramming needs ($410)
- Schedule: Not Applicable.
- Technical: Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Comp	Total
(U) National User (non-AF budget)		72,300	15,100	7,100					
Related RDT&E:									
(U) EELV EMD (PE 64853F).				93,500	297,915	330,336	237,751	Continue	Continue
(U) Medium Launch Vehicles (PE 35119F).									
(U) Titan Space Launch Vehicles (PE 35144F).									

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
LCCV Module												
(U) Acquisition Strategy Panel (ASP)		X										
(U) Defense Acquisition Exec Review			X									
(U) Contract Awards				X								
(U) Tailored System Reqmts Review					X							
(U) Tailored PDR								X				
(U) Downselect to two contracts/concepts									X			
Pre-EMD Module												
(U) Defense Acquisition Exec Review									X			
(U) Tailored CDR-1 planned for 1st qtr FY98												

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603853F Evolved Expendable Launch Veh (EELV) (Space)
PROJECT NO. AND NAME 0006 EELV Dem/Val	

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4

(U) Downselect to single contract planned for late-3rd qtr FY98

EMD Module

(U) Defense Acquisition Exec Review/EMD start planned for late-3rd qtr FY98

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603853F Evolved Expendable Launch Veh (EELV) (Space)
PROJECT NO. AND NAME 0006 EELV Dem/Val	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Concept Development	20,000	32,000	41,000
(U) Rocket Engine Test Stand Modifications	5,805	0	0
(U) Mission Support	3,961	5,147	3,457
(U) Total	29,046	37,147	44,457

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603854F Global Broadcast Service (GBS) (Space)

PROJECT NO. AND NAME: 2679 Global Broadcast Service (GBS)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2679 Global Broadcast Service (GBS)	0	14,000	45,000	98,000	43,000	47,000	62,000	706,000	1,015,000

(U) **A. Mission Description and Budget Item Justification**

Lead acquisition of a three-phased Global Broadcast Service (GBS) program which will ultimately provide a worldwide, satellite-based, high data rate, communications broadcast capability in accordance with the Mission Need Statement approved by the JROC in Aug 95. GBS will provide high data rate connectivity between many distributed information sources and the warfighters who need the information. Warfighters will receive data using small aperature receive antennae and highly mobile terminals. The high GBS capacity (in excess of 20 Mbps per transponder) allows the simultaneous transmission of digitized data such as imagery, logistics data, weather data, maps, operational orders (e.g., Air Tasking Order), and video to multiple receive locations at significantly lower cost than other transmission systems. Phase One, 1996-98, will use commercial satellite leases to provide a CONUS-based testbed for requirements definition and operational concept refinement. Phase Two, 1998-00+, will provide an interim, near worldwide GBS capability at military frequencies hosted on the last three UHF Follow-On (UFO) satellites. Phase Three, 2000+, will provide a fully capable, global capability at military frequencies IAW the MILSATCOM Architecture being developed by the DoD Space Architect. The Air Force is awaiting formal designation by the USD(A&T) as the lead acquisition agency for this joint program. Funding is in this Budget Activity Research Category since it supports the demonstration and validation of a Global Broadcast Service technology.

(U) FY 1995

- (U) N/A
- (U)$0 Total

(U) FY 1996

- (U)$ 4,000 Provide Funds to NSA - COMSEC Development (Fastlane Algorithms, Receive Terminal Chips, & Analysis of Network Level Security Options)
- (U)$ 4,000 Contractor Trades and System Assessments/Analyses
- (U)$ 3,000 FFRDC and SETA Systems Engineering Support
- (U)$ 3,000 Provide Funds to Navy to Acquire Phase 2 UFO Satellite Antenna for Theater Injection
- (U)$ 14,000 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603854F Global Broadcast Service (GBS) (Space)
PROJECT NO. AND NAME 2679 Global Broadcast Service (GBS)	

(U) FY 1997

–	(U)$ 4,500	Provide funds to Navy to Complete Phase 2 UFO Satellite Antenna Acquisition for Theater Injection
–	(U)$ 5,500	Lease Phase 1 Transponder
–	(U)$ 9,000	Develop Broadcast Management Center for UFO in 98, and Support Information Management Interface Development
–	(U)$ 8,000	Provide Funds to NSA to Continue COMSEC Development
–	(U)$ 7,000	Technical Trades & Analyses, Systems Engineering, and Support Costs
–	(U)$ 6,000	Provide Funds to Army for Phase 2 UFO Terminals
–	(U)$ 5,000	Provide Funds to Supporting Organizations for Testbed Sustainment and Operations, and Development of User Terminal-Workstation Interface Specification (NRO, $2M; ESC, $2M; JTPO, $1M)
–	(U)$ 45,000	Total

(U) B. Program Change Summary ($ in Thousands)	FY 1995	FY 1996	FY 1997
(U) Previous President's Budget	N/A	0	0
(U) Appropriated Value			
(U) Adjustments to Appropriated Value			
a. Congressional General Reductions			
b. SBIR			
c. Omnibus and Other Above Threshold Reprogram		14,000	
d. Below Threshold Reprogram			
(U) Adjustments to Budget Years Since FY96 PB			45,000
(U) Current Budget Submit/President's Budget	N/A	14,000	45,000

(U) Change Summary Explanation:

Funding: This program is an FY96 new start pending Congressional approval of DoD reprogramming action FY96-4 PA, dated Feb 8, 1996.
Schedule: Not Applicable.
Technical: Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

Related RDT&E

(U) ARPA-DISA Bosnia Operational Communications Augmentation (BOCA)
(U) ARPA Battlefield Awareness and Data Dissemination (BADD) Advanced Concept Technical Demonstration (ACTD)
(U) Navy UFO Program

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603854F Global Broadcast Service (GBS) (Space)
PROJECT NO. AND NAME 2679 Global Broadcast Service (GBS)	

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Phase I (96-98)												
(U) Joint Warfighter Interoperability Demonstrations (JWID) 96 Demonstrations								x				
(U Lease Commercial Transponder									x	x	x	x
(U) JWID 97 Demonstrations												x
(U) Phase II (98-00+)												
(U) Acquisition Milestone Reviews - TBD												
(U) Launch UFO #8 (Dec 97)												
(U) Launch UFO #9 (Jun 98)												
(U) Launch UFO #10 (Dec 98)												
(U) Phase 3 (00+)												
(U) MILSATCOM Architecture (Define Phase 3)								x				
(U) Acquisition Milestone Reviews - TBD												

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603854F Global Broadcast Service (GBS) (Space)

PROJECT NO. AND NAME: 2679 Global Broadcast Service (GBS)

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Satellite Antenna Development	0	3,000	4,500
(U) COMSEC Developmnat	0	4,000	8,000
(U) Contracted Program Office Analyses/Trades	0	4,000	4,000
(U) FFRDC/SETA Support	0	3,000	3,000
(U) Phase 1 Sustainment	0	0	9,500
(U) Terminal Developments	0	0	6,000
(U) Information & Broadcast Management Developments			10,000
(U) Total	0	14,000	45,000

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
TBD	TBD	TBD	TBD	TBD	0	0	11,000	42,000	TBD	TBD
Support and Management Organizations										
FFRDC Support							3,000	3,000	TBD	TBD
Test and Evaluation Organizations - TBD										
Government Furnished Property:										
Product Development Property - TBD										
Support and Management Property - TBD										
Test and Evaluation Property - TBD										
Subtotal Product Development					0	0	11,000	42,000	TBD	TBD
Subtotal Support and Management					0	0	3,000	3,000	TBD	TBD
Subtotal Test and Evaluation										

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603855F DoD Space Architect (Space)

PROJECT NO. AND NAME: 2678 Space Architect

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2678 Space Architect	0	0	15,000	15,000	15,000	15,000	15,000	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification** - The DoD Space Architect was established on 27 Sep 1995 in response to Congressional concerns with regard to DoD space management, and consolidates into a single, jointly-staffed organization all military space architecture planning and development efforts previously performed within the individual services and on a program-by-program basis.

(U) **Acquisition Strategy:** This is not an acquisition program, however, RDT&E funds will be used to obtain direct support from various space planning and development organizations across the DoD and industry including FFRDC's and contracted System Engineering and Technical Assistance (SETA) technical support in direct support of DoD Space Architect space architecture planning and development. Funds will be applied to existing contract vehicles for FY96 and FY97.

- As primary support, the DoD Space Architect proposes to use two existing SMC contracts for FY96 and FY97 architecture technical support:
  - -- Engineering, Analysis, Design and Development (EADD) Contract; Science Applications International Corporation (SAIC)
  - -- Engineering, Analysis and Design (EAD) Contract; Nichols Research Corporation (NRC)
- These contracts currently provide support to the Air Force Space and Missile Systems Center (SMC/XR) long-range planning, conceptual development, and engineering analyses and assessment efforts.
- For FY98 and subsequent years, the DoD Space Architect intends to compete a separate SETA support contract for space architecture planning and development.

Space Architect RDT&E effort is in Budget Activity -7 (Demonstration and Validation) because the architecture studies involve many programs early in their acquisition phases (i.e., Dem/Val).

(U) FY 1995 ($ in Thousands):
- (U) $ Not Applicable
- (U) $0 Total

(U) FY 1996 ($ in Thousands):
- (U) $ Staff and Equip New Space Architect Organization
- (U) $ Initiate first Architecture Studies
- (U) $0 Total **($8,000 currently being reprogrammed into Space Architect program for FY96 start)**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603855F DoD Space Architect (Space)
PROJECT NO. AND NAME 2678 Space Architect	

(U) FY 1997 ($ in Thousands):
- (U) $15,000 Architectures studies and documentation
- (U) $
- (U) $15,000 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget			0	Cont
(U) Appropriated Value				
(U) Adjustments to Appropriated Value				
a. Cong Gen Reductions				
b. SBIR				
c. Omnibus or Other Above Threshold Reprogram				
d. Below Threshold Reprogramming				
(U) Adjustments to Budget Years Since FY 1996 PB			15,000	
(U) Current Budget Submit/President's Budget		0	15,000	Cont

(U) Change Summary Explanation:

Funding: Program "New Start" -- $8,000 of FY96 funding currently being reprogrammed for the Space Architect.

Schedule: None

Technical: None

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 4 - Demonstration and Validation	PE NUMBER AND TITLE 0603855F DoD Space Architect (Space)
PROJECT NO. AND NAME 2678 Space Architect	

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) N/A								N/A	N/A

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) N/A												

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603855F DoD Space Architect (Space)

PROJECT NO. AND NAME: 2678 Space Architect

(U) A. Project Cost Breakdown ($ in Thousands)

	FY 1995	FY 1996	FY 1997
(U) TBD	0	0	15,000
(U) Total	0	0	15,000

(U) B. Budget Acquisition History and Planning Information ($ in Thousands)

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
None										
Support and Management Organizations										
DoD Space Architect					0	0	0	15,000	Cont	Cont
Test and Evaluation Organizations										
None										
Government Furnished Property: None										
Subtotal Product Development										
Subtotal Support and Management					0	0	0	15,000	Cont	Cont
Subtotal Test and Evaluation										
Total Project					0	0	0	15,000	Cont	Cont

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0207325F Joint Air-to-Surface Standoff Missile (JASSM)
PROJECT NO. AND NAME 1006 Joint Air-to-Surface Standoff Missile (JASSM)	

COST ($ In Thousands)	FY 1995 Actual	1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	Cost to Complete	Total Cost
1006 Joint Air-to-Surface Standoff Missile (JASSM)	0	23,770	198,632	143,033	95,968	28,775	28,340	25,000	Continuing	545,594

(U) **A. Mission Description and Budget Item Justification**

The Joint Air-to-Surface Standoff Missile (JASSM) Program is an FY96 new start follow-on weapon system to the canceled Tri-Service Standoff Attack Missile (TSSAM). It is a joint Air Force/Navy program. JASSM is a long range, conventional air-to-surface, autonomous precision guided, standoff cruise missile compatible with fighter and bomber aircraft and able to attack a variety of both fixed and relocatable targets. JASSM will carry a 1,000 pound class penetrator warhead. Initial integration efforts are for the B-52 and F-16. Objective aircraft include the B-1, B-2, F-15E, F-117, F/A-18, S-3 and P-3. JASSM is funded in Budget Activity 5 EMD because this program is developing a weapon system.

(U) FY 1996

- (U) $11,803 PDRR contractor(s) for JASSM weapon system development and hardware
- (U) $1,049 Flight and ground test support
- (U) $4,975 Aircraft integration
- (U) $4,288 Program office support
- (U) $1,655 Mission support
- (U) $23,770 Total

(U) FY 1997

- (U) $160,146 Continues PDRR contractor(s) for JASSM weapons system development and hardware
- (U) $20,090 Continue flight and ground testing
- (U) $12,850 Continue aircraft integration
- (U) $4,866 Continue program office support
- (U) $680 Continue mission support
- (U) $198,632 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0207325F Joint Air-to-Surface Standoff Missile (JASSM)
PROJECT NO. AND NAME 1006 Joint Air-to-Surface Standoff Missile (JASSM)	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget				
(U) Appropriated Value		25,000	207,000	
(U) Adjustments to Budget since FY96 PB				
a. General Congressional Reduction		-489		
b. SBIR		-224		
c. Above Threshold Reprogramming		-517		
(U) Adjustment to Budget Year			-8,368	
(U) Current Budget Submit/President's Budget		23,770	198,632	TBD

(U) Change Summary Explanation:

Funding: JASSM was not adequately defined at the time of the FY96 PB. As JASSM became better defined, Congress added funding for a FY96 program start with Air Force adding funding in the FY97 PB and FYDP. Current FY96 budget reflects the reprogrammings for the Bosnia Bill and F-16's to Jordan.

Schedule: Approved acquisition strategy is for a 24 month PDRR with contracts to be awarded to two contractors in Jun 96. Competitive rolling downselect to one contractor for an EMD phase (length to be proposed by contractors but estimated at 32 months) will follow.

Technical: TBD

(U) **C. Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Missile Procurement					33,976	95,167	93,461		TBD

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0207325F Joint Air-to-Surface Standoff Missile (JASSM)
PROJECT NO. AND NAME 1006 Joint Air-to-Surface Standoff Missile (JASSM)	

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Contract Award							X					
(U) PDRR Phase complete 3QFY98												

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0207325F Joint Air-to-Surface Standoff Missile (JASSM)
PROJECT NO. AND NAME 1006 Joint Air-to-Surface Standoff Missile (JASSM)	

(U) A. Project Cost Breakdown ($ in Thousands)

	FY 1995	FY 1996	FY 1997
(U) Major Contracts		11,803	160,146
(U) Associated Contracts		4,975	12,850
(U) Support Contracts`		4,288	4,866
(U) In-House		1,655	680
(U) Test Support		1,049	20,090
(U) Total		23,770	198,632

(U) B. Budget Acquisition History and Planning Information ($ in Thousands)

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
JASSM Development Contractors	CPFF/CPIF	Jun 96	TBD	545,594			11,803	160,146		TBD
Support and Management Organizations										
F-16 SPO	Misc	TBD		6,600			2,000	3,600	TBD	TBD
B-52 SPO	Misc	TBD		21,400			2,000	8,500	TBD	TBD
Other A/C SPOs	Misc	TBD		48,325			975	750	TBD	TBD
Sverdrup Tech, Inc	Task Order	TBD		7,277			1,097	1,178	TBD	TBD

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0207325F Joint Air-to-Surface Standoff Missile (JASSM)

PROJECT NO. AND NAME: 1006 Joint Air-to-Surface Standoff Missile (JASSM)

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Navy	Misc	TBD		800			800	0	TBD	TBD
JASSM SPO	Misc	TBD		19,755			4,046	4,368	TBD	TBD
Test and Evaluation										
46TW	Misc	TBD		74,631			1,049	12,486	TBD	TBD
AEDC	Misc	TBD		9,282			0	7,604	TBD	TBD

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property: Not Applicable

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Subtotal Product Development						11,803	160,146	TBD	TBD
Subtotal Support and Management						10,918	18,396	TBD	TBD
Subtotal Test and Evaluation						1,049	20,090	TBD	TBD
Total Project						23,770	198,632	TBD	TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0303606F UHF SATCOM (Space)

PROJECT NO. AND NAME: 2932 UHF SATCOM

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2932 UHF SATCOM	13,368	12,571	0	0	0	0	0	*	*

*Note: Project was not terminated - funding for this project was transferred into PE 0303601F (MILSATCOM Terminals) beginning in FY97. See PE 0303601F documentation for total program costs.

(U) A. Mission Description and Budget Item Justification

UHF Satellite Communications is a program to develop, acquire, and field equipment that improves joint interoperability and implements communication channel efficiency improvements. The major development activities support the design and implementation of the Network Control System (NCS), which implements Demand Assigned Multiple Access (DAMA) to convert dedicated communication channels to time-shared channels and to automate channel allocation to users on an on-demand basis. There is also limited development activity associated with satisfying requirements for DAMA-compliant airborne modems. The acquisition strategy is to continue to develop the DAMA NCS under a Small Business and Innovative Research (SBIR) Phase II contract and then to upgrade and field the developed NCS stations under a SBIR Phase III contract. This program is in budget activity 5 - Engineering and Manufacturing Development, because the network controller has yet to be approved for production.

(U) FY 1995
- (U) $405 Support basic activities required for the UHF Satellite Communications program
- (U) $9,999 Develop NCS capability
- (U) $2,964 Conduct airborne DAMA modem test and evaluation
- (U) $13,368 Total

(U) FY 1996
- (U) $327 Support basic activities required for the UHF Satellite Communications program
- (U) $11,570 Develop and complete NCS enhancements required for limited operational capability
- (U) $674 Develop DAMA modem capabilities
- (U) $12,571 Total

(U) FY 1997
- (U) $0 See PE 0303601F

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0303606F UHF SATCOM (Space)

PROJECT NO. AND NAME: 2932 UHF SATCOM

(U) B. Program Change Summary ($ in Thousands)	FY 1995	FY 1996*	FY 1997
(U) Previous President's Budget	20,254	15,568	8,786
(U) Appropriated Value	20,879	13,068	
(U) Adjustments to Appropriated Value			
a. Congressional General Reductions	-228	-497	
b. SBIR	-392		
c. Omnibus and Other Above Threshold Reprogram	-3,512		
d. Below Threshold Reprogrammings	-3,379		
(U) Adjustments to Budget Years Since FY96PB			-8,786
(U) Current Budget Submit/President's Budget	13,368	12,571	0

(U) Change Summary Explanation:

Funding: The funding for this project has been transferred into PE 0303601F (MILSATCOM Terminals) beginning in FY97.

* The FY96 PB amount does not reflect funding reductions that are reserved for other DoD reprogramming needs ($137)

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Aircraft Procurement	6,200	11,627							*
(U) Other Procurement		11,483							*

* Note: See PE 0303601F documentation for total program costs. Other procurement costs are equipment costs only.

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997 *			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Network Control System												
(U) Testing		x---	---	---	---	---	----	---x				
(U) Deliveries								x---	---x			

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0303606F UHF SATCOM (Space)

PROJECT NO. AND NAME: 2932 UHF SATCOM

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997 *			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) DAMA Modem Certification Testing	x---	---	---	---	---	---	---x					
(U) Airborne DAMA Terminal												
(U) Contract Award							x					
(U) Deliveries										x---	---	---
(U) Ground DAMA Terminal Deliveries								x---	---	---	---	---

* Funding for this project has been transferred into PE 0303601F (MILSATCOM Terminals) beginning in FY97. These schedule items will be reflected on the R-2 Exhibit for PE 0303601F.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0303606F UHF SATCOM (Space)

PROJECT NO. AND NAME: 2932 UHF SATCOM

(U) A. Project Cost Breakdown ($ in Thousands)

	FY 1995	FY 1996	FY 1997
(U) Develop Network Control System Capability	9,999		
(U) NCS Enhancements for Limited Operational Capability		11,570	
(U) Airborne Modem Testing	2,964		
(U) Develop DAMA modem capabilities		674	
(U) SPO Operations	405	327	
(U) Total	13,368	12,571	

(U) B. Budget Acquisition History and Planning Information ($ in Thousands)

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
ViaSat	CPAF	Oct 95	N/A	N/A		6,507	7,587		*	*
Miscellaneous	Various	Various	N/A	N/A	14,698	1,929	442		*	*
* Note: See PE 0303601F documentation for total program costs										
Support and Management Organizations										
MITRE	Various	Various	N/A	N/A	5,411	2,843	2,342		*	*
Spt Contractors	Various	Various	N/A	N/A	1,804	1,684	1,873		*	*
Miscellaneous	Various	Various	N/A	N/A	619	405	327		*	*

Test and Evaluation Organizations

Not Applicable.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0303606F UHF SATCOM (Space)
PROJECT NO. AND NAME 2932 UHF SATCOM	

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property	N/A								
Support and Management Property	N/A								
Test and Evaluation Property	N/A								
Subtotal Product Development				14,698	8,436	8,029		*	*
Subtotal Support and Management				7,834	4,932	4,542		*	*
Subtotal Test and Evaluation									*
Total Project				22,532	13,368	12,571		*	*

* Note: See PE 0303601F documentation for total program costs

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604201F Acft Avionics Equipment Development

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	4,674	15,833	18,620	19,353	8,462	4,696	3,071	TBD	TBD
2257 Standard Avionics & JSRC Initiatives	1,220	4,722	1,013	4,630	1,448	1,569	1,669	TBD	TBD
2258 Standard Inertial Navigation Unit	533	623	459	0	0	0	0	TBD	TBD
3264 Standard Flight Data Recorder (SFDR)	704	0	0	0	0	0	0	N/A	N/A
4017 Compass/Attitude & Heading Reference System (C/AHRS)	2,217	0	0	0	0	0	0	N/A	N/A
2050 Joint Helmet-Mounted Cueing System (JHMCS)	0	10,488	17,148	14,723	7,014	3,127	1,402	TBD	TBD

(U) **A. Mission Description and Budget Item Justification**

This program element explores and develops integrated avionics architectures and components which will reduce acquisition and support costs, increase weapon system performance and availability, and foster weapons system interoperability with standard interfaces. This program element is devoted to the demonstration and Engineering and Manufacturing Development (EMD) of integrated avionics architectures and open systems. The scope is both domestic and international. Reliability and Maintainability (R&M) play a major role in the identification of specific development efforts within this element as evidenced by the evolution of the Standard Inertial Navigation Unit (INU) and the Standard Flight Data Recorder. Joint avionics development efforts are pursued through participation in and support of the Joint Service Review Committee (JSRC). Current initiatives include the Embedded Global Positioning System/Inertial Navigation System and the Joint Helmet-Mounted Cueing System. This is budget activity 5 due to the development nature of the effort.

(U) **Acquisition Strategy:**

Acquisition strategy is incorporated at the project level.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY96 PB)	4,680	16,892	23,529	TBD
(U) Appropriated Value	4,824	16,892	23,529	
(U) Adjustments to Appropriated Value				
a. Congressional General Reductions	-53	-329		
b. Below Threshold Reprogramming (BTR)	0	0		
c. Above Threshold Reprogramming (ATR)	0	-295		
d. Small Business Innovative Research (SBIR)	-97	-435		
(U) Adjustment to Budget since FY96PB			-4,909	
(U) Current Budget Submit/President's Budget	4,674	15,833	18,620	TBD

(U) Change Summary Explanation:

Funding: In FY 95 the $53,000 for Congressional reductions was undistributed.
In FY 96 the ATR of $295,000 includes $118,000 for the Bosnia bill and $177,000 for reprogramming for F-16s to Jordan.
In FY 97 the C/AHRS task was reduced by $3.97 million (program terminated in FY96) and JHMCS was reduced by $877,000; Standard Avionics was reduced by $43,000; and Standard INU was reduced by $19,000 (total of $4.909 million).

Schedule: No changes

Technical: No changes

(U) **C. Other Program Funding Summary ($ in Thousands)** Not Applicable

(U) **D. Schedule Profile** See individual projects

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604201F Acft Avionics Equipment Development

PROJECT NO. AND NAME: 2257 Standard Avionics & JSRC Initiatives

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2257 Standard Avionics & JSRC Initiatives	1,220	4,722	1,013	4,630	1,448	1,569	1,669	TBD	TBD

(U) A. Mission Description and Budget Item Justification

This project identifies, demonstrates and/or develops candidate architecture standards and open system modular components for the Air Force and other services through the JSRC. Maintains/updates the common avionics database to promote aircraft interoperability. Supports international avionics initiatives and standardization activities. Develops an opportunity matrix for tactical and airlift programs to identify opportunities to leverage investments. JSRC is a phase 0 concept studies project that explores candidate avionics systems and designs for potential developmental efforts and aircraft interoperability initiatives. One such system is a data link capability for aircraft.

(U) FY 1995

- (U) $ 133 T-38 upgrade
- (U) $ 88 MARK XV (Next generation Identification Friend or Foe (IFF)) close-out support
- (U) $ 391 Avionics Roadmap
- (U) $ 150 Modular Avionics Electronic Cockpit
- (U) $ 170 Logistics Planning & Support
- (U) $ 288 Program Management Support
- (U) $1,220 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 2257 Standard Avionics & JSRC Initiatives	

(U) FY 1996

- (U) $1,400 Continue tri-service standardization opportunities via the Joint Service Review Committee (JSRC) processes
- (U) $1,600 Avionics Technology Transition Efforts
- (U) $1,000 Open Avionics System Architecture Efforts
- (U) $ 300 Continue Avionics Planning Baseline and Database
- (U) $ 422 Program Management Support
- (U) $4,722 Total

(U) FY 1997

- (U) $ 130 Continue tri-service standardization opportunities via the JSRC processes
- (U) $ 170 Open Avionics System Architecture Efforts
- (U) $ 300 Continue Avionics Planning Baseline
- (U) $ 413 Program Management Support
- (U) $1,013 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,129	1,231	1,061	TBD
(U) Appropriated Value	2,510			
(U) Adjustments to Appropriated Value				
a. General Congressional Reduction	-53	-95		
b. Below Threshold Reprogramming	-1,237			
c. Small Business Innovative Research	-97			
(U) Adjustment to Budget since FY96PB		3,586	-48	
(U) Current Budget Submit/President's Budget	1,220	4,722	1,013	TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 2257 Standard Avionics & JSRC Initiatives	

(U) Change Summary Explanation:

Funding: Adjustment in FY 96 for Congressional reductions and a within threshold alignment of $3,586,000 from the Compass/Attitude & Heading Reference System which was terminated in FY 96.
Adjustment in FY 97 covers general O&M and inflation reductions.

Schedule: No changes

Technical: No changes

(U) C. **Other Program Funding Summary ($ in Thousands)** Not Applicable

(U) D. **Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Publish Avionics Planning Baseline	O				O				X			
(U) Demonstrate IMA								X				

O - Completed Effort
X - Planned Effort

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 2257 Standard Avionics & JSRC Initiatives	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Avionics Database	391	300	300
(U) Open Avionics System Architecture Efforts	183	1,000	170
(U) Joint Service Review Committee	179	1,400	130
(U) Program Management Support	297	422	413
(U) Avionics Technology Transition Efforts	170	1,600	0
(U) Total	1220	4,722	1,013

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**: Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604201F Acft Avionics Equipment Development

PROJECT NO. AND NAME: 2258 Standard Inertial Navigation Unit

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2258 Standard Inertial Navigation Unit	533	623	459	0	0	0	0	TBD	TBD

(U) A. **Mission Description and Budget Item Justification**

Develop DoD standard Embedded Global Positioning System (GPS)/ Inertial Navigation System (INS) (EGI) Precise Positioning System (PPS), (0.8 nm/h free inertial) Navigation System for Army's OH-58 Kiowa Warrior, Special Operations, Apache AH-64A+ and AH-64 C/D Apache Longbow helicopters, Navy's AH-1W Super Cobra helicopter, F-18 aircraft, EA-6B aircraft, and Air Force F-15 Eagle. Directly tied to the Congressionally mandated Minimum Avionics Requirement (MAR) capability for DoD aircraft and the Joint Chiefs of Staff (JCS) Radio Navigation Master Plan. Develop enhanced accuracy (0.3 nm/hr) Inertial Navigation Unit (INU) for the F-117A aircraft. Continue development of INU depot Support Equipment (SE) for the Standard Ring Laser Gyro (RLG) program. Embedded GPS/INS efforts resulted from a Tri-service acquisition plan. Program currently is in phase II (Engineering and Manufacturing Development). Contracts were awarded on a full and open basis to Honeywell and Litton Industries.

(U) FY 1995
- (U) $NSP Completed QT&E program
- (U) $NSP Completed Enhanced Accuracy INU testing and integration for F-117A
- (U) $533 Program Management Support
- (U) $533 Total

(U) FY 1996
- (U) $NSP Continue Embedded Global Positioning Satellite (GPS) Inertial Navigation System (INS) (EGI) integration
- (U) $ 90 Engineering Tasks
- (U) $533 Program Management Support.
- (U) $623 Total

(U) FY 1997
- (U) $NSP Conduct follow-on EGI procurement source selection

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 2258 Standard Inertial Navigation Unit	

- (U) $459 Program Management Support
- (U) $459 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	533	533	480	TBD
(U) Appropriated Value	0	533	480	
(U) Adjustments to Appropriated Value				
a. Below Threshold Reprogramming	533	0		
b. Congressional General Reductions		-10		
c. Adjustments to Budget Years since FY95 PB	0	0	0	
(U) Adjustment to Budget since FY96PB		100	-21	
(U) Current Budget Submit/President's Budget	533	623	459	TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 2258 Standard Inertial Navigation Unit	

(U) Change Summary Explanation:

Funding: FY 96 reduced by $10,000 for Congressional cuts and increased by $100,000 (net increase of $90K) for engineering tasks as part of realignment of funds from Compass/Attitude & Heading Reference System.
FY 97 reduced for general O&M and inflation reductions.

Schedule: No changes
Technical: No changes

(U) **C. Other Program Funding Summary ($ in Thousands)** Not applicable

(U) **D. Schedule Profile** (specific FY96-97 activities being planned)

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Complete Risk Reduction test program												
(U) Awarded Tri-service Global Positioning System/ Inertial Navigation Unit (GPS/INU) Contract												
(U) Complete F-117 Testing		O										
(U) Integrate GPS/INU on New Aircraft								X				X
(U) Complete Qualification, Testing, and Evaluation (QT&E)				O								

O - Completed Effort
X - Planned Effort

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 2258 Standard Inertial Navigation Unit	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Engineering Tasks	0	90	0
(U) Program Management Support	533	533	459
(U) Total	533	623	459

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)** Not applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604201F Acft Avionics Equipment Development

PROJECT NO. AND NAME: 3264 Standard Flight Data Recorder (SFDR)

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3264 Standard Flight Data Recorder (SFDR)	704	0	0	0	0	0	0	N/A	N/A

(U) A. Mission Description and Budget Item Justification

A Joint Service Review Committee-sponsored initiative to develop a standard crash survivable flight data recorder for various Air Force aircraft. SFDR contract was awarded in Jul 88 to Smith Industries, Firm Fixed Price (FFP). Program is currently in Phase II, (Engineering, Manufacturing, and Development).

(U) FY 1995
- (U) $604 Completed Test Program Software Development
- (U) $100 Mission Support
- (U) $704 Total

(U) FY 1996
- (U) $0 Program acquisition is completed and transitioning to logistics support depot.

(U) FY 1997
- (U) $0 Program acquisition is completed and transitioning to logistics support depot.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 3264 Standard Flight Data Recorder (SFDR)	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	704	0	0	N/A
(U) Appropriated Value	0	0	0	
(U) Adjustments to Appropriated Value				
a. Below Threshold Reprogramming	704			
(U) Current Budget Submit/President's Budget	704	0	0	N/A

(U) Change Summary Explanation:

Funding: No changes

Schedule: No changes

Technical: No changes

(U) **C. Other Program Funding Summary ($ in Thousands)** Not applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 3264 Standard Flight Data Recorder (SFDR)	

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Integrated Process Team Leadership Transfer												
(U) Data Processing Unit Production Deliveries			O									
(U) TPS Development			O									
(U) MH-53 SFDR Functional Configuration Audit/ Physical Configuration Audit (FCA/PCA)				O								

O - Completed Effort
X - Planned Effort

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 3264 Standard Flight Data Recorder (SFDR)	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Air Force Helicopter Development	0	0	0
(U) Contractor Residual Tasks	0	0	0
(U) Mission Support	100	0	0
(U) Test Program Sets	604	0	0
(U) Total	704		

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)** Not applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604201F Acft Avionics Equipment Development

PROJECT NO. AND NAME: 4017 Compass/Attitude & Heading Reference System (C/AHRS)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4017 Compass/Attitude & Heading Reference System (C/AHRS)	2,217	0	0	0	0	0	0	N/A	N/A

(U) A. Mission Description and Budget Item Justification

Joint Service Review Committee-supported program. Develops functional replacement systems for several existing compass systems and C/AHRS for use in various Air Force and Navy aircraft. Tri-service Memorandum Of Agreement (MOA) includes the Army as potential user. C/AHRS is currently in phase II (Engineering, Manufacturing and Development). Contract awarded to Smith Industries, Cost Plus Firm Fixed Fee (CPFF). C/AHRS will be terminated in FY95 (contract close-out in progress).

(U) FY 1995

- (U) $ 805 Contract Termination.
- (U) $ 903 Completed fabrication of units for flight/qualification/durability testing.
- (U) $ 233 Flight/qualification/durability testing.
- (U) $ 276 Program Management Support.
- (U) $2,217 Total

(U) FY 1996

- (U) $0 Program cancellation and startup of Integrated Avionics Technology and Open Systems Architectures
- (U) $0 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,217	3,686	2,985	TBD
(U) Appropriated Value	2,217	3,686		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 4017 Compass/Attitude & Heading Reference System (C/AHRS)	

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Adjustments to Appropriated Value				
a. Below Threshold Reprogramming				
(U) Adjustments to Budget Years since FY96PB		-3,686	-2,985	
(U) Current Budget Submit/President's Budget	2,217	0	0	TBD

(U) Change Summary Explanation:

Funding: Effort terminated in FY96 and funding realigned in FYs 96-01 to Projects 2257 and 2258 for avionics initiatives. FY97 funds reallocated to other PEs.

Schedule: Project Termination

Technical: Project Termination

(U) C. Other Program Funding Summary ($ in Thousands) Not Applicable

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Test Readiness Review												
(U) Qualification Test												
(U) Maintainibility/Training (M/T) Demo												
(U) DT&E/IOT&E			O									
(U) Incremental Functional Configuration Audit/Physical Configuration Audit (FCA/PCA)			O									
Transition to Advanced Avionics System						O						
Contract Termination					O							

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 4017 Compass/Attitude & Heading Reference System (C/AHRS)	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Primary Hardware Development	1,708		
(U) Developmental Test and Evaluation (DT&E)	233		
(U) Support Equipment Acquisition	0		
(U) Transition New Avionics Systems		-3,686	-2,985
(U) Program Management Support	276		
(U) Total*	2,217	-3,686	-2,985

*Note: FY96 funds realigned to projects 2257 & 2258 for avionics initiatives.

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations: Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604201F Acft Avionics Equipment Development

PROJECT NO. AND NAME: 2050 Joint Helmet-Mounted Cueing System (JHMCS)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2050 Joint Helmet-Mounted Cueing System (JHMCS)	0	10,488	17,148	14,723	7,014	3,127	1,402	TBD	TBD

(U) A. Mission Description and Budget Item Justification

This Joint program with the USN will develop a helmet display system, capable of depicting aircraft heading data, pilots viewing perspective, target indication graphics and digital information. Consolidating this information on the pilot's visor allows the pilot to quickly align sensors and weapons on targets and engage threats using High Off-Boresight Angle (HOBA) weapons such as the AIM-9X. The JHMCS includes a helmet with a mounted visor display capability, a helmet-vehicle interface cable, and several other components. JHMCS is currently in Phase I (Demonstration/Validation).

(U) FY 1996

- (U) $ 2,200 Initiate Interface Design and interface control documentation.
- (U) $ 3,300 Perform integration analysis between the helmet and F-15, F-16, and F-22.
- (U) $ 1,800 Request For Proposal (RFP) Development.
- (U) $ 2,000 Demonstrate prototype/technology concepts for helmet alternatives.
- (U) $ 700 Develop preplanned product improvement plan.
- (U) $ 488 Program Management Support.
- (U) $10,488 Total

(U) FY 1997

- (U) $13,500 Conduct Joint Helmet Mounted Cueing System (JHMCS) EMD contract.
- (U) $ 3,000 Conduct design/demonstration reviews and complete standard interface with F-15, F-16, F-22 & F/A-18.
- (U) NSP Determine maintenance concepts.
- (U) $ 148 Initiate support equipment development.
- (U) $ 500 Program management support
- (U) $17,148 Total

(U) B. Program Change Summary ($ in Thousands)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604201F Acft Avionics Equipment Development

PROJECT NO. AND NAME: 2050 Joint Helmet-Mounted Cueing System (JHMCS)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	11,442	19,003	TBD
(U) Appropriated Value	0	11,442	19,003	
(U) Adjustments to Appropriated Value			0	
a. Congressional General Reductions	0	-224	0	
b. Above Threshold Reprogramming (ATR)		-295	0	
c. SBIR		-435	0	
(U) Adjustments to Budget Years since FY96PB		0	-1,855	
(U) Current Budget Submit/President's Budget	0	10,488	17,148	TBD

(U) Change Summary Explanation: JHMCS is an FY 96 new start.

Funding: FY 96 budget reduced by $0.954 million for Congressional, ATR (Bosnia & F-16s to Jordan) and SBIR actions.
FY97 budget reduced by $1.855 million for O&M ($1.125M) and inflation ($ 0.730M) reductions.

Schedule: No Changes

Technical: No Changes

(U) **C. Other Program Funding Summary ($ in Thousands) Not Applicable**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U)									

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Mission Need Statement (MNS) Receipt												

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 2050 Joint Helmet-Mounted Cueing System (JHMCS)	

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Joint Operational Requirements Document (JORD) Development	O											
(U) Milestone 0 Acquisition Decision Memorandum (ADM)	O											
(U) Milestone I					O							
(U) Request for Proposal (RFP) release							X					
(U) Milestone II (EMD Contract Award)										X		

O - Completed Effort
X - Planned Effort

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604201F Acft Avionics Equipment Development

PROJECT NO. AND NAME: 2050 Joint Helmet-Mounted Cueing System (JHMCS)

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Interface Design and Integration	0	5,500	3,000
(U) Initiate EMD Contract Award	0	0	13,500
(U) RFP Development	0	1,800	0
(U) Helmet Demonstration	0	2,000	0
(U) Program Mangement Support	0	488	500
(U) Studies/Engineering	0	700	148
(U) Total	0	10,488	17,148

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations								
TBD	TBD	2/97	16,648	16,648	0	16,648	Continuing	TBD
Support and Management Organizations								
TBD	TBD	2/97	500	500	0	500	Continuing	TBD
Test and Evaluation Organizations								
TBD	TBD	TBD	TBD	TBD	0	0	Continuing	TBD

(U) **B. Budget Acquisition History and Planning Information Continued ($ in Thousands)**

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604201F Acft Avionics Equipment Development
PROJECT NO. AND NAME 2050 Joint Helmet-Mounted Cueing System (JHMCS)	

Government Furnished Property: TBD

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property									
Support and Management Property									
Test and Evaluation Property									
Subtotal Product Development					8,200	16,648	Continuing	TBD	
Subtotal Support and Management					2,288	500	Continuing	TBD	
Subtotal Test and Evaluation					0	0	Continuing	TBD	
Total Project					10,488	17,148	Continuing	TBD	

(U) C. **Funding Profile ($ in Thousands)** Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604218F Engine Model Derivative Prog

PROJECT NO. AND NAME: 2634 Engine Model Derivative Programs (EMDP)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2634 Engine Model Derivative Programs (EMDP)	739	721	705	747	774	796	808	0	Continuing

(U) A. Mission Description and Budget Item Justification

EMDP is an engineering development program that provides the latest engine technology advances to current weapon systems and provides a framework for engine development for future systems. EMDP contributes to system life extension, reduced life cycle cost, and enhanced performance. Enhanced performance is required to counter increases in system weight and increased threat capability. EMDP demonstrates derivative engine concepts incorporating advanced technology and components from government and contractor funded programs. EMDP demonstrates advances in performance, durability, operability, supportability, reliability, maintainability, and unique capabilities, such as thrust reversing and vectoring nozzles. These demonstrations are in prototype derivatives of existing engines prior to full scale development. Early demonstration of improved engine characteristics significantly reduces risk and shortens engine development and qualification, allowing quick, cost-effective response to weapon system needs. EMDP also evaluates candidate engines (commercial or military) to provide competitive engine opportunities. EMDP ensures the Air Force has propulsion alternatives to meet near- and far-term needs. EMDP plans for and sustains the engineering development necessary to provide increased performance, reduced life cycle cost and system life extension for air breathing engines for current and future systems. This program is in budget activity 5 - Engineering and Manufacturing Development because it applies advanced technology to existing engines to demonstrate possible performance improvements.

(U) FY 1995 ($ in Thousands):

- (U) $ 67 Upgrades for the Engine Optimization Model. This software tool supports all ongoing and future roadmapping studies.
- (U) $ 120 AGM-130 Engine Integration Study. This study is to support ACC and SPD (System Program Director) evaluation of two derivative AGM-130 configurations incorporating Williams International F112 engines. The technical requirements will be coordinated with MQM-107 target requirements to reduce the projected development costs.
- (U) $ 552 C-130J Propulsion Technical Review. This effort supports the C-130 SPO acquisition of the new C-130J aircraft. The study evaluated the new AE2100-D3 commercial engine for the unique military applications and environments.
- (U) $ 739 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604218F Engine Model Derivative Prog
PROJECT NO. AND NAME 2634 Engine Model Derivative Programs (EMDP)	

(U) FY 1996 ($ in Thousands):

- (U) $ 32 Continue/complete the AGM-130 Engine Integration Study.
- (U) $661 C-130E/H Propulsion Roadmapping. This effort will support an ACC and SPD (System Program Director) request to provide and evaluate propulsion options for the C-130 aircraft fleet. Goals will be to address deficiencies identified in Mission Area Plans and to reduce life cycle costs of the C-130 weapon system.
- (U) $ 8 Establish contract vehicles with P&W, GE, Williams, Allison, Teledyne, Sundstrand, Microturbo and Rolls Royce.
- (U) $ 20 Optimization and Effectiveness Model integration. This effort will improve the software tool that is the core of roadmapping studies.
- (U) $721 Total

(U) FY 1997 ($ in Thousands):

- (U) $705 Road mapping Studies - These efforts are intended to assist the aircraft SPDs, engine System Support Managers (SSMs) and the using commands in developing a long term propulsion plan of enhancements, modifications, and upgrades to meet the unique requirements of each system. The F-111F study done in 1993 and the F-15/16 study just completed are examples of this type of program. The road mapping studies will consume the entire EMDP budget (as currently funded) in future years. Examples of candidate systems for evaluation include A-10, B-1, B-52, C-5, F-117, KC-10, KC-135, C-141, and T-38.
- (U) $705 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY96)	739	756	739	Continuing
(U) Appropriated Value	761	756		
(U) Adjustments to Appropriated Value				
a. Cong Gen Reductions	-8	-15		
b. SBIR	-14	-13		
c. Omnibus or Other Above Threshold Reprogram	0			
d. Below Threshold Reprogramming	0			
(U) Adjustments to Budget Years Since FY 1996 PB	0	-7	-34	
(U) Current Budget Submit(FY97)/President's Budget	739	721	705	Continuing

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604218F Engine Model Derivative Prog
PROJECT NO. AND NAME 2634 Engine Model Derivative Programs (EMDP)	

(U) Change Summary Explanation:

Funding: FY97 reduction for inflation.

Schedule: None

Technical: None

(U) C. **Other Program Funding Summary ($ in Thousands):** Not Applicable

Related RDT&E:

(U) - PE # 0603202F, Aircraft Propulsion Subsystem Integration, provides fan and low pressure turbine technology.
(U) - PE # 0603216F, Advanced Turbine Engine Gas Generator, provides compressor, combustor, and high pressure turbine technology.
(U) - PE # 0602203F, Aerospace Propulsion, provides additional component and engine test data.
(U) - PE # 0708011F, Industrial Preparedness Program, provides materials processing and component fabrication demonstration.
(U) - Activities conducted by the Army, Navy, National Aeronautics and Space Administration, and propulsion industry Independent Research and Development (IR&D).
(U) - PE # 0604268F, Aircraft Engine Component Improvement Program, complements EMDP by addressing engine safety problems, service-revealed deficiencies, and improved reliability. This PE will change to #0207268F with submission of the FY97 President's Budget.
(U) - The Air Force and Navy have a broad memorandum of understanding for joint cooperative propulsion programs in areas of common interest.
(U) - There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) D. **Schedule Profile:** The FY96 C-130 Study is expected to begin in May and continue for eight months.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604218F Engine Model Derivative Prog
PROJECT NO. AND NAME 2634 Engine Model Derivative Programs (EMDP)	

(U) A. **Project Cost Breakdown ($ in Thousands)**

C-130 Roadmap study is planned for FY96. Specific FY97 roadmapping studies have not yet been determined.

(U) B. **Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
P & W	FFP/CPFF	8 Mar 96	N/A	N/A	$ 1,231	$ 67	$ 21	$TBD	CONT	CONT
GE	FFP/CPFF	24 Apr 96	N/A	N/A	$ 1,138	$ 0	$ 1	$TBD	CONT	CONT
Williams Int'l	FFP/CPFF	28 Feb 96	N/A	N/A	$ 215	$ 120	$ 33	$TBD	CONT	CONT
Allison	FFP/CPFF	28 Feb 96	N/A	N/A	$ 594	$ 552	$ 662	$TBD	CONT	CONT
Teledyne CAE	FFP/CPFF	5 Feb 96	N/A	N/A	$ 2,882	$ 0	$ 1	$TBD	CONT	CONT
Allied Signal	FFP/CPFF	N/A	N/A	N/A	$ 186	$ 0	N/A	N/A	CONT	CONT
Sundstrand	CPFF	8 Mar 96	N/A	N/A	N/A	N/A	$ 1	$ 0	CONT	CONT
Microturbo	CPFF	2 May 96	N/A	N/A	N/A	N/A	$ 1	$ 0	CONT	CONT
Rolls Royce	CPFF	21 May 96	N/A	N/A	N/A	N/A	$ 1	N/A	CONT	CONT
Total					$ 6,246	$ 739	$ 721	$ 705	CONT	CONT

Support and Management Organizations: Not applicable.

Test and Evaluation Organizations: Not applicable.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604218F Engine Model Derivative Prog
PROJECT NO. AND NAME 2634 Engine Model Derivative Programs (EMDP)	

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604222F Nuclear Weapons Support

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	5,503	4,550	4,788	4,781	4,726	4,901	4,918	Continuing	Continuing
4236 Engineering Analysis	1,204	688	726	721	712	755	740	Continuing	Continuing
5708 Nuclear Weapons Support	4,299	3,862	4,062	4,060	4,014	4,146	4,178	Continuing	Continuing

(U) A. **Mission Description and Budget Item Justification**

Provides funds for maintaining core USAF nuclear weapon system expertise. Includes in-house technical capabilities, contractual efforts, supplies and equipment, travel and salaries of the San Antonio Air Logistics Center, Nuclear Weapons Directorate, Nuclear Weapons Integration Division's civilian and military nuclear weapon specialists at Kirtland Air Force Base. Provides technical guidance for continued and improved weapons capability, interoperability, safety, surety, security, development, stockpile management and retirement. Customers are: DoD (Air Force, Navy and Defense Nuclear Agency [DNA]), DOE and NATO. Supports US Strategic Command and Air Combat Command Required Operational Capability 16-71 (Peacekeeper), 12-76 (Air Launched Cruise Missile), 6-76 (B61 Strategic Bomb), 6-69 (B83 Modern Strategic Bomb), and SAC System Operational Requirements Document 13-82-III (Advanced Cruise Missile). Air Force representative for development and implementation of the Joint DoD-DOE Surety Plan. This plan documents nuclear weapon issues which benefit from the application of risk assessment, data collection, and model development. The Nuclear Weapons Integration Division is responsible for all USAF nuclear weapons development, systems engineering, nuclear surety engineering, engineering analyses and weapons support procedure changes. These efforts place this project in RDT&E research category/budget activity, Engineering and Manufacturing Development. This work is tied to the DOE nuclear weapons development process independent of the DoD acquisition system. Weapons are always undergoing some form of RDT&E to continually assure safety and reliability as the DoD restructures the nation's nuclear stockpile. Therefore, USAF platforms require continuing engineering development and analysis to ensure compatibility and safety of nuclear systems. Funding this element is essential to maintaining current safety and reliability levels in the US nuclear stockpile.

(U) **Acquisition Strategy:** Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604222F Nuclear Weapons Support

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	5,609	4,822	4,855	Cont
(U) Appropriated Value	5,637	4,822		
(U) Adjustments to Appropriated Value				
(U) a. Congressional and Undistributed Reductions	-28	-94		
(U) b. SBIR	-106	-113		
(U) c. Omnibus or Above Threshold Reprogramming		-65		
(U) d. Below Threshold Reprogramming (BTR)				
(U) Adjustments to Budget Years Since FY96 PB			-67	
(U) Current Budget Submit/President's Budget	5,503	4,550	4,788	Cont

(U) Change Summary Explanation:

Funding: Decrease in funding for FY97 and beyond due to inflation (non-pay, military/civilian pay and military/civilian inflation).

* The FY96 PB amount does not reflect funding reductions that are reserved for other DoD reprogramming needs ($50)

Schedule:

Technical:

(U) **C. Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Not Applicable									

Related RDT&E:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604222F Nuclear Weapons Support

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

(U) PE0603851F, ICBM Modernization Dem/Val; PE0604851F, ICBM Modernization EMD.
(U) PE0101122F, Air Launched Cruise Missile; PE 0101120F, Advanced Cruise Missile (ACM).
(U) PE0101113F, B-52 Squadrons.
(U) PE0101126F, B-1B Squadrons; PE0604240F, B-2 Advance Technology Bomber, PE0101127F, B-2 Squadrons.
(U) PE0207130F/0207134F, F-15 A-D Squadrons, F-15E Squadrons.
(U) PE0207590F SEEK EAGLE.

(U) D. Schedule Profile

Technical Capabilities Maintained For:	FY 1995				FY 1996				FY 1997			
Enduring Stockpile Weapons	1	2	3	4	1	2	3	4	1	2	3	4
(U) - B53 Strategic Bomb												
(U) - W80-1 (ALCM, ACM)												
(U) - B61-7, B83 (Strategic Bombs)	(Stockpile Data, i.e., IOC, retirement dates, etc. are classified)											
(U) - B61-3, 4, 10 (Tactical Bombs)												
(U) - W62,W78, W87 (Minuteman III & Peacekeeper)												
Weapons only in Inactive Stockpile (In Storage)												
(U) - W84 (GLCM)												
Weapons Scheduled for Retirement												
(U) - W69 (SRAM A)[1]												
(U) - W56 (Minuteman II)												
(U) - B61-0,2,5 (Strategic Bombs)												

Note: Weapons remain in USAF custody pending DOE scheduling for shipment and dismantlement.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604222F Nuclear Weapons Support

PROJECT NO. AND NAME: 4236 Engineering Analysis

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4236 Engineering Analysis	1,204	688	726	721	712	755	740	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification**

Funds the engineering analysis performed on contract for all new and fielded nuclear weapon systems. Contractors provide technical expertise unavailable through organic resources in critical areas of nuclear weapons safety and security. Projects and fund allocations have been adjusted to better accommodate reduced funding levels in future years.

(U) FY 1995

- (U) $295 Nuclear Aircraft System Support. Analyzed the Aircraft Monitor and Control (AMAC) software for the F-16 software upgrades and provided technical expertise for continued nuclear weapons integration on US and non-US aircraft systems; formatted nuclear weapons loading, delivery, warhead mate and demate technical orders; supported the nuclear hardness data base; and continued development of computer-aided logistics interconnectivity between the Air Force and DOE for the Joint Nuclear Weapons Publication System (JNWPS).
- (U) $659 Nuclear Weapons Program Support. Provided technical expertise to support development, fielding and updates of nuclear weapons stockpile-to-target sequences (STS); completed five program STS revisions; documented and supported weapon safety analyses; documented and supported all weapon program actions, agreements, and program status; and provided technical support on accident resistant shipping containers, use control, long-term storage and dismantlement to weapon Lead Project Officers; completed assessments on aging, inactive stockpile, containers and storage.
- (U) $250 Nuclear Weapons/Systems Assessments. Provided technical assessments and support on nuclear safety analyses for B-52, W80, ALCM and ACM systems and special studies including support of Phase 2 KUMSC door seal analysis.
- (U) $1,204 Total

(U) FY 1996

- (U) $200 Nuclear Aircraft System Support. Revise and verify nuclear weapons loading, delivery, warhead mate and demate technical orders; provide support on the nuclear hardness database; provide AMAC software analysis as required and technical expertise for continued nuclear weapons integration on US and non-US aircraft systems; continue to support development of USAF-DOE interconnectivity to JNWPS.
- (U) $288 Nuclear Weapons Program Support. Provide technical expertise to support development, fielding and updates of nuclear weapon stockpile-to-target sequences; document and support all weapons safety analyses; document and support all weapon program actions, agreements, and program status; provide technical support on accident resistant shipping containers, use control, long-term storage, life extension and

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604222F Nuclear Weapons Support
PROJECT NO. AND NAME 4236 Engineering Analysis	

dismantlement issues to weapon Lead Project Officers.

- (U) $200 Nuclear Weapons/Systems Assessments. Provide technical assessments and support on nuclear safety analyses and limited special studies.
- (U) $688 Total

(U) FY 1997

- (U) $210 Nuclear Aircraft System Support. Revise and verify nuclear weapons loading, delivery, warhead mate and demate technical orders; provide support on the nuclear hardness database; and provide technical expertise for continued nuclear weapons integration on US and non-US aircraft systems.
- (U) $306 Nuclear Weapons Program Support. Provide technical expertise to support development, fielding and updates of nuclear weapon stockpile-to-target sequences; document and support all weapons safety analyses; document and support all weapon program actions, agreements, and program status, provide technical support on inactive stockpile issues, use control, long term storage, life extension and dismantlement issues to weapon Lead Project Officers.
- (U) $210 Nuclear Weapons/System Assessments. Provide technical assessments and support on nuclear safety analyses and limited special studies.
- (U) $726 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,204	710	761	Cont
(U) Appropriated Value	1,204	710		
(U) Adjustments to Appropriated Value				
(U) a. Congressional and Undistributed Reductions		-13		
(U) b. Omnibus or Above Threshold Reprogramming		-9		
(U) Adjustments to Budget Years Since FY96 PB			-35	
(U) Current Budget Submit/President's Budget	1,204	688	726	Cont

(U) Change Summary Explanation:
Funding: Decrease in funding for FY97 and beyond due to non-pay inflation.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604222F Nuclear Weapons Support
PROJECT NO. AND NAME 4236 Engineering Analysis	

Schedule: N/A

Technical: N/A

(U) C. **Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Not Applicable									

(U) D. **Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Not Applicable												

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604222F Nuclear Weapons Support
PROJECT NO. AND NAME 4236 Engineering Analysis	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Contractor Engineering Support	1,204	688	726
(U) Total	1,204	688	726

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Miscellaneous		NA	NA	NA	Cont	1,204	688	726	Cont	Cont
DOE/ALO, Albuquerque, NM										
TECH REPS, Inc., Albuquerque, NM										
Orion International, Albuquerque, NM										
Naval Air Warfare Center, Indianapolis, IN										
Oklahoma City Air Logistics Center, Tinker AFB, OK										
Silicon Graphics, Albuquerque, NM										
Support and Management Organizations										
None										
Test and Evaluation Organizations										
None										

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604222F Nuclear Weapons Support
PROJECT NO. AND NAME 4236 Engineering Analysis	

(U) **B. Budget Acquisition History and Planning Information Continued ($ in Thousands)**

Government Furnished Property: Not Applicable

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property									
Support and Management Property									
Test and Evaluation Property									
Subtotal Product Development					688	726	LOE	Cont	
Subtotal Support and Management									
Subtotal Test and Evaluation									
Total Project					688	726	LOE	Cont	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604222F Nuclear Weapons Support

PROJECT NO. AND NAME: 5708 Nuclear Weapons Support

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
5708 Nuclear Weapons Support	4,299	3,862	4,062	4,060	4,014	4,146	4,178	Continuing	Continuing

(U) **A. Mission Description and Budget Item Justification**

Funds San Antonio Air Logistics Center, Nuclear Weapons Integration Division's civilians at Kirtland AFB, New Mexico providing technical and engineering support for all new and fielded USAF nuclear weapon systems. Projects and fund allocations have been adjusted to better accommodate reduced funding levels in future years.

(U) FY 1995

- (U) $1,280 Nuclear Aircraft System Support. Supported the F-111E/F and the B-52H USAF Nuclear Weapon System Safety Group (NWSSG) Operational Safety Reviews (OSRs); conducted independent nuclear surety evaluations and made nuclear safety design certification recommendations on new and modified nuclear aircraft systems; assumed management of the F-15E Nuclear Project Officers Group and continued management of the B-52H Nuclear Project Officers Group; generated, coordinated and executed an F-15E Aircraft Monitor and Control (AMAC) test in support of a major version change of the F-15E Operational Flight Program (OFP); conducted AMAC tests on the F-16C/D Block 30 SCU-2 and on the F-16A/B 15Z2; coordinated B61 development tests for the B61-3/4 Alt 335 and B61-11; conducted a B-1B Block 4.7 software AMAC test; developed an Aircraft Weapons System Nuclear Certification Process Document; completed the B-2A Technical Nuclear Safety Analysis Report and briefed recommendations during the NWSSG B-2A Preoperational Safety Study; conducted the B-2A "Five Aircraft" AMAC test; performed engineering analyses required for nuclear weapon compatibility certification on aircraft systems; continued to support the B-52H Weapon System Safety Assessment; continued C-17 nuclear safety certification efforts; provided technical support for efforts to upgrade the use control devices on the strategic weapon systems; and completed/published MIL-STD 1822, Nuclear Certification of Weapon Systems, Subsystems, and Associated Facilities and Equipment.
- (U) $729 Nuclear Ground-Launched Missile Support. Supported START I and START II treaties, provided nuclear surety design criteria interpretations and guidance to ICBM program office/contractors for weapon system modifications (Rapid Execution and Combat Targeting [REACT], Minuteman III Guidance Replacement Program [GRP], Single Reentry Vehicle [SRV] program, Airborne Launch Control System [ALCS] transition to the Navy E6B Aircraft Program, upgrade programs, and Code Processing System); performed safety analyses and independent evaluations for nuclear safety design certification of weapon system modification; conducted the Technical Nuclear Safety Analysis of REACT modification to Minuteman III (WS-133B Weapon System) and briefed recommendations during the USAF NWSSG Special Safety Study; and supported the ALCS NWSSG Operational Safety Review.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604222F Nuclear Weapons Support
PROJECT NO. AND NAME 5708 Nuclear Weapons Support	

–	(U) $1,320	Nuclear Weapons Program Support. Completed and documented HPRF Phase 2 study; completed inactive stockpile and aging assessments for all AF weapons; established ICBM warhead database for force structure management; completed Safety Enhanced Reentry Vehicle (SERV) Options Study and initial certification; initiated ICBM extended life assessments; approved W62/W78/W87/W80/B61 STS revisions; initiated and approved B83 support equipment upgrade; accomplished nuclear weapon safety and compatibility studies; supported USAF nuclear weapon stockpile activities (B83 Mod 1, B53 JTA reliability, B61 Flight Test Program); examined W80 environments and finalized W80 Credible Abnormal Environment Combinations package; initiated and managed B61 radar and PAL encryption upgrades; supported non-proliferation technology studies; assisted in initiation of the Agent Defeat Concept Study; supported DOE phase 1 and 2 studies and joint DoD/DOE special studies including initiation of the B61-11 program; supported environmental and intrinsic radiation studies; continued support to USAF, DoD and other agencies in all facets of nuclear arsenal; provided the AFMC member to the USAF NWSSG for six major surety activities involving Airborne C2, Minuteman, F-111, B-52, B-2 and nuclear weapon logistics and retirement reviews.
–	(U) $970	Nuclear Weapons/Systems Assessments. Continued to develop joint DoD/DOE nuclear surety assessment methodology; conducted fault tree analyses of W80 Inadvertent Nuclear Detonation study and for other nuclear weapons and weapons systems; initiated the Agent Defeat Concept Study for HQ Air Combat Command; provided other special assessments as required; and assisted HQ DNA in B-52 Weapon System Safety Assessment.
–	(U) $4,299	Total
	(U) FY 1996	
–	(U) $1,060	Nuclear Aircraft System Support. Reduce FY 1995 level of effort: continue support to US Strategic Command's nuclear safe escape effort; include B-2A in nuclear hardness database; support NWSSG action items and Operational Safety Reviews as capable; perform nuclear safety certification assessments; conduct nuclear safety analyses; support design, development, standardization and procurement of stores management system for nuclear weapons command and control; provide nuclear surety design criteria, standards specifications and related requirements documents for all USAF nuclear-capable aircraft weapon systems; continue C-17 nuclear safety efforts; manage the B-52H and F-15E Nuclear Project Officers Groups; and perform an independent analysis of B-2A block 20 software. Cancel planned Aircraft Monitor and Control Test.
–	(U) $700	Nuclear Ground-Launched Missile Support. Reduce FY 1995 level of effort: continue to support START I and START II treaties; Provide technical nuclear safety design and evaluation for all ground-launched missile systems; provide nuclear surety design criteria interpretations and guidance to ICBM program office/contractors for weapon system modifications (Rapid Execution and Combat Targeting [REACT], Minuteman III Guidance Replacement Program [GRP,] Single Reentry Vehicle [SRV] program, Airborne Launch Control System [ALCS] transition to the Navy E6B Aircraft Program, upgrade programs, and Code Processing System); perform safety analyses and independent evaluations for nuclear safety design certification of weapons system modifications; support NWSSG action items, Special Safety Studies, and Operational Safety Reviews as capable.
–	(U) $1,152	Nuclear Weapons Program Support. Continue FY 1995 level of effort: accomplish nuclear weapon safety and compatibility studies, support

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604222F Nuclear Weapons Support
PROJECT NO. AND NAME 5708 Nuclear Weapons Support	

environmental and intrinsic radiation studies; continue the B61-11 Program; continue support to USAF, DoD and other agencies in all facets of nuclear arsenal; continue to manage the B53, B61, W80, B83, W84, and the ICBM warheads Nuclear Project Officers Groups; initiate a study to develop a nuclear weapons roadmap: assess all components/subassemblies to determine current status, anticipated age-related degradation problems, estimated replacement need dates, and likely problems due to sunset technology and changes in the DOE production complex.

- (U) $950 Nuclear Weapons/Systems Assessments. Reduce FY 1995 level of effort: continue to develop joint DoD/DOE nuclear surety assessment methodology; conduct fault tree analyses of nuclear weapons systems; begin W78/W87 assessments and continue Agent Defeat Concept studies;downscale Kirtland Underground Munitions Storage Complex (KUMSC) study; provide other special assessments as capable.
- (U) $3,862 Total

(U) FY 1997

- (U) $1,100 Nuclear Aircraft System Support. Continue FY 1996 level of effort: continue support to US Strategic Command's nuclear safe escape effort; complete adding B2A to nuclear hardness database; support NWSSG action items and Operational Safety Reviews as capable; perform nuclear safety certification assessment; conduct nuclear safety analysis; support design, development, standardization and procurement of stores management system for nuclear weapons command and control; provide nuclear surety design criteria, standards specifications and related requirements documents for all USAF nuclear-capable aircraft weapon systems; and perform an independent analysis of B-2A block 30 software. Cancel planned Aircraft Monitor and Control Test.
- (U) $782 Nuclear Ground-Launched Missile Support. Continue FY 1996 level of effort: continue to support START I and START II treaties; provide nuclear surety design criteria standards specifications and related requirements documents for all USAF ground-launched missile systems; perform safety analyses and independent evaluations for nuclear safety design certification of weapons system modifications; support NWSSG safety studies.
- (U) $1,188 Nuclear Weapons Program Support. Continue FY 1996 level of effort: accomplish nuclear weapon safety and compatibility studies, support USAF nuclear weapon stockpile activities and weapon use control analysis techniques; support non-proliferation technology studies; support environmental and intrinsic radiation studies; continue the Nuclear Weapons Capability Assessment to develop a weapons roadmap; continue B61-11 Program; continue support to USAF, DoD and other agencies in all facets of nuclear arsenal.
- (U) $992 Nuclear Weapons/Systems Assessments. Continue FY 1996 level of effort: extend completion of Agent Defeat Concept phase 0 studies into FY98; complete KUMSC study; continue to develop joint DoD/DOE nuclear surety assessment methodology; conduct fault tree analyses of nuclear weapons and weapon systems; provide other special assessments as capable.
- (U) $4,062 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604222F Nuclear Weapons Support

PROJECT NO. AND NAME: 5708 Nuclear Weapons Support

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,405	4,112	4,094	Cont
(U) Appropriated Value	4,433	4,112		
(U) Adjustments to Appropriated Value				
a. Congressional and Undistributed Reductions	-28	-81		
b. SBIR	-106	-113		
c. Omnibus or Above threshold Reprogramming		-56		
(U) Adjustments to Budget Years Since FY96 PB			-32	
(U) Current Budget Submit/President's Budget	4,299	3,862	4062	Cont

(U) Change Summary Explanation:

Funding: Decrease in funding for FY97 and beyond due to inflation (military/civilian pay and military/civilian inflation).

Schedule: N/A

Technical: N/A

(U) **C. Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Not Applicable									

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Not Applicable												

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604222F Nuclear Weapons Support
PROJECT NO. AND NAME 5708 Nuclear Weapons Support	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Program Management Personnel	240	234	234
(U) Research Personnel	2,712	2,720	2,870
(U) Travel	300	300	275
(U) Training Development	150	100	150
(U) Research Support Equipment Acquisition	400	145	125
(U) Miscellaneous	497	363	408
(U) Total	4,299	3,862	4,062

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
SA-ALC/NWI	Appr	N/A	N/A	N/A	Cont	4,299	3,862	4,062	Cont	Cont
Support and Management Organizations										
None										
Test and Evaluation Organizations										
None										

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604222F Nuclear Weapons Support
PROJECT NO. AND NAME 5708 Nuclear Weapons Support	

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property: Not Applicable

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property									
Support and Management Property									
Test and Evaluation Property									
Subtotal Product Development				Cont	3,862	4,062	Cont	Cont	
Subtotal Support and Management									
Subtotal Test and Evaluation									
Total Project				Cont	3,862	4,062	Cont	Cont	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	75,702	189,527	220,932	202,133	202,580	181,922	73,879	191,552	1,466,493
1019 ECM Improvements	2,464	9,890	43,438	58,522	65,602	76,006	0	161,280	435,019
1020 AFMSS	0	10,283	10,847	11,979	0	0	0	0	33,109
1021 B-1 Simulator	0	6,752	4,875	5,570	4,600	6,042	13,724	27,484	69,047
4143 Conventional Weapons Upgrade	73,238	162,602	161,772	126,062	132,378	99,874	60,155	2,788	929,318

(U) **A. Mission Description and Budget Item Justification**

(U) With the drawdown of forward-based US ground, naval, and tactical air forces, current defense strategy calls for long range, conventionally armed strategic bombers to play a major role in the initial stages of a regional contingency. The 95 B-1B Lancers in the Air Force inventory will constitute one-half of all US strategic bombers -- making it the centerpiece of the conventional bomber force well into the next century. To maximize its contribution in this role, the Air Force must enhance the B-1's capability to perform precision attacks against moderately defended targets deep in enemy airspace. The needed enhancements fall primarily into two categories: improved lethality through integration of advanced conventional weapons, and improved survivability through upgrades to the electronic countermeasures (ECM) system. The Air Force established the Conventional Mission Upgrade Program (CMUP) to fulfill these requirements.

(U) This Program Element provides RDT&E funding for CMUP. The program completed integration of Cluster Bomb Units (CBUs) in FY95. Funding in the FYDP covers integration of the Joint Direct Attack Munition (JDAM), Wind Corrected Munitions Dispenser (WCMD), and Joint Stand-Off Weapon (JSOW), as well as upgrades to the existing ECM suite. Parallel and complimentary enhancements include an upgrade to the avionics computers to provide growth capability and reduce support costs, development of an interface to the Air Force standard mission planning system for more effective employment of the B-1 in a theater scenario, and upgrades to the air crew and maintenance training systems to keep them consistent with the aircraft's configuration. The FY97 program includes work in Research Category/Budget Activity Engineering and Manufacturing Development, and is divided into four Projects as follows:

(U) **Project 1019:** The existing ECM system was designed and optimized to support the strategic nuclear mission (i.e., low altitude penetration against specific air defense threats). The Defensive Systems Upgrade Program (DSUP) provides for Electronic Countermeasures (ECM) improvements needed to support B-1 conventional operations at medium to high altitudes in low to medium threat environments. The B-1 needs survivability enhancements in this regime to maximize effectiveness of the weapons capabilities provided under Project 4143. The DSUP has been restructured as an incremental program -- matching specific ECM

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B

improvements to mission requirements based on priority threats at discrete points in time. Priority threats will be those which Air Combat Command has determined are most critical to counter in a typical B-1 mission supporting Defense Planning Guidance scenarios. These defensive system enhancements will concentrate on three areas: situational awareness, countermeasures effectiveness and reliability and maintainability.

(U) **Project 1020:** This project provides improved B-1 mission planning capabilities by adding an aircraft specific software module to the ongoing Air Force Mission Support System (AFMSS) program. Automated mission planning systems traditionally have been developed and deployed by individual Air Force operating commands to support their assigned aircraft and weapons systems. The Air Force is now transitioning to a standard system, the AFMSS. While AFMSS provides common mission planning capabilities for all aircraft, the aircraft, weapons, and electronics (A/W/E) hardware and software on each type aircraft provide unique interfaces and functionality not provided by the AFMSS "core" system. This project provides those aircraft unique interfaces; the B-1 A/W/E module will supplement the AFMSS core capabilities to achieve enhanced route planning, penetration, and weapons delivery capabilities. AFMSS replaces an aging mission planning system which is no longer fully supportable and does not meet current mission requirements. This A/W/E module will be developed concurrently with the AFMSS core software and the B-1 operational flight programs.

(U) **Project 1021:** This project provides updates to the existing training system necessary to match changes made to the aircraft described in the other projects. The total B-1 Training System (TS) consists of the Simulator System (SS) to train air crew members and Maintenance Training Equipment (MTE) to train maintenance personnel. The SS is actually a suite of systems which provides the necessary visual, motion, and aural cues for complete ground training of B-1 air crew members -- there are five Weapon System Trainers, five Cockpit Procedure Trainers, two Mission Trainers and one Training System Support Center (TSSC). The TSSC includes the computational system resources required to support software, hardware, and firmware changes. The MTE provides maintenance training for simulation of fault isolation and removal/replacement of all B-1 aircraft systems. The MTE, also a suite of systems, includes eight Avionics/Armament Maintenance Training Systems, 10 Simulator Maintenance Training Systems, one Primary/Secondary Flight Control System Maintenance Trainer and one TSSC to support software, hardware, and firmware changes.

(U) **Project 4143:** The Conventional Weapons Upgrade Program (CWUP) improves the B-1's effectiveness in conventional operations by integrating advanced conventional weapons. Specific enhancements include integration of CBUs (an ACAT III Program, EMD completed in FY95), Wind Corrected Munitions Dispenser (WCMD) kits (ACAT III), JDAM (ACAT ID), JSOW (pre-MDAP), and aircraft enhancements necessary to carry these weapons. Aircraft enhancements included under the JDAM integration effort are an anti-jam secure-voice radio (communications upgrade) for improved interoperability with other theater forces, a Mil-Std-1760 electrical interconnection system which provides a common interface between aircraft and precision weapons, a Global Positioning System (GPS) receiver for providing position updates to precision weapons (also satisfies congressional direction for navigation enhancements), and an upgraded avionics computer suite to handle the advanced weapons requirements and significantly improve computer reliability and maintainability. This project also includes preliminary engineering and planning studies for potential future weapons system enhancements and for weapon system operational support improvements as well as the Live Fire Test and Evaluation.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B

(U) **Acquisition Strategy:**

(U) These major upgrades will be accomplished during three phases and integrated in conjunction with ongoing sustainment block upgrades. RDT&E work on Phase I, "Enhanced Capability," contains the Block C CBU upgrade (EMD completed in FY95). Phase II, "Near Precision Capability," contains both Block D (GPS/Comm Navigation Management System, JDAM, and Mil-Std-1760 integration) and Block E (computer and WCMD upgrades). Phase III, "Standoff Capability," contains the Block F DSUP integration upgrade and the Block G JSOW integration upgrade. Rockwell, International is the integrating contractor for all major aircraft upgrades. AFMSS and training system upgrades will be released periodically during Phases I, II, and III.

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Current President's Budget	75,920	173,838	150,620	1,624,963
(U) Appropriated Value	74,119	202,438		1,659,483
(U) Adjustments to Appropriated Value				
a. Undistributed Reductions	-806	-3,963		-9,477
b. SBIR	-1,392	-4,761		-7,802
c. Omnibus or Other Above Threshold Reprogramming		-4,187		-4,187
d. Below Threshold Reprogramming	+3,781			+3,013
(U) Adjustments to Budget Years Since FY96 PB			+70,312	-174,537
(U) Current Budget Submit/President's Budget	75,702	189,527	220,932	1,466,493

(U) Change Summary Explanation:

(U) Funding: See Project Level R-2 Exhibits.

(U) Schedule: See Project Level R-2 Exhibits.

(U) Technical: See Project Level R-2 Exhibits.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B

(U) C. **Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) PE 0101126F, Aircraft Procurement (B-1); BP11, Modifications (CMUP-related only)	10,300	16,800	22,300	60,000	76,800	86,500	72,000	570,900	915,700
(U) PE 0101126F, Other Procurement (B-1)				481					481
(U) PE 0208006F, RDT&E, AFMSS	2,550	*	*	*	*	*	*	*	3,920
(U) PE 0208006F, Operations and Maintenance (AFMSS)			500	1,500	1,500				3,500
(U) PE 0604270F, EW Development			28,400	5,200	1,000	900	0	0	35,500

(U) *NOTE: FY94 and FY95 activities in support of B-1 were funded under the AFMSS program. FY96 and beyond activities funded by B-1.

Related RDT&E:

(U) Program Element #0205164F, Global Positioning System (GPS)
(U) Program Element #0604618F/N, Joint Direct Attack Munition (JDAM)
(U) Program Element #0604727F/N, Joint Stand-Off Weapon (JSOW)
(U) Program Element #0604604F, Wind Corrected Munitions Dispenser (WCMD)
(U) - Funding will move into Program Element #0604600F, Wind Corrected Munitions Dispenser (WCMD), in FY96
(U) Program Element #0208006F, Air Force Mission Support System (AFMSS)
(U) Program Element #0207130F, F-15 (Contributes to simulator IVACC).
(U) Program Element #604270F, Electronic Warfare (EW) Development
(U) Program Element #305164F, Global Positioning System (GPS)

(U) D. **Schedule Profile**

(U) See Project Level R-2 Exhibits

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 1019 ECM Improvements

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1019 ECM Improvements	2,464	9,890	43,438	58,522	65,602	76,006	0	161,280	435,019

(U) A. Mission Description and Budget Item Justification

(U) The B-1's expanding conventional mission requires improved ECM capabilities for enhanced survivability at medium to high altitudes in modern air defense environments. The Defensive System Upgrade Program (DSUP) is being restructured as an incremental upgrade program, matching specific ECM improvements to mission requirements based on priority threats at discrete points in time. Priority threats will be those which Air Combat Command has determined are most critical to counter in a typical B-1 mission supporting Defense Planning Guidance (DPG) scenarios. Project 1019 provides RDT&E funding for improved B-1 ECM capabilities to address current deficiencies in situational awareness, jamming effectiveness, and reliability and maintainability.

(U) Acquisition strategy: The original acquisition strategy for DSUP called for a pre-EMD risk reduction phase, in which the Air Force would refine system requirements and an integrating contractor, supported by up to four subcontractors, would demonstrate potential system solutions. The contractor would then make a selection from among these candidate solutions and proceed into EMD. This strategy was initiated in FY93, with risk reduction planning leading up to development of an RFP by the prime contractor. Responding to Congressional restrictions in FY94, the Air Force stopped work on the ECM project except for completing studies underway to support the Cost and Operational Effectiveness Analysis (COEA). With additional cuts in FY95 and FY96, the program became unexecutable. In response, ACC requested the acquisition community develop an incremental upgrade strategy which would introduce capability enhancements as soon as possible given a prudent acquisition strategy. RDT&E work in FY95, 96, and 97 supports this new strategy and will focus on four activities:

(U) - Translate ACC operational requirements into detailed system engineering requirements.

(U) - Define the revised acquisition strategy through the Integrated Acquisition Strategy Panel (IASP) process. This will include an assessment of whether the Navy Integrated Defensive Electronic Countermeasures (IDECM) provides a cost-effective, viable solution for some or all of the B-1's requirements (this assessment is funded in a separate PE).

(U) - Fund the integrating contractor to develop an RFP to select an EMD subcontractor, complete System Requirements Review and System Functional Review prior to awarding an EMD contract.

(U) - Award an EMD contract in FY97 after a Milestone II decision.

(U) Contractual work in FYs 95 and 96 is executed via a Contract Change Proposal (CCP) to the existing CMUP "Phase IIA" contract. Once the integrating contractor selects a subcontractor, the Air Force will award a new, sole-source, cost-plus-award fee contract for EMD. Rockwell International is the integrating contractor for all aircraft upgrades.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 1019 ECM Improvements	

(U) B-1 ECM capability will be significantly enhanced in the near term with integration of the ALE-50 towed decoy. This system is currently under development and integration, which is funded in PE 0604270F, Electronic Warfare Development. The first DSUP increment will be fielded as part of CMUP Block F. It will capitalize on the capabilities provided by the ALE-50.

(U) Government organizations responsible for various development efforts include: the B-1 System Program Office (SPO) at ASC, Wright-Patterson AFB, OH; Oklahoma City Air Logistics Center (OC-ALC), Tinker AFB, OK; Warner Robins Air Logistics Center (WR-ALC), Robins AFB, GA; Air Force Flight Test Center, Edwards AFB, CA; Air Force Developmental Test Center (AFDTC), Eglin AFB, FL; and Air Force Operational Test and Evaluation Center (AFOTEC).

(U) The FY97 program is categorized as research category 6.5 (EMD). The B-1 is an operational weapon system; this ongoing development program upgrades its conventional capabilities.

(U) FY 1995

– (U)	$976	Risk reduction and planning for EMD for incremental upgrade program
– (U)	$250	Two SETA personnel to support additional EMD workload
– (U)	$808	Risk Reduction testing, demonstration, and planning in preparation for start of EMD
– (U)	$430	Mission support/other
– (U)	$2,464	Total

(U) FY 1996

– (U)	$5,996	Start systems engineering process to translate top-level system requirements into lower-level requirements, reduce program schedule risk, and accelerate entry into EMD
– (U)	$1,992	Begin development of a draft RFP for a new contract to be awarded in FY97
– (U)	$662	Mission support/other (includes 2 SETA personnel)
– (U)	N/A	Complete architecture study to assess applicability of IDECM program to B-1 requirements (separately funded)
– (U)	$400	Test planning in preparation for EMD start
– (U)	$840	COEA completion by Institute for Defense Analysis
– (U)	$9,890	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 1019 ECM Improvements	

(U) FY 1997

- (U) $2,500 Continue contractor systems engineering process, culminating in System Requirements Review
- (U) $3,000 Vendor RFP update
- (U) $3,000 EMD proposal preparation
- (U) $3,500 Integrating contractor (Rockwell) selection of EMD subcontractor
- (U) $8,000 System Engineering and program activities to complete System Functional Review (SFR)
- (U) $19,500 EMD activities (development for Group B modifications) beyond SFR
- (U) $3,938 Mission support/other
- (U) $43,438 Total

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Current President's Budget	2,453	3,092	33,038	305,506
(U) Appropriated Value	2,500	9,692		311,733
(U) Adjustments to Appropriated Value				
a. Undistributed Reductions		-189		-189
b. SBIR		-200		-200
c. Omnibus or Other Above Threshold Reprogramming		-263		-263
d. Below Threshold Reprogramming				
e. RDT&E realignment	-36	+850		+814
(U) Adjustments to Budget Years Since FY96 PB			+10,400	123,124
(U) Current Budget Submit/President's Budget	2,464	9,890	43,438	435,019

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 1019 ECM Improvements	

(U) Change Summary Explanation:

(U) Funding:

(U) FY95 (-36): RDT&E project realignment to project 4143.
(U) FY96 (+850): RDT&E project realignment from project 4143.
(U) FY96 (-652): Undistributed Reductions (-190), SBIR (-200), Bosnia reprogramming (-129), F-16s to Jordan (-133)
(U) FY96 (+6,600): Appropriations plus-up for ECM risk reduction.
(U) FY97 (+10,400): Incremental upgrade strategy. Start EMD in FY97.

(U) Schedule: EMD start still planned for FY97, but at an increased level of effort, with RAA planned for around the turn of the century.

(U) Technical: No change.

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) PE 0101126F, Aircraft Procurement (B-1); BP11, Modifications	0	0	0	0	0	9,300	31,500	377,200	418,000
(U) PE 0604270F, EW Development			28,400	TBD	0	0	0	0	TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 1019 ECM Improvements

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Acquisition Milestones												
(U) - Acq Strat Panel/Overarching IPT							X					
(U) - Milestone II									X			
(U) Engineering Milestones												
(U) - SRR								X				
(U) - SFR										X		
(U) T&E Milestones												
(U) Contract Milestones												
(U) - CCP to Phase IIA contract							X					
(U) - Award EMD Contract after downselection to EC vendor											X	

(U) Milestones Beyond FY 1997

(U) Acquisition Milestones	
(U) - Milestone III	3QFY02
(U) - Required Assets Available	1QFY02
(U) - Full Operational Capability	2QFY08
(U) Engineering Milestones	
(U) - PDR	4QFY97
(U) T&E Milestones	
(U) - Flight Test Start	4QFY00
(U) - Complete Flight Test	1QFY02
(U) Contract Milestones	
(U) - LRIP	4QFY00
(U) - Full Rate Production	3QFY02

Note: This Project experienced a funding cut across the FYDP late in the process of finalizing the budget request. While this document accurately reflects Project funding, the program office was still assessing the schedule impact as of the date this document was submitted.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 1019 ECM Improvements

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Part 1: Requirements			
(U) Risk Reduction/Evaluation, Prep for SFR	1,784	7,988	20,000
(U) Contractor EMD, Prep for PDR	0	0	19,500
(U) OGC/Mission Support	680	1,902	3,938
(U) Total	2,464	9,890	43,438

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program	
Product Development Organizations											
(U) RI	SS/CPAF	Aug 93	14,964		6,000	976	7,988	0	0	15,940	
(U) RI	SS/CPAF	May 97	167,470		0	0	0	39,500	203,506	243,006	
Support and Management Organizations											
(U) Miscellaneous	Various	Quarterly	50,289		11,817	1,380	1,502	1,726	33,864	50,289	
(U) ECO	Various	Quarterly	44,372		0	0	0	122	44,250	44,372	
Test and Evaluation Organizations											
(U) AFFTC	P.O.	Various*	57,004		0	0	108	400	1,000	55,496	57,004
(U) Other Test	Various	Quarterly	20,000		0	0	0	0	0	20,000	20,000

*Note: P.O. provided to AFFTC annually for government flight test activities

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 1019 ECM Improvements	

(U) B. **Budget Acquisition History and Planning Information Continued ($ in Thousands)**

Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property									
(U) Various	TBD	FY96	TBD	0	0	0	1,090	4,294	5,384
Support and Management Property									
Test and Evaluation Property									
(U) Subtotal Product Development				6,000	976	7,988	40,590	207,800	263,354
(U) Subtotal Support and Management				11,817	1,380	1,502	1,848	78,114	94,661
(U) Subtotal Test and Evaluation					108	400	1,000	75,496	77,004
(U) Total Project				17,817	2,464	9,890	43,438	361,410	435,019

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 1020 AFMSS

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1020 AFMSS	0	10,283	10,847	11,979	0	0	0	0	33,109

(U) A. **Mission Description and Budget Item Justification**

(U) Automated mission planning systems traditionally have been developed by individual Air Force operating commands to support their assigned aircraft and weapons systems. The Tactical Air Forces (TAF) and the Strategic Air Command (SAC), for example, began fielding mission support capabilities in various forms in the late 1970s, sometimes as extensions of avionics initialization systems already developed and in other cases as personal computer (PC), minicomputer or mainframe applications. The Air Force is now migrating to a common mission planning system, the Air Force Mission Support System (AFMSS). The AFMSS core system provides common mission planning capabilities. Each weapon system using AFMSS must, however, provide a unique aircraft/weapons/electronics (A/W/E) module to interface with and supplement the AFMSS core system to meet specific requirements for mission planning functionality.

(U) The B-1 currently uses the Mission Data Preparation System (MDPS). The MDPS will be replaced with AFMSS and a B-1 specific A/W/E module. Full compatibility will require concurrent development with the evolutionary AFMSS core software, now scheduled for annual updates through FY98, and the aircraft OFPs, which are affected by aircraft changes such as those planned under the B-1B Conventional Mission Upgrade Program.

(U) The program fulfills needs outlined in the B-1 Mission Need Statement (21 Aug 92) and Operational Requirements Document (22 Jan 93). As an interface component hosted on AFMSS, this program also responds to the Statement of Operational Need (SON) for a Strategic MDPS, Phase III (16 Feb 88) (SON 19-82). The AFMSS program implements TAF 312-87-1-B, System Operational Requirements Document (SORD) for TAF Mission Support System (with Military Airlift Command, SAC, TAF and United States Special Operations Command Annexes), 28 Sep 90.

(U) Acquisition strategy: ESC/YV will manage the development effort of the B-1 A/W/E, with ASC/YD retaining PMD and funding authority for the program. Together, the organizations will report to AFPEO/FB, the Program Executive Officer for Fighters and Bombers. The Government has awarded a cost-plus-award-fee (CPAF) contract to Logicon for development of this A/W/E, using full-and-open competition and streamlined source selection. The award fee plan is structured to motivate the contractor to provide timely, high quality outputs that meet or exceed the minimum requirements, primarily in software design, development, and management while making maximum use of the AFMSS core. The award fee plan is further structured to encourage cost-effective design, development, and management of the software. Also included in the plan, but with much less emphasis, are special studies, training and maintenance. The award fee plan shall apply to this contract period and any future contractual periods, unless modified.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 1020 AFMSS	

(U) The implementation plan for the B-1B A/W/E module for AFMSS has been modified from that described in the FY96 President's Budget request. The Air Force now plans a "single, combined release" of the B-1B A/W/E software vice the previously planned "two release" approach. This release will provide the full functionality required for both the CBU (Block C) and JDAM/1760/GPS/Comm (Block D) upgrades. This change in plan was made to ensure the A/W/E module would be available to reduce risk for Block D. There will be a single Block C/Block D combined release procurement through 1QFY98 with planned follow-on software development related to OFP changes for Blocks E, F and G and any evolving B-1 mission planning requirements through FY00. In accordance with Integrated Weapon Systems Management (IWSM), the government plans to transition the program to an Air Logistics Center (ALC) to be determined later for management of follow-on organic support of the A/W/E software not earlier than FY00.

(U) FY 1995

- (U) N/A (FY 1995: $2,550 funded within PE #0208006F/$1,140 funded within PE #0604618F)

(U) FY 1996

- (U) $8,673 Continue Logicon contract development activities
- (U) $1,610 Mission support/other
- (U) $10,283 Total

(U) FY 1997

- (U) $8,387 Continue Logicon contract
- (U) $2,460 Mission support/other
- (U) $10,847 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 1020 AFMSS	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Current President's Budget	*	6,168	6,168	16,415
(U) Appropriated Value	*	6,168		16,415
(U) Adjustments to Appropriated Value				
a. Undistributed Reductions		-120		-120
b. SBIR				
c. Omnibus or Other Above Threshold Reprogramming				
d. Below Threshold Reprogramming				
e. RDT&E realignment		+4,235		+4,235
(U) Adjustments to Budget Years Since FY96 PB			+4,679	+12,579
(U) Current Budget Submit/President's Budget	*	10,283	10,847	33,109

(U) Change Summary Explanation:

(U) Funding:

(U) FY96 (-120): Congressional reductions

(U) FY96 (+4,235): RDT&E project realignment from project 4143 to fully fund A/W/E and to add effort for Block D.

(U) FY97 (+4,679): Funding transferred from Project 4143 and from Contractor Logistics Support (CLS) procurement to fund A/W/E development for Block D and Block E.

(U) Schedule: "Single, combined release" planned vice previous "two-release" approach (see above).

(U) Technical: "Single, combined release" planned vice previous "two-release" approach (see above).

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 1020 AFMSS

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) PE 0208006F, RDT&E (MPS)	2,550	*	*	*	*	*	*	*	3,920
(U) PE 0604618F, RDT&E (JDAM)	1,140								1,140
(U) PE 0208006F, Operations and Maintenance (MPS)			500	1,500	1,500				3,500
(U) PE 0101126F, Other Procurement (B-1)				481					481

*NOTE: FY94 and FY95 activities in support of B-1 were funded under the Mission Planning System program. FY95 activities in support of B-1 were also funded under the JDAM program. FY96 and beyond activities are funded by B-1.

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) **Acquisition Milestones**												
(U) - Strategic Roundtable												
(U) - Tactical Roundtable												
(U) - Acquisition Strategy Panel												
(U) **Engineering Milestones**												
(U) - Systems Design Review	X*											
(U) - Preliminary Design Review						X	X†					
(U) - Critical Design Review								X				
(U) **T&E Milestones**												
(U) - CMUP JDAM DT&E/IOT&E	2QFY98											
(U) - Test Readiness Review/FQT											X	
(U) - SVT	1QFY98											
(U) **Contract Milestones**												
(U) - Source Selection Start												
(U) - Contract Award	X*											
(U) - Software Delivery	1QFY98											

†NOTE: Incremental PDR will be held to support Block C and Block D, respectively.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 1020 AFMSS

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Contract Funding		8,673	8,387
(U) Other Government Costs		1,610	2,460
(U) Total		10,283	10,847

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
(U) LOGICON	CPAF	Aug 94	*	*	0	0	8,673	8,387	9,822	26,882
Support and Management Organizations										
(U) Miscellaneous	Miscellaneous	Various			0	0	1,610	2,460	2,157	6,227
Test and Evaluation Organizations										

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 1020 AFMSS	

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property: Not Applicable

Product Development Property

Support and Management Property

Test and Evaluation Property

Subtotal Product Development	8,673	8,387	9,822	26,882
Subtotal Support and Management	1,610	2,460	2,157	6,227
Subtotal Test and Evaluation				
Total Project	10,283	10,847	11,979	33,109

(U) *NOTE: Funded Under The MPS Program, Program Element #0208006F in FY94 and FY95. Funded under the JDAM program, Program Element #0604618F in FY95

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 1021 B-1 Simulator

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1021 B-1 Simulator	0	6,752	4,875	5,570	4,600	6,042	13,724	27,484	69,047

(U) **A. Mission Description and Budget Item Justification**

(U) This project provides software updates to the existing training system necessary to match changes made to the aircraft described in the preceding exhibits. These updates are accomplished through block upgrades as dictated by the aircraft schedule.

(U) The total B-1 Training System (TS) consists of the Simulator System (SS) to train air crew members and Maintenance Training Equipment (MTE) to train maintenance personnel. The SS is actually a suite of systems which provides the necessary visual, motion, and aural cues for complete ground training of B-1 air crew members -- there are five Weapon System Trainers, five Cockpit Procedure Trainers, two Mission Trainers, and one Training System Support Center (TSSC). The TSSC includes the computational system resources required to support software, hardware, and firmware changes. The MTE provides maintenance training through simulation of fault isolation and removal/replacement for all B-1 aircraft systems. The MTE, also a suite of systems, includes eight Avionics/Armament Maintenance Training Systems, 10 Simulator Maintenance Training Systems, one Primary/Secondary Flight Control System Maintenance Trainer and one TSSC to support software, hardware, and firmware changes.

(U) The "Simulator Updates" modification funded in PE 0101126F, B-1 Squadrons, BP1100 is a related effort to upgrade the visual systems in the Weapon System Trainers and Mission Trainers. The software upgrade funded in Project 1021 has been structured to be independent of the visual system upgrade.

(U) Acquisition Strategy: The Loral-Quintron contract awarded 21 Jun 94 is a 5-year, 4 month contract. This contract encompasses development, production and CLS through FY99. The development portion is a Cost Plus Award Fee (CPAF) type contract and the production is Firm Fixed Price (FFP). The CLS is Fixed Price Award Fee (FPAF) for the simulator system and FFP for the Maintenance Training Equipment. It is Time and Materials for over and above work on both the Simulator and System and MTE.

(U) FY 1995

(U) N/A (FY 1995: $3,360 funded within Project 4143)

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 1021 B-1 Simulator	

(U) FY 1996

- (U) $2,389 WST Block B/C
- (U) $2,000 MTE computer rehost
- (U) $1,000 CPT computer rehost
- (U) $491 Award fee Mar/Sep 96
- (U) $872 Mission support/other
- (U) $6,752 Total

(U) FY 1997

- (U) $2,806 MTE computer rehost
- (U) $800 Begin Block D development
- (U) $308 Award fee Mar/Sep 97
- (U) $961 Mission support/other
- (U) $4,875 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Current President's Budget	*	8,656	4,875	118,825
(U) Appropriated Value	*	8,656		118,825
(U) Adjustments to Appropriated Value				
a. Undistributed Reductions		-170		-170
b. SBIR		-250		-250
c. Omnibus or Other Above Threshold Reprogramming		-243		-243
d. Below Threshold Reprogramming				
e. RDT&E Realignment		-1,241		-1,241
(U) Adjustments to Budget Years Since FY96 PB				-47,874
(U) Current Budget Submit/President's Budget	*	6,752	4,875	69,047

(U) *Note: Funding for the B-1 simulator in FY94 and FY95 was $1,523 and $3,360 respectively, and was funded under project 4143, Conventional Weapons Upgrade.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 1021 B-1 Simulator	

(U) Change Summary Explanation:

(U) Funding:

(U) FY96 (-663): Undistributed Reductions (-169), SBIR (-250), Bosnia reprogramming (-119), F-16s to Jordan (-123).

(U) FY96 (-1,241): RDT&E project realignment to Project 4143.

(U) FY98-99 (-13,012): Funding transferred to Project 4143 to fully fund AF/OSD estimate for Block D/Computer/WCMD. Funds were available because AF/OSD estimate rephased corresponding simulator work.

(U) FY00 (+670): Transferred from Project 4143 to fully fund AF/OSD estimate.

(U) To Complete (-47,874): Fund to current AF/OSD estimate.

(U) Schedule: A delay in the availability of computer software data to the new contractor resulted in a 4 to 6 month delay in the WST production start and first delivery.

(U) Technical: None.

(U) C. **Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) PE 0101126F, Aircraft Procurement (B-1); BP11, Modifications	6,900	1,700	5,900		*				27,600

*Simulator mod production for Block D funded in Mod Number 3150-R (Navstar GPS-comm upgrade) (2,500)

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 1021 B-1 Simulator

(U) **D. Schedule Profile**

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
(U) **Acquisition Milestones**																
(U) - Start EMD - Block B/C - WST			X*													
(U) - Start Production Block - B/C - WST											X					
(U) - First Delivery - WST/MT												X				
(U) - Start EMD - MTE rehost											X					
(U) - Start Production - MTE rehost																X
(U) - MTE rehost delivery																X
(U) - Start EMD - CPT rehost											X					
(U) - Start Production - CPT rehost														X		
(U) - CPT rehost delivery															X	
(U) **Engineering Milestones**																
(U) - SR Block B/C - WST (SRR)				X*												
(U) - PDR Block B/C - WST							X*									
(U) - CDR Block B/C - WST									X*							
(U) **T&E Milestones**																
(U) - System T&E - Block B/C WST											X					
(U) **Contract Milestones**																
(U) - Block B/C WST Award			X*													
(U) - Block B/C WST Delivery												X				
(U) - MTE rehost award											X					
(U) - MTE rehost delivery																X
(U) - CPT rehost award										X						
(U) - CPT rehost delivery															X	
(U) - Block D award																X

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 1021 B-1 Simulator	

(U) **Milestones Beyond FY 1997**

(U) Block D	
(U) - SRR	1QFY98
(U) - PDR	2QFY98
(U) - CDR	4QFY98
(U) End H/W Development	2QFY99
(U) End S/W Development	2QFY99
(U) End H/W & S/W Integration	2QFY99
(U) End T&E	3QFY99
(U) Site Activation	3QFY99
(U) Production Units Installed	4QFY99
(U) Block E	
(U) - SRR	3QFY00
(U) - PDR	1QFY01
(U) - CDR	2QFY01
(U) End H/W & S/W Development	3QFY01
(U) End H/W & S/W Integration	4QFY01
(U) End T&E	1QFY02
(U) Site Activation	1QFY02
(U) Production Units Installed	1QFY02

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 1021 B-1 Simulator

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Major Contract			
(U) Block B/C			
(U) - WST		2,389	
(U) - MTE computer rehost		2,000	2,806
(U) - CPT computer rehost		1,000	
(U) Block D			800
(U) Award Fee		491	308
(U) Mission Support/Other		872	961
(U) Total		6,752	4,875

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
(U) Loral-Quintron	C/CPAF	Jun 94	*	N/A		*	5,389	3,914	51,678**	60,981
Support and Management Organizations										
(U) Various						*	1,363	961	5,742**	8,066

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 1021 B-1 Simulator	

Test and Evaluation Organizations

(U) *Funded in Conventional Weapon Upgrade Project 4143 in FY94-95.
(U) **New contract begins FY00.

(U) **B. Budget Acquisition History and Planning Information Continued ($ in Thousands)**

Government Furnished Property: Not Applicable

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property									
Support and Management Property									
Test and Evaluation Property									
(U) Subtotal Product Development						5,389	3,914	51,678	60,981
(U) Subtotal Support and Management						1,363	961	5,742	8,066
(U) Subtotal Test and Evaluation									
(U) Total Project						6,752	4,875	57,420	69,047

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 4143 Conventional Weapons Upgrade

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4143 Conventional Weapons Upgrade	73,238	162,602	161,772	126,062	132,378	99,874	60,155	2,788	929,318

(U) **A. Mission Description and Budget Item Justification**

(U) The B-1 will deliver the lion's share of the heavy bomber fleet's conventional weapons in future conflicts. Current B-1 conventional combat capability is optimized for delivery of MK-82 non-precision 500 pound gravity bombs. Project 4143 RDT&E funding for increasing B-1 conventional weapons employment capability by upgrading the following systems:

- (U) CBUs: Modify 50 of the 101 existing B-1 conventional bomb modules (now used only for MK-82 bombs) for integration of cluster bomb units (CBUs).
- (U) GPS/Communications Navigation Management System: Incorporate Global Positioning System (GPS) capability for more precise long range navigation, TACAN emulation, and weapons delivery. Integrate the ARC-210 "HAVE QUICK" secure/anti-jam communications system for improved capability to operate within force packages. Includes Demand Assign Multiple Access/Advanced Narrowband Digital Voice Terminal (DAMA/ANDVT), a SATCOM-required communications upgrade.
- (U) JDAM/Mil-Std-1760: Modify B-1 rotary launcher and develop interfaces for JDAM and other advanced conventional weapons. Incorporate Mil-Std-1760 weapons interface required for use with JDAM and other future precision weapons.
- (U) Computers: Upgrade the current avionics computer complex to provide for weapons flexibility and reduce operation and support costs. Existing avionics computers will be replaced with modern, 32-bit hardware, and current software will be converted to Ada.
- (U) Wind Corrected Munitions Dispenser: Add Mil-Std-1760 weapon interface to modified conventional bomb modules (see "CBUs" above) to allow B-1 to employ WCMD. Increases accuracy of CBUs when released at high altitudes.
- (U) Advanced Munitions: Develop necessary modifications to integrate Joint Standoff Weapon (JSOW).

(U) Acquisition Strategy: The conventional weapons upgrade program (CWUP) is accomplished in three phases. In each phase cost type contracts are used for EMD and fixed price contracts for production/mod kits:

- (U) Phase I: Enhanced capability (but unguided) weapons (CBU) integration
- (U) Phase II: Near precision weapons integration (JDAM/1760/GPS/Comm, computer upgrade, and WCMD) and congressionally-directed demonstration of the feasibility of adding a GPS-aided targeting system [designated as the Relative Targeting System (RTS) on B-1 -- RTS is not currently an approved or funded program requirement]. These are divided into three sub-phases:
  - (U) Phase IIA: Pre-EMD (design analyses, trade studies, engineering work leading up to the hardware preliminary design review)
  - (U) Phase IIB: EMD (continued development effort through flight test, kit proof, and physical configuration audit)
  - (U) Phase IIC: Production (aircraft installation and modification kits)
  - (U) Preliminary engineering and planning studies necessary to determine the feasibility and cost/schedule of potential future weapon system enhancements

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 4143 Conventional Weapons Upgrade	

- (U) Phase III: Precision weapons with standoff capability (JSOW)

(U) To minimize aircraft downtime and differences in fielded configurations, these phased upgrades will be introduced in scheduled block upgrades in conjunction with major sustainment software releases. The Phase I CBU capability is being fielded in Block C. Block D will include JDAM/Mil-Std-1760 and GPS/Comm modifications. The computer and WCMD upgrades will be fielded as part of Block E. JSOW capability will be fielded in Block G. Block C EMD was completed on schedule in FY95, and production is proceeding toward a Required Assets Available (RAA) milestone in 3QFY96. The Block D EMD effort is also on track, with software and system PDR in 1QFY96 and JDAM safe separation testing in 2QFY96. Block E EMD for the computer and WCMD is scheduled to start in 2QFY97.

(U) Rockwell International, Seal Beach, CA, and the Boeing Company, Seattle, WA, were associate contractors for Phase I. The Air Force selected Rockwell International to be the integrating contractor to manage Phase II and Phase III upgrades. Rockwell International is the prime contractor for Phase II with the Boeing Company as their major team member. A sole-source contract for Phase IIB EMD was awarded to Rockwell in Mar 95.

(U) Government organizations responsible for development efforts include: the B-1 System Program Office (SPO) and Simulator Systems SPO at ASC, Wright-Patterson AFB, OH, and at Oklahoma City Air Logistics Center (OC-ALC), Tinker AFB, OK; Rome Laboratories, Griffiss AFB, NY; Warner Robins Air Logistics Center (WR-ALC), Robins AFB, GA; the Air Force Operational Test and Evaluation Center (AFOTEC), Kirtland AFB, NM; Air Force Flight Test Center, Edwards AFB, CA; JDAM/JSOW SPO, Eglin AFB, FL; GPS Joint SPO (JPO), Los Angeles AFB, CA; and AFMSS SPO, ESC, Hanscom AFB, Mass.

(U) This project is categorized as Research Category EMD program because it is an operational weapon system with an ongoing development program which will upgrade conventional weapons capability.

(U) FY 1995

– (U)	$9,237	Complete Phase I contract and flight test activities for CBUs
– (U)	$3,360	Simulator upgrades to keep the training system consistent with aircraft modifications prior to block B/C integration
– (U)	$4,956	Complete Phase IIA contract activities for JDAM, Mil-Std-1760, GPS and Communications Navigation Management System Upgrade
– (U)	$48,803	Award Phase IIB (EMD) contract to prime contractor; begin development activities for integration of JDAM, Mil-Std-1760, GPS, and Communications Navigation Management System
– (U)	$1,293	Studies and planning for computer upgrade
– (U)	$5,589	Mission support/other
– (U)	$73,238	Total

(U) FY 1996

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 4143 Conventional Weapons Upgrade	

- (U) $96,929 Continue Phase IIB contract activities for JDAM, 1760, GPS and Communications Navigation Management System flight test planning
- (U) $15,000 B-1 Virtual Umbilical implementation
- (U) $9,400 Engineering Change Proposal to Phase IIB contract for computer upgrade and continue development activities
- (U) $2,114 Engineering Change Proposal to Phase IIB contract for Wind Corrected Munition Dispenser (WCMD) kit integration and begin development
- (U) $22,501 Government flight test in support of Phase IIB contract
- (U) $16,658 Mission support/other
- (U) $162,602 Total

(U) FY 1997

- (U) $76,638 Continue Phase IIB contract activities for JDAM, 1760, GPS, and Communications Navigation Management System
- (U) $29,876 Continue Computer upgrade
- (U) $10,800 Continue WCMD activities
- (U) $14,553 Government flight test in support of Phase IIB
- (U) $29,905 Mission support/other
- (U) $161,772 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Current President's Budget	73,467	155,922	106,539	1,184,217
(U) Appropriated Value	71,619	177,922		1,212,510
(U) Adjustments to Appropriated Value				
a. Undistributed Reductions	-806	-3,484		-8,998
b. SBIR	-1,392	-4,311		-7,352
c. Omnibus or Other Above Threshold Reprogramming		-3,681		-3,681
d. Below Threshold Reprogramming	+3,781			+3,013
e. RDT&E Realignment	+36	-3,844		-3,808
(U) Adjustments to Budget Years Since FY96 PB			+55,233	-262,366
(U) Current Budget Submit/President's Budget	73,238	162,602	161,772	929,318

(U) Change Summary Explanation:

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 4143 Conventional Weapons Upgrade	

(U) Funding:

(U) FY95 (+36): RDT&E project realignment from Project 1019.

(U) FY96 (-11,474): Undistributed Reductions (-3,483), SBIR (-4,311), Bosnia reprogramming (-1,821), F-16s to Jordan (-1,859).

(U) FY96 (+22,000): Appropriations plus-ups for JDAM integration (+7,000) and to equip the B-1 with precision guided munitions (+15,000).

(U) FY96 (-3,844): RDT&E project realignments between Projects 4143, 1019, 1020, and 1021.

(U) FY97 (+71,233): Per OUSD(A&T) ADM dated 25 Jan 95, funds were added to the Project to fully fund the Service Cost Position cost estimate for the JDAM/1760/GPS/Comm/Computer/WCMD upgrades. Funds were also added to the GPS/Comm upgrade to make it compatible with the Demand Assign Multiple Access/Advanced Narrowband Digital Voice Terminal (DAMA/ANDVT) SATCOM architecture; and for Program Depot Maintenance (PDM) for test aircraft.

(U) FY97 (-15,000): OSD-directed funding cut.

(U) FY98 to FY01 (-119,348): Per OUSD(A&T) ADM dated 25 Jan 95, funds were added to the Project to fully fund the Service Cost Position cost estimate for the JDAM/1760/GPS/Comm/Computer/WCMD upgrades. Funds were also added for Programmed Depot Maintenance for test aircraft. A small amount of funding was subsequently transferred from the Project into the B-1 procurement line for accelerated procurement of JDAM/1760 modification kits. Funding for integration of the canceled Tri-Service Standoff Attack Missile (TSSAM) was removed.

(U) FY01 (-5,800): Sourced for OSD-directed funding cut.

(U) "To complete" (-262,366): Estimate for JSOW integration revised downward.

(U) Schedule: The production decision for JDAM/1760 kits has been moved from Jan 99 to Oct 98, with a Low-Rate Initial Production decision in Jun 98, to support acceleration of JDAM capability on the B-1. This will result in Required Assets Available (RAA) (3 aircraft) and Initial Operational Capability (2 squadrons of 12 aircraft each, 2 launchers per aircraft) both occurring in FY00 instead of FY01 and FY02, respectively.

(U) Technical: The B-52 has been designated the threshold bomber test platform for JDAM in place of the B-1. This reduces development and operational test requirements for B-1/JDAM integration, enabling acceleration of JDAM capability on the B-1. DAMA/ANDVT SATCOM compatibility has been added to the GPS/Comm upgrade. TSSAM integration on the B-1 has been canceled.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 4143 Conventional Weapons Upgrade

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) PE 0101126F, Aircraft Procurement (B-1); BP11, Modifications	10,300	16,800	22,300	60,000	76,800*	77,200	40,500	193,700	497,700

*Includes 2,500 for Block D Simulator mod production (see Project 1021)

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) **Acquisition Milestones**												
(U) - SSC MS II Decision		X*										
(U) - CBU MS III Decision			X*									
(U) - Phase I EMD Complete				X*								
(U) - Phase I RAA (CBU)							X					
(U) - Phase I FOC											X	
(U) **Engineering Milestones**												
(U) - Phase I CDR (CBU)												
(U) - Phase II H/W PDR (GPS/Comm, JDAM/1760)		X*										
(U) - Phase II CDR (GPS/Comm)							X					
(U) - Phase II CDR (JDAM/1760)							X					
(U) **T&E Milestones**												
(U) - Start Phase I CBU Flight Test	X*											
(U) - Complete Phase I CBU Flight Test				X*								
(U) - Start Phase II GPS/Comm Flight Test												X
(U) **Contract Milestones**												
(U) - Phase II EMD		X*										
(U) - Phase I Production			X*									
(U) - Phase II Production (GPS/Comm - Group A)												X
(U) - Phase II Production (GPS/Comm - Group B)										X		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 4143 Conventional Weapons Upgrade	

(U) Milestones Beyond FY97

(U) **Acquisition Milestones**	
(U) - Required Assests Available (GPS/Comm)	1QFY00
(U) - Full Operational Capability (GPS/Comm)	1QFY01
(U) - Required Assets Available (JDAM/1760)	3QFY00
(U) - Full Operational Capability (JDAM/1760)	2QFY02
(U) - Required Assets Available (Computer)	1QFY02
(U) - Required Assets Available (WCMD)	1QFY02
(U) - Required Assets Available (JSOW)	2QFY02
(U) - Full Operational Capability (WCMD)	4QFY06
(U) - Full Operational Capability (JSOW)	4QFY06
(U) - Full Operational Capability (Computer)	4QFY06
(U) **Engineering Milestones**	
(U) - Phase II CDR (Computer)	1QFY98
(U) **T&E Milestones**	
(U) - Begin Flight Test(GPS/Comm/JDAM/1760)	4QFY97
(U) - Complete Flight Test (GPS/Comm)	3QFY98
(U) - Complete Flight Test/EMD (JDAM/1760)	3QFY98
(U) - Begin Flight Test (Computer)	1QFY00
(U) - Begin Flight Test (WCMD)	1QFY00
(U) - Complete EMD/Flight Test (WCMD)	1QFY01
(U) - Complete Flight Test (Computer)	1QFY01
(U) - Begin Flight Test (JSOW)	3QFY01
(U) **Contract Milestones**	
(U) - Phase II Production (GPS/Comm) (Group B)	2QFY97
(U) - Phase II Production (GPS/Comm) (Group A)	4QFY97
(U) - Phase II LRIP (JDAM/1760)	3QFY98
(U) - Phase II Production (JDAM/1760)	1QFY99
(U) - Phase III EMD (JSOW)	1QFY99
(U) - Phase II Production (WCMD)	3QFY01

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 4143 Conventional Weapons Upgrade	

(U)	- Phase II Production (Computer)	3QFY01
(U)	- Phase III Production (JSOW)	2QFY02

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 4143 Conventional Weapons Upgrade	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Major Contract:			
(U) Phase I	4,092	0	0
(U) Phase IIA	4,841	0	0
(U) Phase IIB	45,285	96,929	76,638
(U) B-1 Virtual Umbilical implementation	0	15,000	0
(U) RTS Demo	0	0	0
(U) Simulator Contract*	2,537	0	0
(U) Computer	0	9,400	29,876
(U) WCMD	0	2,114	10,800
(U) Other Government Costs:			
(U) Government Test	7,758	22,501	14,553
(U) Mission Support/OGC**	8,725	16,658	29,905
(U) Total	73,238	162,602	161,772

(U) *Note: The Simulator contractor shown for FY94 and FY95 keeps the training system consistent with aircraft modifications prior to Block B/C integration. The money for FY96 and FY97 is allocated under Project 1021.
(U) ** Note: Mission Support/OGC line includes GFE.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604226F B-1B

PROJECT NO. AND NAME: 4143 Conventional Weapons Upgrade

(U) B. Budget Acquisition History and Planning Information ($ in Thousands)

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
(U) RI - CBUs	SS/CPFF	93	4,960	4,960	4,960	0	0	0	0	4,960
(U) RI - CBUs	SS/CPFF	1/94	7,739	7,739	5,779	1,960	0	0	0	7,739
(U) Boeing CBUs	SS/CPFF		5,812	5,812	3,680	2,132	0	0	0	5,812
(U) RI-PH IIA	SS/CPFF	8/93	76,108	76,108	71,267	4,841	0	0	0	76,108
(U) RI-PH IIB	SS/CPAF	3/95	280,876	280,876	849	45,285	111,929	76,638	46,175	280,876
(U) RI-PH IIB*	SS/CPAF	2/97	184,024	184,024	0	0	9,400	29,876	144,748	184,024
(U) RI-PH IIB*	SS/CPAF	2/97	38,461	38,461	0	0	2,114	10,800	25,547	38,461
(U) LORAL/QT	C/CPAF	6/94	3,744	3,744	1,207	2,537	0	0	0	3,744
(U) RI-RTS	SS/CPAF	8/94	7,941	7,941	7,941	0	0	0	0	7,941
(U) TBD-PH III	SS/CPAF	TBD	28,203	28,203	0	0	0	0	28,203	28,203
Support and Management Organizations										
(U) ECO	Multiple	Various	N/A	N/A	0	0	10,912	14,717	45,636	71,265
(U) Mission Support/OGC	Various	Various	N/A	N/A	8,496	8,219	5,521	13,840	72,510	108,586
Test and Evaluation Organizations										
(U) AFFTC	P.O.	Various*	N/A	N/A	6,250	7,758	22,501	14,553	56,565	107,627

* ECP to Phase IIB contract for computer upgrade and WCMD integration EMD.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604226F B-1B
PROJECT NO. AND NAME 4143 Conventional Weapons Upgrade	

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
(U) Product Development Property				20	506	225	1,348	1,873	3,972
(U) Support and Management Property									
(U) Test and Evaluation Property									
(U) Subtotal Product Development				55,046	57,261	123,668	118,662	246,546	641,840
(U) Subtotal Support and Management				8,496	8,219	16,433	28,557	118,146	179,851
(U) Subtotal Test and Evaluation				6,250	7,758	22,501	14,553	56,565	107,627
(U) Total Project				110,449	73,238	162,602	161,772	421,257	929,318

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604227F Flight Simulator Development

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	13,669	8,349	4,439	4,694	4,650	4,828	4,939	Continuing	TBD
2325 Simulator Development Activities	2,665	1,645	1,461	1,527	1,369	1,443	1,497	Continuing	TBD
2769 Simulator Update Development	3,452	3,153	2,978	3,167	3,281	3,385	3,442	Continuing	TBD
3000 KC-135 Aircrew Training System	100	131	0	0	0	0	0	0	2,420
4022 Simulator for Electronic Combat Training (SECT)	6,014	3,420	0	0	0	0	0	0	27,738
3135 Advanced Training System (ATS)	1,438	0	0	0	0	0	0	0	34,266

(U) **A. Mission Description and Budget Item Justification:** This is a continuing program element for development of aircrew and maintenance training techniques and devices. Devoted to the engineering and manufacturing development (EMD) of aircrew and maintenance training systems, this program element is included in budget activity EMD. Objectives are to adapt simulation technology and standards developed in the laboratories and industry to satisfy MAJCOM training requirements, and to develop prototype training devices.

(U) Project 3135 - Advanced Training System (ATS) was transferred to PE 0604243 (Manpower, Personnel, & Training) as of FY96. FY96 to FY98 funds will transfer with the program and become Project 4369 - Air Education and Training Management System.

(U) Acquisition Strategy: Maximize the use of free and open competitive awards. Mission support efforts use a variety of contract vehicles. Specific programs use contract types appropriate to the work to be performed. The Simulator for Electronic Combat Training (SECT) contract, for example, has been restructured from a Cost Plus Award Fee to a Fixed Price Incentive Firm contract.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	13,955	8,786	4,650	TBD
(U) Appropriated Value	14,261	8,786		
(U) Adjustments to Appropriated Value				
a. Cong/Gen Reduction	-306	-171		
b. SBIR	-265	-132		
c. Omnibus or Other Above Threshold Reprogram		-134		
d. Below Threshold Reprogram	-21			
(U) Adjustments to Budget Years since FY96 PB			-211	
(U) Current Budget Submit/President's Budget	13,669	8,349	4,439	TBD

(U) Change Summary Explanation:

Funding: FY95 changes include Congressional General Reductions and Below Threshold Reprogramming. FY96 changes include Congressional General Reductions, Omnibus/Other Above Threshold reprogramming for Bosnia, and Below Threshold Reprogramming. FY97 includes changes due to revised inflation rates.

Schedule: Not Applicable

Technical: Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604227F Flight Simulator Development

PROJECT NO. AND NAME: 2325 Simulator Development Activities

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2325 Simulator Development Activities	2,665	1,645	1,461	1,527	1,369	1,443	1,497	Continuing	TBD

(U) A. Mission Description and Budget Item Justification ($ in Thousands)

This project supports engineering development of new aircrew and maintenance training technologies and standards. Funds the pre-production of first article training devices to satisfy the customer's training requirements. Efforts currently planned or underway include using artificial intelligence techniques in the development of a generic Intelligent Training Management System (TMS). SMART 2000, an evaluation of cutting-edge technology for training, will also be developed.

(U) FY 1995

- (U) $1,591 Completed development of the Structural Modeling (SM) core architecture. Continue support of programs using SM.
- (U) $338 Started evaluation, integration, and documentation of latest training technologies (SMART 2000).
- (U) $142 Continued Peripheral Vision testing.
- (U) $259 Technical support.
- (U) $130 Initiated development of Technology Roadmap.
- (U) $118 Initiated low cost helmet-mounted display
- (U) $87 Mission support
- (U) $2,665 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 2325 Simulator Development Activities	

(U) FY 1996

–	(U) $300	Initiate development of subjective techniques for the transfer of training from the simulator to the aircraft.
–	(U) $225	Technical support for Vis/Eval effort.
–	(U) $150	Evaluate technologies for Area of Interest (AOI) visual system.
–	(U) $144	Develop a Universal Threat Simulation System (UTSS) to use for joint service applications.
–	(U) $96	Continue Dynamic Peripheral Acuity evaluations.
–	(U) $200	Continue development of structural modeling
–	(U) $300	Network evaluation training and simulation
–	(U) $130	Continue development of Technology Roadmap.
–	(U) $100	Mission support
–	(U) $1,645	Total

(U) FY 1997

–	(U) $100	Continue development of UTSS; work to populate the database and standards.
–	(U) $200	Continue evaluation support for SMART 2000.
–	(U) $300	Initiate evaluation of Faster than Real-Time training simulation.
–	(U) $339	Initiate evaluation of improved G-suit/G-seat/sensory simulation capability.
–	(U) $130	Continue development of technology Roadmap.
–	(U) $300	Continue subjective transfer training
–	(U) $92	Mission support
–	(U) $1,461	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 2325 Simulator Development Activities	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	2,043	1,677	1,531	TBD
(U) Appropriated Value	3,935	1,677		
(U) Adjustments to Appropriated Value				
a. Cong/Gen Reduction	-306	-32		
b. SBIR[1]				
c. Omnibus or Other Above Threshold Reprogram				
d. Below Threshold Reprogram	-964			
(U) Adjustment to Budget Years since FY96 PB			-70	
(U) Current Budget Submit/President's Budget	2,665	1,645	1461	TBD

(U) Change Summary Explanation:

Funding: FY95 changes include Congressional General Reductions for FFRDC, Non-FFRDC, travel, and university research and Below Threshold Reprogramming to project 4022 (SECT) from project 2325, due to underestimation of software development costs; FY96 includes changes due to revised economic assumptions; FY97 includes changes due to revised inflation rates.

[1]Adjustments to FY95 appropriated value also include SBIR reduction (-265).

Schedule: Minor changes to FY95, FY96, and FY97 schedules
Technical: Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 2325 Simulator Development Activities	

(U) C. **Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
Related RDT&E:									
(U) 0604243F, Project 4369, Air Education Training Management System		1,010	961	1,021					2,992

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 2325 Simulator Development Activities	

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Peripheral Vision Testing								X				
(U) Structural Modeling Complete				X*								
(U) Intelligent Training Management System Complete					X*							
(U) Simulator Training Transfer Complete								X				
(U) SMART 2000 integration & Documentation			X*									X
(U) Prototype Training System SMART 2000												X
(U) Universal Threat Simulator System Architecture Development												X
(U) Technology Roadmap												X
(U) Faster than Real-Time												X
(U) Area of Interest (AOI)												X
(U) G-Suit/G-Seat Sensory Simulation												X

* denotes completed milestone event

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 2325 Simulator Development Activities	

(U) A. **Project Cost Breakdown ($ in Thousands)**

	1995	1996	1997
Structural Modeling	1,591	200	0
Intelligent Training Management System	0	0	
Peripheral Vision Testing	142	96	0
Espirit Visual System Testing	0	0	0
Simulator Training Transfer	0	300	300
SMART 2000	338	0	200
Universal Threat Simulator	0	144	100
Technical support	259	225	0
Technology Roadmap	130	130	130
G-suit/G-seat/sensory Simulation	0	0	339
Faster than Real-Time Simulation	0	0	300
Low Cost Helmet-Mounted Display	118	150	0
Network Evaluation	0	300	0
Mission Support	87	100	92
Total	2,665	1,645	1,461

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604227F Flight Simulator Development

PROJECT NO. AND NAME: 2325 Simulator Development Activities

(U) B. Budget Acquisition History and Planning Information ($ in Thousands)

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Numerous	Various	Various	None	None	36,945	2,578	1,545	1,369	TBD	TBD
Support and Management Organizations										
Training Systems Program Office, ASC, WPAFB	Various	Various	0	0	0	87	100	92	TBD	TBD
Test and Evaluation Organizations Not Applicable										

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property: Not Applicable

Subtotal Product Development	36,945	2,578	1,545	1,369	TBD	TBD
Subtotal Support and Management	0	87	100	92	TBD	TBD
Subtotal Test and Evaluation	0	0	0	0	0	0
Total Project	36,945	2,665	1,645	1,461	TBD	TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 2769 Simulator Update Development	

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2769 Simulator Update Development	3,452	3,153	2,978	3,167	3,281	3,385	3,442	Continuing	TBD

(U) A. **Mission Description and Budget Item Justification ($ in Thousands)** This project provides critical Training System Product Group (TSPG) support for multiple user command's products to include F-16 Weapon System Trainer, B-1B conventional upgrade, Simulator for Electronic Combat Training SECT, C-17 training suite, Universal Training Device, and C-141 Aircrew Training System. These support systems include a computer center, communications, Systems Engineering and Technical Assistance (SETA) contracting, travel, supplies, specialized training, and equipment.

(U) FY 1995

- (U) $574 Travel
- (U) $49 Communications
- (U) $114 Training
- (U) $718 SETA
- (U) $790 Management
- (U) $483 Computer center
- (U) $189 Supplies
- (U) $172 Equipment
- (U) $196 Miscellaneous
- (U) $167 Support
- (U) $3,452 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 2769 Simulator Update Development	

(U) FY 1996

- (U) $457 Travel
- (U) $ 44 Communications
- (U) $135 Training
- (U) $779 SETA
- (U) $839 Management
- (U) $385 Computer center
- (U) $180 Supplies
- (U) $117 Equipment
- (U) $217 Miscellaneous
- (U) $3153 Total

(U) FY 1997

- (U) $512 Travel
- (U) $ 42 Communications
- (U) $ 89 Training
- (U) $673 SETA
- (U) $798 Management
- (U) $400 Computer center
- (U) $155 Supplies
- (U) $107 Equipment
- (U) $202 Miscellaneous
- (U) $2978 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604227F Flight Simulator Development

PROJECT NO. AND NAME: 2769 Simulator Update Development

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,574	3,187	3,119	TBD
(U) Appropriated Value	3,635	3,487		
(U) Adjustments to Appropriated Value				
a. Cong Gen Reductions		-68		
b. SBIR		-132		
c. Omnibus and Other Above Threshold Reprogram		-134		
d. Below Threshold Reprogramming	-183			
(U) Adjustment to Budget Year after FY96 PB			-141	
(U) Current Budget Submit/President's Budget	3,452	3,153	2,978	TBD

(U) Change Summary Explanation:

Funding: FY95 Below Threshold Reprogramming into project 4022 SECT due to underestimation of software development costs. FY96 changes include Congressional General Reductions, SBIR, and an Omnibus/Other Above Threshold Reprogramming for Bosnia. FY97 includes changes due to revised inflation rates.

Schedule: Not Applicable

Technical: Not Applicable

(U) **C. Other Program Funding Summary ($ in Thousands)** Not Applicable

(U) **D. Schedule Profile Not Applicable**

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 2769 Simulator Update Development	

(U) A. **Project Cost Breakdown ($ in Thousands)**

	1995	1996	1997
Travel	574	457	512
Communications	49	44	47
Training	114	135	89
SETA	718	779	673
Management	790	839	793
Computer Center	483	385	400
Supplies	189	180	155
Equipment	172	117	107
Miscellaneous	196	217	202
Support	167	0	0
Total	3,452	3,153	2,978

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 2769 Simulator Update Development	

(U) B. **Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations Not Applicable										
Support and Management Organizations										
Training System Program Office (SPO) ASC, WPAFB, OH	Various	Various	None	None	36,199	3,452	3,153	2,978	Cont	TBD
Test and Evaluation Organizations Not Applicable										

(U) B. **Budget Acquisition History and Planning Information Continued ($ in Thousands)**

Government Furnished Property: Not Applicable

Subtotal Product Development	0	0	0	0	0	0
Subtotal Support and Management	36,199	3,452	3,153	2,978	Cont	TBD
Subtotal Test and Evaluation	0	0	0	0	0	0
Total Project	36,199	3,452	3,153	2,978	Cont	TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604227F Flight Simulator Development

PROJECT NO. AND NAME: 3000 KC-135 Aircrew Training System

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3000 KC-135 Aircrew Training System	100	131	0	0	0	0	0	0	2,420

(U) **A. Mission Description and Budget Item Justification ($ in Thousands)** This project provides mission support for KC-135 aircrew training system development.

(U) FY 1995
- (U) $ 100 Mission Support
- (U) $ 100 Total

(U) FY 1996
- (U) $ 131 Mission Support
- (U) $ 131 Total

(U) FY 1997 Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development

PROJECT NO. AND NAME
3000 KC-135 Aircrew Training System

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	100	1,434	0	5,059
(U) Appropriated Value	1,438	1,434		
(U) Adjustments to Appropriated Value				
a. Cong/Gen Reduction		-3		
b. SBIR				
c. Omnibus or Other Above Threshold Reprogram				
d. Below Threshold Reprogram	-1,338	-1,300		
(U) Adjustment to Budget Year after FY96 PB				
(U) Current Budget Submit/President's Budget	100	131	0	2,423

(U) Change Summary Explanation:

Funding: FY95 changes include Below Threshold Reprogramming into project 4022 (SECT) due to underestimation of software development costs. Program will be complete in FY96 and excess funding transferred into SECT; FY96 changes also include Congressional General Reductions.

Schedule: Not Applicable

Technical: Not Applicable

(U) **C. Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Aircraft Procurement, AF Budget Activity 07,	10,600	16,600	1,800	0	0	0	0	0	36,000

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 3000 KC-135 Aircrew Training System	

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Mission Support	X	X	X	X	X	X	X	X				

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 3000 KC-135 Aircrew Training System	

(U) A. **Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Navigator WST Development	0	0	0
(U) Mission Support	100	131	Complete
(U) Total	100	131	Complete

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 3000 KC-135 Aircrew Training System	

(U) B. **Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Flight Safety Inc.	C/FP	Jul 92	4,837	4,837	2,137	0	0	0	0	2,137
Support and Management Organizations										
OG-LIRB & ASC/YWM	None	None	250	250	52	100	131	0	0	283
Test and Evaluation Organizations	Not Applicable									

(U) B. **Budget Acquisition History and Planning Information Continued ($ in Thousands)**

Government Furnished Property: Not Applicable

Subtotal Product Development	2,137				2,137
Subtotal Support and Management	52	100	131		283
Total Project	2,189	100	131		2,420

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604227F Flight Simulator Development

PROJECT NO. AND NAME: 4022 Simulator for Electronic Combat Training (SECT)

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4022 Simulator for Electronic Combat Training (SECT)	6,014	3,420	0	0	0	0	0	0	27,738

(U) A. **Mission Description and Budget Item Justification ($ in Thousands)**

The SECT will replace outdated simulation devices that support Electronic Warfare Officer Training. The simulator will train students in basic threat recognition and associated electronic combat procedures in a simulated airborne environment. This training is possible only with simulation due to environment, security and range restrictions. This is a one-of-a-kind system with no scheduled production effort.

(U) FY 1995
- (U) $1,200 Began in-plant test of system
- (U) $2,423 Began complete system code/unit test
- (U) $2,273 Completed system design and hardware/software integration
- (U) $118 Mission Support
- (U) $6,014 Total

(U) FY 1996
- (U) $ 1,200 Deploy and complete on-site test of system at Corey Station NTC FL
- (U) $ 2,120 Complete hardware/software integration.
- (U) $100 Mission support
- (U) $ 3,420 Total

(U) FY 1997 Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604227F Flight Simulator Development

PROJECT NO. AND NAME: 4022 Simulator for Electronic Combat Training (SECT)

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	6,800	2,488	0	TBD
(U) Appropriated Value	3,638	3,488		
(U) Adjustments to Appropriated Value				
a. Cong/Gen Reduction		-68		
b. SBIR				
c. Omnibus or Other Above Threshold Reprogram				
d. Below Threshold Reprogram	+2,391			
(U) Adjustment to Budget Year after FY96 PB				
(U) Current Budget Submit/President's Budget	6,014	3,420	0	27,104

(U) Change Summary Explanation:

Funding: FY95 changes include Below Threshold Reprogramming from projects 2325, 2769, 3000, and 4156; FY96 includes Congressional General Reductions.

Schedule: Required Assets Available (RAA) date has moved to Aug 96 due to under estimation of software development effort. Contract restructure from a cost plus award fee to fix price incentive fee. New modification reflects RAA of Aug 96.

Technical: Technical requirements unchanged since FY94.

(U) **C. Other Program Funding Summary ($ in Thousands)** Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 4022 Simulator for Electronic Combat Training (SECT)	

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Contractor Engineer Verification Review (CELR)						X*						
(U) Development Test & Eval(DT&E) / System Performance & Development Eval (SPADE)							X*					
(U)Operational Test & Eval (OT&E)/ Government Functional Mission Test								X*				
(U)In-Plant test						X*						
(U)Facilities ready						X*						
(U)System delivery, Required Assets Available (RAA)								X*				

* = Completion

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 4022 Simulator for Electronic Combat Training (SECT)	

(U) A. **Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Critical Design Review (CDR)			
(U) Readiness assessment			
(U) Complete CDR			
(U) Begin System Code and Unit test			
(U) Government In-Plant test	1,200		
(U) Complete System code and Unit test	2,423		
(U) Complete Hardware Software Integration	2,273		
(U) Deploy and Complete On-site test of System		1,200	
(U) Begin/Complete Hardware System integration		2,120	
(U) Mission Support	118	100	
(U) Total	6,014	3,420	

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 4022 Simulator for Electronic Combat Training (SECT)	

(U) B. **Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
AAI Corp Hunt Valley MD	FPIF	Apr 92	25,100	25,155	17,886	5,896	3,320	0	0	27,102
Support and Management Organizations										
ASC/YWMT				0	418	118	100	0	0	636
Test and Evaluation Organizations	N/A									

(U) B. **Budget Acquisition History and Planning Information Continued ($ in Thousands)**

Government Furnished Property: Not Applicable

Subtotal Product Development	17,886	5,896	3,320	0	0	27,102
Subtotal Support and Management	418	118	100	0	0	636
Subtotal Test and Evaluation	0	0	0	0	0	0
Total Project	18,304	6,014	3,420			27,738

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604227F Flight Simulator Development

PROJECT NO. AND NAME: 3135 Advanced Training System (ATS)

COST (In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3135 Advanced Training System (ATS)	1,438	0	0	0	0	0	0	0	34,266

(U) **A. Mission Description and Budget Item Justification ($ in Thousands)**

ATS supports instructional development, delivery, evaluation, and resource management at Air Education and Training Command's Technical Training Centers. Its main goals are to free instructors for individualized instruction in complex, highly technical tasks; promote efficient training; and provide rapid course creation and updating. Commercial hardware and software will yield a reliable and easily maintainable system. This project is transferring to the Air Education and Training Management System (AETMS) project in PE 0604243F, Manpower, Personnel, and Training Development as of FY96.

(U) FY 1995

- (U) $578 Continued course conversions. Complete Operational Test and Evaluation. Install Low-Rate Initial Production Suite at Keesler AFB MS. (There is no specific cost breakdown for the individual efforts.)
- (U) $660 Initiated AETMS upgrade to ATS
- (U) $200 Installed Prototype AETMS at selected AETC sites.
- (U) $1,438 Total

(U) FY 1996 Not Applicable. (program moved to PE 0604243F)

(U) FY 1997 Not Applicable. (program moved to PE 0604243F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 3135 Advanced Training System (ATS)	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	1,438			
(U) Appropriated Value				
(U) Adjustments to Appropriated Value				
a. Cong/Gen Reduction				
b. SBIR				
c. Omnibus or Other Above Threshold Reprogram				
d. Below Threshold Reprogram				
(U) Adjustment to Budget Year after FY96 PB				
(U) Current Budget Submit/President's Budget	1,438			

(U) Change Summary Explanation:

Funding: Project transferred to Project 4369, in PE 0604243F, Manpower, Personnel & Training.

Schedule: Not Applicable

Technical: Not Applicable

(U) **C. Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) N/A									
Related RDT&E:									
(U) 0604243F, Project 4369, Air Education Training Management System		1,010	961	1,021					2,992

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604227F Flight Simulator Development
PROJECT NO. AND NAME 3135 Advanced Training System (ATS)	

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) LRIP installations				X*								

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604233F Specialized Undergraduate Pilot Trng

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	36,274	58,999	84,291	70,721	44,993	25,188	14,867	34,300	391,203
3853 T-1A Tanker-Transport Training System (TTTS)	188	0	0	0	0	0	0	0	15,265
4102 Joint Primary Acft Trng Sys (JPATS)	35,898	44,033	64,531	61,130	44,993	25,188	14,867	34,300	331,032
4228 T-3A Enhanced Flight Screener (EFS)	188	0	0	0	0	0	0	0	589
4376 T-38 Avionics Upgrade Program (AUP)	0	14,966	19,760	9,591	0	0	0	0	44,317

(U) **A. Mission Description and Budget Item Justification**

Supports Air Education and Training Command's (AETC) implementation of Specialized Undergraduate Pilot Training (SUPT) and the Department of the Defense initiative for joint pilot training. The T-1A is a derivative of the commercially available Beech 400A "Beechjet," missionized for the training role. The aircraft will accommodate an instructor and two students. The T-1A Ground Based Training System (GBTS) includes compatible simulators, mock-ups, courseware, syllabus, and student management and scheduling. The Tanker-Transport syllabus includes training in high and low altitude instrument approaches, crew coordination, asymmetric thrust situations, airdrop fundamentals, low-level navigation, airborne rendezvous, and cell formation. The Joint Primary Aircraft Training System (JPATS) is a joint USAF/USN venture to replace the Services' fleets of primary trainer aircraft (T-37 and T-34 respectively) and associated GBTS. The Air Force is the lead or Executive Service. The T-3A Enhanced Flight Screener (EFS) will be used at the United States Air Force Academy and Hondo Field, Texas to standardize flight screening prior to SUPT. The aircraft is aerobatic certified and has side-by-side seating, dual stick controls, dual throttles, and tricycle gear. The T-38 Avionics Upgrade Program (AUP) is planned as an integrated modernization of the T-38 and AT-38 cockpits to support mission ready bomber/fighter training. Since much of the work in this program element involves the missionization of commercial aircraft equipment and components, the Budget Activity is Engineering and Manufacturing Development (EMD).

(U) **Acquisition Strategy:** Each acquisition has been or will be competitively awarded with the intent of maximizing the use of commercially available equipment and best commercial practices. The T-1A procurement is a firm fixed price contract, and the final production order used FY95 funds. The JPATS Program competitively awarded two contracts: a firm fixed price contractor logistics support (CLS) contract and a fixed price incentive fee engineering & manufacturing development (EMD)/production contract with several options. All of the T-3A production aircraft were delivered under a firm fixed price contract. The T-38 AUP

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng

acquisition strategy calls for the competitive award of three fixed price contracts to a single prime to a) conduct EMD and production; b) provide Contractor Logistics Support including Contractor Operated and Maintained Base Supply; and c) provide maintenance of current and new aircrew training devices (ATDs).

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	36,322	63,042	100,417	384,329
(U) Appropriated Value	37,433	63,042		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-408	-1,221		
b. SBIR	-703	-1,484		
c. Omnibus and Other Above Threshold Reprogramming		-1,338		
d. Below Threshold Reprogramming	-48			
(U) Adjustments to Budget Years since FY96 PB			-16,126	
(U) Current Budget Submit/President's Budget	36,274	58,999	84,291	391,203

(U) Change Summary Explanation:

Funding: FY95 and FY96 include congressional/general reductions, SBIR, and reprogrammings. FY96 reprogramming was for Bosnia I and F-16s to Jordan. FY 97 and Total Cost include inflation rate changes; decreased near-term and increased far-term RDT&E requirement for Joint Primary Aircraft Training System (JPATS) Ground Based Training System (GBTS) based on contractor proposals, and the requirement for out-year Contractor Advisory and Assistance Support (CAAS).

Schedule: Minor schedule changes due to late JPATS contract award resulting from source selection protests.

Technical: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604233F Specialized Undergraduate Pilot Trng

(U) C. **Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Aircraft Procurement, Air Force									
(U) 0804740F, T-1A TTTS	177,517	37,587	4,578	0	0	0	0	0	978,942
(U) (Quantity)	(32)	(0)	(0)						(180)
(U) 0804740F, JPATS	92,610	29,163	67,183	67,368	109,436	106,349	107,264	1,306,500	1,885,873
(U) (Quantity)	(3)	(3)	(12)	(18)	(18)	(24)	(30)	(264)	(372)
(U) 0804741F, T-38 Avionics Upgrade	0	0	0	31,300	121,596	112,322	116,906	249,200	631,324
(U) (Quantity)				(27)	(93)	(82)	(85)	(138)	(425)
(U) Aircraft Procurement, Navy, 0804754N, Undergraduate Pilot Training, 033900, JPATS	0	0	0	0	0	32,718	78,348	1,559,900	1,670,966
(U) (Quantity)						(8)	(24)	(307)	(339)
(U) Military Construction, Air Force, 0804741F, JPATS	0	0	0	2,544	0	3,300	0	14,300	20,144
(U) Military Construction, Navy						7,600	1,300	600	9,500
Related RDT&E:									
(U) RDT&E, Navy, 0603208N, Training System Aircraft, H1150, JPATS	3,752	1,706	1,952	3,512	5,336	3,580	909	0	24,315

(U) D. **Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Reference individual project data												

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604233F Specialized Undergraduate Pilot Trng

PROJECT NO. AND NAME: 3853 T-1A Tanker-Transport Training System (TTTS)

COST *($ In Thousands)*	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3853 T-1A Tanker-Transport Training System (TTTS)	188	0	0	0	0	0	0	0	15,265

(U) **A. Mission Description and Budget Item Justification ($ in Thousands)**

The T-1A is a program to missionize a small business jet aircraft (Beech 400A) to implement the tanker-transport track of Specialized Undergraduate Pilot Training (SUPT).

(U) FY 1995

- (U) $188 Provided mission support for operation of the T-1A System Program Office
- (U) $188 Total

(U) FY 1996

- (U) None
- (U) $0 Total

(U) FY 1997

- (U) None
- (U) $0 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 3853 T-1A Tanker-Transport Training System (TTTS)	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	188	0	0	15,233
(U) Appropriated Value	188			
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions				
b. SBIR				
c. Omnibus or Other Above Threshold Reprogramming				
d. Below Threshold Reprogrammings				
(U) Adjustments to Budget Years Since FY96 PB				
(U) Current Budget Submit/President's Budget	188	0	0	15,265

(U) Change Summary Explanation:

Funding: Minor within program element reprogrammings.

Schedule: N/A

Technical: N/A

(U) **C. Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Aircraft Procurement, Air Force									
(U) 0804740F, T-1A TTTS	177,517	37,587	4,578	0	0	0	0	0	978,942
(U) (Quantity)	(32)	(0)	(0)						(180)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 3853 T-1A Tanker-Transport Training System (TTTS)	

(U) D. Schedule Profile

		FY 1995				FY 1996				FY 1997			
		1	2	3	4	1	2	3	4	1	2	3	4
(U)	Begin Aircraft Deliveries Vance AFB	X*											
(U)	Complete Aircraft Deliveries Laughlin AFB		X*										
(U)	Simulator Deliveries Vance AFB				X*								
(U)	Complete Aircraft Deliveries Vance AFB						X						
(U)	Begin Aircraft Deliveries Columbus AFB						X						
(U)	Simulator Deliveries Columbus AFB								X				
(U)	Complete Aircraft Deliveries Columbus AFB											X	

* Denotes milestone completion

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 3853 T-1A Tanker-Transport Training System (TTTS)	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Mission Support	188	0	0
(U) Total	188	0	0

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Support and Management Organizations										
ASC/YT	Misc	Misc	N/A	N/A	15,077	188	0	0	0	15,265
Test and Evaluation Organizations										

Note: No RDT&E contract exceeds $1 million.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 3853 T-1A Tanker-Transport Training System (TTTS)	

(U) B. **Budget Acquisition History and Planning Information Continued ($ in Thousands)**

Government Furnished Property: Not Applicable

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property									
Support and Management Property									
Test and Evaluation Property									
				Total Prior to FY 1995					
Subtotal Support and Management				15,077	0	0	0	15,265	
Subtotal Test and Evaluation									
Total Project				15,077	0	0	0	15,265	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604233F Specialized Undergraduate Pilot Trng

PROJECT NO. AND NAME: 4102 Joint Primary Acft Trng Sys (JPATS)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4102 Joint Primary Acft Trng Sys (JPATS)	35,898	44,033	64,531	61,130	44,993	25,188	14,867	34,300	331,032

(U) A. **Mission Description and Budget Item Justification ($ in Thousands)**

The Joint Primary Aircraft Training System (JPATS) is a joint USAF/USN venture to replace the Services' fleets of primary trainer aircraft (T-37 and T-34, respectively) and associated Ground Based Training Systems (GBTS). The aircraft and GBTS will be used to train entry level student aviators in the fundamentals of flying so they can transition into advanced tracks leading to qualification as military pilots, navigators, and naval fight officers. The program includes the purchase of aircraft, simulators, and other associated ground-based training devices, training management systems, instructional courseware, and logistics support. Funding reflects the requirements of the Sep 93 Operational Requirements Document. In Jun 95, Raytheon (Beech) Aircraft was selected as the aircraft prime contractor. Resolution of protests and contract award occurred in Feb 96.

(U) FY 1995

- (U) $35,898 Award acquisition contract for manufacturing development phase; begin GBTS Contract Change Proposal, and mission support
- (U) $35,898 Total

(U) FY 1996

- (U) $44,033 Continue contractor-conducted GBTS source selection; begin flight test program; begin escape system and bird-strike testing; continue Airframe Structural Integrity Program (ASIP) and Engine Structural Integrity Program (ENSIP); and continue missionization; mission support
- (U) $44,033 Total

(U) FY 1997

- (U) $64,531 Continue first aircraft development; modify contract to support GBTS development; continue flight test program; Contractor Advisory and Assistance Support (CAAS)
- (U) $64,531 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 4102 Joint Primary Acft Trng Sys (JPATS)	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	36,649	47,024	76,639	308,790
(U) Appropriated Value	37,057	47,024		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-408	-911		
b. Small Business Innovation Research (SBIR)	-703	-1,107		
c. Omnibus or Other Above Threshold Reprogramming		-973		
d. Below Threshold Reprogramming	-48			
(U) Adjustments to Budget Years since FY96 PB			-12,108	
(U) Current Budget Submit/President's Budget	35,898	44,033	64,531	331,032

(U) Change Summary Explanation:

Funding: FY95 and FY96 reflect undistributed congressional reductions, SBIR, and reprogrammings. FY96 reprogramming is for Bosnia and F-16s to Jordan bills. FY97 and beyond include inflation rate changes, decreased near-term RDT&E requirement and increased long-term RDT&E requirement for the JPATS Ground Based Training System (GBTS) based on contractor proposals, and the requirement for out-year Contractor Advisory and Assistance Support (CAAS).

Schedule: Minor schedule changes due to late JPATS contract award resulting from source selection protests.

Technical: N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604233F Specialized Undergraduate Pilot Trng

PROJECT NO. AND NAME: 4102 Joint Primary Acft Trng Sys (JPATS)

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Aircraft Procurement, Air Force, 0804740F, JPATS	92,610	29,163	67,183	67,368	109,436	106,349	107,264	1,306,500	1,885,873
(U) (Quantity)	(3)	(3)	(12)	(18)	(18)	(24)	(30)	(264)	(372)
(U) Aircraft Procurement, Navy, 0804745N, Undergraduate Pilot Training, 033900, JPATS	0	0	0	0	0	32,718	78,348	1,559,900	1,670,966
(U) (Quantity)						(8)	(24)	(307)	(339)
(U) RDT&E, Navy, 0603208N, Training System Aircraft, H1150, JPATS	3,752	1,706	1,952	3,512	5,336	3,580	909	0	24,315
(U) Military Construction, Air Force, 0804741F, JPATS	0	0	0	2,544	0	3,300	0	14,300	20,144
(U) Military Construction, Navy						7,600	1,300	600	9,500

(U) D. Schedule Profile

		FY 1995				FY 1996				FY 1997			
		1	2	3	4	1	2	3	4	1	2	3	4
(U)	Aircraft Contract Award						X*						
(U)	GBTS Subcontract									X			
(U)	Aircraft CDR									X			
(U)	Delivery of Aircraft T-1	1Q99											
(U)	Milestone III	2Q00											
(U)	IOC Air Force	4Q01											
(U)	IOC Navy	2Q04											

*Denotes milestone completion

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 4102 Joint Primary Acft Trng Sys (JPATS)	

(U) A. **Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Aircraft Missionization/Test and Evaluation	32,732	37,896	33,612
(U) Ground Based Training System	0	2,139	29,019
(U) Mission Support	3,166	3,998	1,900
(U) Total	35,898	44,033	64,531

(U) B. **Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Raytheon Aircraft Company	FPAF	5 Feb 96	TBD	TBD	N/A	32,732	37,896	33,612	12,435	116,675
GBTS-TBD	TBD	5 Apr 97	TBD	TBD	N/A	N/A	2,139	29,019	125,543	156,701
Product Development Organizations										
Support and Management Organizations										
Misc	Misc	Misc	N/A	N/A	6,092	3,166	3,998	1,900	42,500	57,656
Test and Evaluation Organizations										

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 4102 Joint Primary Acft Trng Sys (JPATS)	

(U) B. **Budget Acquisition History and Planning Information Continued ($ in Thousands)**

Government Furnished Property: Not Applicable

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property									
Support and Management Property									
Test and Evaluation Property									
Subtotal Product Development				N/A	32,732	40,035	62,631	137,978	273,376
Subtotal Support and Management				6,092	3,166	3,998	1,900	42,500	57,656
Subtotal Test and Evaluation									
Total Project				6,092	35,898	44,033	64,531	180,478	331,032

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604233F Specialized Undergraduate Pilot Trng

PROJECT NO. AND NAME: 4228 T-3A Enhanced Flight Screener (EFS)

COST (*$ In Thousands*)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4228 T-3A Enhanced Flight Screener (EFS)	188	0	0	0	0	0	0	0	589

(U) **A. Mission Description and Budget Item Justification ($ in Thousands)**

The T-3A Enhanced Flight Screener, a missionized Slingsby Firefly, is a more capable and maneuverable replacement for the aging T-41. The T-3A will provide a more thorough assessment of candidates' capabilities thus lowering pilot training attrition.

(U) FY 1995

- (U) $188 Provided mission support for the operation for the T-3A System Program Office
- (U) $188 Total

(U) FY 1996

- (U) $0 Total

(U) FY 1997

- (U) $0 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604233F Specialized Undergraduate Pilot Trng

PROJECT NO. AND NAME: 4228 T-3A Enhanced Flight Screener (EFS)

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	188	0	0	583
(U) Appropriated Value	188			
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions				
b. SBIR				
c. Omnibus or Other Above Threshold Reprogramming				
d. Below Threshold Reprogramming				
(U) Adjustments to Budget Years Since FY96 PB				
(U) Current Budget Submit/President's Budget	188	0	0	589

(U) Change Summary Explanation:

Funding: Minor within program element and below threshold reprogrammings.

Schedule: N/A

Technical: N/A

(U) **C. Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Aircraft Procurement, Air Force, 0804740F, T-3A Enhanced Flight Screener	0	0	0	0	0	0	0	0	42,043
(U) (Quantity)									(113)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 4228 T-3A Enhanced Flight Screener (EFS)	

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) RAA 29 Aircraft at USAF Academy	X*											
(U) Full Operational Capability (FOC) 56 Aircraft at USAF Academy			X*									
(U) FOC 57 Aircraft at Hondo					X*							

* Denotes milestone completion

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604233F Specialized Undergraduate Pilot Trng

PROJECT NO. AND NAME: 4228 T-3A Enhanced Flight Screener (EFS)

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Mission Support	188	0	0
(U) Total	188	0	0

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations N/A										
Support and Management Organizations										
ASC/YW	Misc	Misc	N/A	N/A	401	188	0	0	0	589
Test and Evaluation Organizations										

Note: No RDT&E contract exceeds $1 million. T-3A RDT&E funds covered management and support only. T-3A was a non-developmental item.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 4228 T-3A Enhanced Flight Screener (EFS)	

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property: Not Applicable

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property N/A									
Support and Management Property N/A									
Test and Evaluation Property N/A									
Subtotal Product Development				0	0	0	0	0	
Subtotal Support and Management				401	0	0	0	589	
Subtotal Test and Evaluation				0	0	0	0	0	
Total Project				401	0	0	0	589	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604233F Specialized Undergraduate Pilot Trng

PROJECT NO. AND NAME: 4376 T-38 Avionics Upgrade Program (AUP)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4376 T-38 Avionics Upgrade Program (AUP)	0	14,966	19,760	9,591	0	0	0	0	44,317

(U) **A. Mission Description and Budget Item Justification ($ in Thousands)**

The T-38 Avionics Upgrade Program (AUP) is planned as an integrated modernization of the T-38 and AT-38 cockpits to support mission-ready bomber and fighter training. The modernized digital cockpit will include Global Positioning System (GPS), Heads-Up Display (HUD), Inertial Navigation System (INS), Multi-function Displays (MFDs), Data Transfer System (DTS), No-Drop Bombing System (NDBS), and Hands-On Throttle and Stick (HOTAS) switchology. HUD symbology will be the new USAF standard recently certified as a primary flight reference. Also included is the acquisition of two types of aircrew training devices (ATDs) to replace the existing T-51 simulators. The program includes the design, integration, test, and installation of the cockpit prototype in aircraft, simulators, ATDs, and other training devices.

(U) FY 1995

- (U) $0 Developed and finalized acquisition strategy; developed Systems Requirements Document; developed request for proposal (RFP), and began source selection activities (PE 0604201F funded).
- (U) $0 Total

(U) FY 1996

- (U) $14,966 Release RFP, receive proposals, and complete source selection process; award contract for Engineering and Manufacturing Development (EMD) with options for production, installation and support for 425 AT/T-38 aircraft; begin EMD - conduct System Requirement Review
- (U) $14,966 Total

(U) FY 1997

- (U) $19,760 Continue EMD phase - conduct System/Software Design Review (DR); start system integration and contractor testing and complete demonstrations
- (U) $19,760 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604233F Specialized Undergraduate Pilot Trng

PROJECT NO. AND NAME: 4376 T-38 Avionics Upgrade Program (AUP)

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	16,018	23,778	50,741
(U) Appropriated Value	0	16,018		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions		-310		
b. SBIR		-377		
c. Omnibus or Other Above Threshold Reprogramming		-365		
d. Below Threshold Reprogramming				
(U) Adjustments to Budget Years Since FY96 PB			-4,018	
(U) Current Budget Submit/President's Budget	0	14,966	19,760	44,317

(U) Change Summary Explanation:

Funding: FY96 includes undistributed reductions, SBIR, and a reprogramming to support Bosnia and F-16s to Jordan bills. FY97 includes a reduction to compensate for a late contract award in FY96. FY97 and beyond include reductions to accommodate revised inflation rates.

Schedule: Slight delay in contract award.

Technical: N/A

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) 0804741F, T-38 AUP	0	0	0	31,300	121,596	112,322	116,906	249,200	631,324
(U) (Quantity)				(27)	(93)	(82)	(85)	(138)	(425)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 4376 T-38 Avionics Upgrade Program (AUP)	

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Acquisition Milestones												
(U) Strategic Roundtable	X*											
(U) Tactical Roundtable		X*										
(U) Milestone 0			X*									
(U) Milestone I/II				X*								
(U) Engineering Milestones												
(U) Develop Systems Requirement Document				X*								
(U) Begin Engineering and Manufacturing Development (EMD)							X					
(U) Complete DRs (H/W, S/W, System)											X	
(U) T&E Milestones												
(U) Draft Test and Evaluation Master Plan (TEMP)				X*								
(U) TEMP								X				
(U) Begin Systems Integration Laboratory Demonstrations								X				
(U) Begin Contractor System Testing											X	
(U) Contract Milestones												
(U) Release Request for Proposal					X*							
(U) Complete Source Selection							X					
(U) Contract Award							X					

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 4376 T-38 Avionics Upgrade Program (AUP)	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Prime Mission Support		584	248
(U) Platform Integration			
(U) - Electronic System Integration		3,617	3,609
(U) - Platform Mod Kit			5,898
(U) - Platform Software		4,786	4,429
(U) System Test & Evaluation			
(U) - Developmental Test & Evaluation		211	1,465
(U) - Mockups		1,370	903
(U) - Test & Evaluation Support		2	174
(U) System Engineering / Project Management			
(U) - System Engineering (NON - Integrated Logistics Support (ILS))		218	214
(U) - System Engineering Program Management		565	700
(U) Technical Data			
(U) - Data (NON- ILS)		36	38
(U) - Data (ILS)		1,303	20
(U) Training			
(U) - Training Equipment		1,128	1,143
(U) Spare & Repair Parts			
(U) - Initial Spare & Repair Parts		64	0
(U) Other (Engineering Change Order & Other Gov't Costs)		1,082	919
(U) Total		14,966	19,760

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 4376 T-38 Avionics Upgrade Program (AUP)	

(U) B. Budget Acquisition History and Planning Information ($ in Thousands)

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
TBD										
Support and Management Organizations										
TBD										
Test and Evaluation Organizations										
TBD										

Note: Categorization by performing organization will be available after source selection.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604233F Specialized Undergraduate Pilot Trng
PROJECT NO. AND NAME 4376 T-38 Avionics Upgrade Program (AUP)	

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property: Not Applicable

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property	TBD								
Support and Management Property	TBD								
Test and Evaluation Property	TBD								
Subtotal Product Development									
Subtotal Support and Management									
Subtotal Test and Evaluation									
Total Project				0	14,966	19,760	9,591	44,317	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604239F F-22 EMD

PROJECT NO. AND NAME: 4069 Advanced Tactical Fighter - FSD

COST ($ In Thousands)	FY 1994 Actual	FY 1995 Estimate	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4069 Advanced Tactical Fighter - FSD	2,058,804	2,280,555	2,164,897	2,002,959	2,214,512	1,418,283	959,505	577,436	19,500	21,204,600

(U) A. **Mission Description and Budget Item Justification**

This program is in budget activity 5 - Engineering and Manufacturing Development, because the F-22 Program is developing the next-generation air superiority fighter for the USAF to counter emerging worldwide threats. The F-22 is designed to penetrate enemy airspace and achieve a first look, first kill capability against multiple targets. The F-22 is characterized by a low observable, highly maneuverable airframe, advanced integrated avionics, and aerodynamic performance that allows supersonic cruise without the use of afterburner. The F-22 is currently in the Engineering and Manufacturing Development (EMD) phase of acquisition and plans to release long lead production funding for Lot 1 aircraft in FY98. The contract is Cost Plus Award Fee with Lockheed Martin Aeronautical Systems (LMAS) and Pratt & Whitney (P&W) to produce the F119 engines. The engines are provided to LMAS as Government Furnished Equipment (GFE).

The EMD phase effort consists of:

- Design, development, fabrication, test and delivery of thirteen flight test vehicles (11 single seat and 2 dual seat) and two ground test vehicles (static and fatigue).
- Design, development, fabrication, and delivery of 39 flight qualified engines.
- Design, development, fabrication, integration, and test of the EMD avionics suite including air-to-surface provision.
- Updating the YF-22 Avionics Flying Laboratory with EMD assets and software to become a Flying Test Bed (FTB) to support avionics integration.
- Design, development, and test of F-22 weapons system support and training system.
- Renovation of facilities at Edwards Air Force Base (AFB) in support of the F-22 program.

Note: Total Cost includes $3,779,811 of Demonstration and Validation funding prior to FY92.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604239F F-22 EMD
PROJECT NO. AND NAME 4069 Advanced Tactical Fighter - FSD	

(U) FY 1995 ($ in Thousands):

- (U)$1,256,733 Air Vehicle
  - Finalized FTB test configuration. (Not Separately Priced (NSP))
  - Completed Air Vehicle CDR/Initial Production Readiness Review (PRR). (NSP)
  - Continued to design/fabricate support system equipment for test. (NSP)
  - Continued technical order development. (NSP)
  - Initiated assembly of Engineering and Manufacturing Development (EMD) aircraft #1. (NSP)
  - Fabricated major sub-assembly items for EMD aircraft #2 and Static Test aircraft. (NSP)
  - Continued Detailed Design. (NSP)
  - Continued design and development of Air Vehicle support system products. (NSP)
  - Initiated fabrication of Support Equipment (SE) in support of final aircraft assembly. (NSP)
- (U) $630,806 Avionics
  - Continued development of initial Block 0 software release. (NSP)
  - Conducted Avionics, subsystem CDRs. (NSP)
  - Initiated FTB design and structural modification design. (NSP)
  - Controls and Displays (C&D), Store Management System (SMS) first article delivery. (NSP)
- (U) $322,385 Engine
  - Continued engine development test program - add (2) test engines (5 Total). (NSP)
  - Initiated long lead for initial flight test engines. (NSP)
  - Continued engine support system product development/fabrication for flight test. (NSP)
- (U) $70,631 Other Government Cost
  - Manpower, equipment purchases, facility modifications at Edwards AFB.
  - Support of engine development test program.
  - Jet effects, inlet, and stores separation testing at AEDC, Phase I aperture measurements at Rome Labs.
  - Mission support of the SPO; travel, computer costs, training, communications, misc contracts, etc.
  - Procurement of required government furnished equipment (GFE).
- (U)$2,280,555 Total

(U) FY 1996 ($ in Thousands):

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604239F F-22 EMD
PROJECT NO. AND NAME 4069 Advanced Tactical Fighter - FSD	

- (U)$1,263,072 Air Vehicle
  - Continue assembly of Engineering and Manufacturing Development (EMD) aircraft #1 and #2. (NSP)
  - Software Block 0 release. (NSP)
  - Initiate assembly of static test article, and EMD aircraft #3. (NSP)
  - Initiate structural modification of Flying Test Bed (FTB). (NSP)
  - Fabricate Support System elements for F-22 first flight. (NSP)
  - Conduct Two-Seat Air Vehicle Preliminary Design Review (PDR). (NSP)
  - Complete Training System Requirements Description Review Update. (NSP)
  - Complete fabrication and delivery of Support Equipment in support of final assembly. (NSP)
  - Fabricate and deliver Support Equipment to support flight test. (NSP)
- (U) $517,233 Avionics
  - Begin mission software Block 2 detailed design. (NSP)
  - Conduct mission software Block 2 PDR. (NSP)
  - Complete mission software Block 1 coding. (NSP)
  - Inertial Reference System (IRS) first article delivery. (NSP)
  - Initiate mission software Block 3 design. (NSP)
  - Continue FTB design/kit fabrication. (NSP)
- (U) $286,483 Engine
  - Continue engine development test program and initial flight clearance qualification. (NSP)
  - Add (2) test engines (7 total).
  - Build and test initial flight test engines. (NSP)
  - Deliver and validate engine support system products. (NSP)
- (U)$98,109 Other Government Cost
  - Manpower, computer networks, control room modifications at Edwards AFB.
  - Continued support of engine development test program.
  - Further stores separation and bay acoustics wind tunnel testing at AEDC.
  - Phase II aperture measurements at Rome Labs, and first session variable sidestick controller testing at VISTA labs.
  - Mission support of the SPO; travel, computer costs, training, communications, misc contracts, etc.
  - Procurement of required government furnished equipment (GFE).
- (U)$2,164,897 Total

(U) FY 1997 ($ in Thousands):

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604239F F-22 EMD
PROJECT NO. AND NAME 4069 Advanced Tactical Fighter - FSD	

- (U)$1,235,127 Air Vehicle
  - Complete assembly of Engineering and Manufacturing Development (EMD) aircraft #1 and #2. (NSP)
  - Conduct Interim Production Readiness Review (PRR). (NSP)
  - Conduct First Flight Readiness Review (FRR). (NSP)
  - Conduct F-22 first flight. (NSP)
  - Continue structural modification of Flying Test Bed (FTB). (NSP)
  - Initiate fabrication of fatigue article. (NSP)
  - Continue assembly of Engineering and Manufacturing Development (EMD) aircraft #3. (NSP)
  - Initiate fabrication of Engineering and Manufacturing Development (EMD) aircraft #4, #5, #6, and #7. (NSP)
  - Initiate procurement of four Pre-Production Vehicles (PPVs). (NSP)
  - Complete Two-Seat Air Vehicle Critical Design Review (CDR). (NSP)
  - Tech order data for First Development Test & Evaluation (DT&E) aircraft available. (NSP)
  - Integrated Maintenance Information System (IMIS) for flight test available. (NSP)
  - Supply Support Provisioning Management System implemented. (NSP)
  - Complete initial supportability assessment. (NSP)
- (U) $418,105 Avionics
  - Complete Block 1 Computer Software Component (CSC) integration. (NSP)
  - Continue Avionics Integration Laboratory (AIL) integration in preparation of Block 1 integration testing. (NSP)
  - Initiate and complete FTB modifications, fabrication, and installation, conduct air worthiness review. (NSP)
  - Complete mission software Block 2 coding and unit test. (NSP)
  - Conduct mission software Block 3 Preliminary Design Review (PDR). (NSP)
- (U) $248,927 Engine
  - Initiate production engine qualification testing. (NSP)
  - Deliver and support flight test engines. (NSP)
  - Initiate procurement of engines to support Pre-Production Vehicles (PPVs). (NSP)
  - Begin verification of engine support system products. (NSP)
- (U)$100,800 Other Government Cost
  - Flight test support at Edwards AFB.
  - Continued support of engine testing.
  - Further phase II aperture measurements at Rome Labs, second session variable sidestick controller testing at VISTA labs.
  - Additional stores separation wind tunnel testing at AEDC.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604239F F-22 EMD
PROJECT NO. AND NAME 4069 Advanced Tactical Fighter - FSD	

- Mission support of the SPO; travel, computer costs, training, communications, misc contracts, etc.
- Procurement of required government furnished equipment (GFE).

– (U)$2,002,959 Total

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY96)	2,461,149	2,138,718	1,957,067	19,482,307
(U) Appropriated Value	2,351,049	2,238,718		
(U) Adjustments to Appropriated Value				
a. Congressional General Reductions	-25,757	-43,834		
b. Small Business Innovative Research	-44,737	-29,987		
c. Adjustments to Budget Years Since FY96 PB			45,892	1,722,293
(U) FY97 President's Budget	2,280,555	2,164,897	2,002,959	21,204,600

(U) Change Summary Explanation:

Funding: (FY97 PB)

- $100 million restoral of FY96 budget cut in the FY96 appropriation bill is included in appropriated value.
- FY97 Budget reflects transfer of funding for 4 pre-production verification (PPV) aircraft from procurement (3010) to RDT&E (3600). The $1.72B increase results from the PPV transfer and refinement of the estimated cost to complete development.

Schedule: (FY97 PB)

- FY96 $100 million restoral received in December 95 did not provide sufficient funding in the time frame needed to impact program schedule.

Technical: (FY97 PB)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604239F F-22 EMD
PROJECT NO. AND NAME 4069 Advanced Tactical Fighter - FSD	

(U) C. **Other Program Funding Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	*To Compl	Total Cost
(U) Military Construction (PE 0604239F)	4,550	12,100	4,390	0	0	0	0	0	21,040
(U) Military Construction (PE 0207219F)	0	0	0	0	300	0	0	182,607	182,907
(U) Aircraft Procurement (PE 0207219F)	0	0	0	86,782	1,085,214	2,005,563	3,265,555	42,241,286	48,684,400

* Funding in To Complete column reflects estimated cost to procure 438 aircraft.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604239F F-22 EMD
PROJECT NO. AND NAME 4069 Advanced Tactical Fighter - FSD	

(U) **D. Schedule Profile***

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Aircraft Delivered (EMD Test Article)											1	
Program Milestones												
- DAB Review LRIP LL, 1QFY98												
- DAB MS III, 4QFY02												
Engineering Milestones												
- Air Vehicle CDR, 2QFY95		X										
- 2 Seat Air Vehicle CDR, 3QFY97											X	
- First Flight, 3QFY97											X	
- First Avionics Flight, 2QFY99												
T&E Milestones												
- DT&E First Flight, 3QFY97											X	
- Dedicated IOT&E, 1QFY02												

* Schedule changes from FY96 PB reflect results of the third rephase.

EMD = Engineering & Manufacturing Development, DAB = Defense Acquisition Board, PPV = Pre-Production (Aircraft), LRIP = Low Rate Initial Production, LL = Long Lead, MS = Milestone, CDR = Critical Design Review, DT&E = Developmental Test & Evaluation, IOT&E = Initial Operational Test & Evaluation

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604239F F-22 EMD
PROJECT NO. AND NAME 4069 Advanced Tactical Fighter - FSD	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Air Vehicle/Avionics	1,887,539	1,780,305	1,653,232
(U) Engine	322,385	286,483	248,927
(U) Government Cost			
- Government Test	46,401	66,009	68,459
- Mission Support	17,353	16,000	16,000
- GFE	6,877	16,100	16,341
(U) Total	2,280,555	2,164,897	2,002,959

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604239F F-22 EMD
PROJECT NO. AND NAME 4069 Advanced Tactical Fighter - FSD	

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	*Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Lockheed (Air Veh)	C/CPAF	Aug 91	11,413,600	14,001,514	4,646,604	1,887,539	1,780,305	1,653,232	4,033,834	14,001,514
Pratt & Whitney	C/CPAF	Aug 91	1,955,700	2,319,175	1,007,900	322,385	286,483	248,927	453,480	2,319,175
Support and Management Organizations										
Support Contracts	Various	Various			5,113	1,542	1,500	1,500	9,363	19,018
In House Support	Various	Various			29,834	15,811	14,500	14,500	80,337	154,982
Test and Evaluation Organizations										
AEDC	PO				71,428	18,466	21,720	17,661	23,277	152,552
AFFTC	PO				13,041	23,112	33,848	39,900	534,106	644,007
All other test	Various	Various			7,099	4,823	10,441	10,898	19,680	52,941

* Note: The Project Office EAC includes the following items not included in the Performing Activity (ie Contractor) EAC - Base Fee, Award Fee, SPO Planned CCPs (Bogey List), SPO FY96 POM initiatives not yet on contract, E,C,R Firm Risk Items, and Pre-Production Verification (PPV) aircraft move to EMD (3600).

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604239F F-22 EMD
PROJECT NO. AND NAME 4069 Advanced Tactical Fighter - FSD	

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property									
GFE	Various	Various	Various	6,123	6,877	16,100	16,341	35,159	80,600
Support and Management Property									
Test and Evaluation Property									
Subtotal Product Development									
Subtotal Support and Management									
Subtotal Test and Evaluation									
Total Project				9,566,953*	2,280,555	2,164,897	2,002,959	5,189,236	21,204,600

* Includes $3,779,811 of Demonstration and Validation funding prior to FY 92.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604243F Mnpwr Pers & Trng Development

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	4,260	5,006	4,940	5,194	4,269	4,394	4,457	Continuing	TBD
3818 Maintainance Skills Tutors (MST)	4,260	3,996	3,979	4,173	4,269	4,394	4,457	Continuing	TBD
4369 Air Education & Training Management Sys (AETMS)	0	1,010	961	1,021	0	0	0	0	2,992

(U) **A. Mission Description and Budget Item Justification**

This program develops manpower, personnel, and training (MPT) technologies to improve effectiveness of Air Force training, performance, assessment, personnel acquisition, job assignment, force management, and human performance in weapon systems. MSTs are designed to leverage senior maintenance personnel experience, through the use of artificial intelligence, for use in training junior specialists. AETMS will be the major Air Education and Training Command (AETC) training system with emphasis on centralized training for a decentralized training environment. AETC will benefit from more standardized training command-wide. This program is in Budget Activity 5 as it provides for the development and engineering of training and tutorial systems.

(U) **Acquisition Strategy:**

MST - Full and open competition, inclusive of small disadvantaged firms, for a Cost Plus Award Fee (CPAF), Indefinite Delivery, Indefinite Quantity (IDAQ) contract. Individual delivery orders will be negotiated and awarded for each tutor development, Cognitive Task Analysis (CTA), or other parts of the statement of work.

AETMS - Engineering Change Proposals (ECPs) to be incorporated by modifying current Firm Fixed Price (FFP) contract with LORAL.

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,466	5,300	5,174	TBD
(U) Appropriated Value	4,636	5,300		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-84	-137		
b. SBIR	-86	-103		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604243F Mnpwr Pers & Trng Development

	FY 1995	FY 1996	FY 1997	Total Cost
c. Omnibus or Other Above Threshold Reprogramming		-54		
d. Below Threshold Reprogramming	-206			
(U) Adjustments to Budget Years Since FY96 PB			-234	
(U) Current Budget Submit/President's Budget	4260	5,006	4,940	TBD

(U) Change Summary Explanation:

Funding: AETMS was generated in the transfer of the Advanced Training System from PE 0604227F in FY96. FY95 and FY96 reflect undistributed congressional reductions, below threshold reprogramming, Omnibus and other above threshold reprogramming, and SBIR reductions. FY97 includes reduction based on revised inflation rates.

Schedule: Not Applicable

Technical: Not Applicable

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Related RDT&E:									
(U) 0604227F, Project 3135, Advanced Training System	1,438								

(U) D. Schedule Profile: See individual projects.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604243F Mnpwr Pers & Trng Development

PROJECT NO. AND NAME: 3818 Maintainance Skills Tutors (MST)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3818 Maintainance Skills Tutors (MST)	4,260	3,996	3,979	4,173	4,269	4,394	4,457	Continuing	TBD

(U) **A. Mission Description and Budget Item Justification**

MST fields multiple, computer-based tutors, intelligent tutoring systems, and training delivery systems for the Combat Air Forces, other Air Force agencies, and total force to improve training of complex skills for a broad range of Air Force jobs -- primarily aircraft maintenance troubleshooting. These MSTs may include some initial skills training, but primary emphasis is on the more difficult cognitive skills such as understanding and troubleshooting problems that the maintenance-aiding equipment and systems are unable to diagnose. Four of the initial tutors will be fieldable test/research assets developed by Armstrong Lab under the Basic Job Skills (BJS) program. The System Program Office (SPO) is developing two tutors as a pre-EMD cost and schedule risk reduction effort. This effort was approved by the Designated Acquisition Commander (DAC), HSC/CC, with support from the users. The core tutor software models from this effort will be reused for the remaining five tutors. The last five tutors will be developed during EMD.

(U) FY 1995

- (U) $2,201 Continued development, begin operational evaluation and fielding of the F-16 flightline Avionics A and C shop tutors.
- (U) $1,140 Began cognitive task analysis for the F-16 flightline Avionics B shop tutors
- (U) $400 Began operational evaluation and fielding of two F-15 flightline avionics tutors and two F-15 flightline pneudraulics tutors.
- (U) $519 Began evaluation of tutors authorizing package options
- (U) $4,260 Total

(U) FY 1996

- (U) $998 Complete development and operational evaluation and upgrade of F-16 and F-16 avionics tutors
- (U) $2,298 Begin development of F-16 flightline Avionics B shop tutors
- (U) $600 Continue evaluation of tutors authorizing package options
- (U) $100 Begin evaluation and modification (of Rapid Intelligent Tutor Development System (RIDES)) and continue other tutor authoring software
- (U) $3,996 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604243F Mnpwr Pers & Trng Development
PROJECT NO. AND NAME 3818 Maintainance Skills Tutors (MST)	

(U) FY 1997

- (U) $719 Begin development of the F-16 Tactical Aircraft Maintenance Specialist (TAMS) 1 tutor
- (U) $750 Begin training delivery systems development
- (U) $600 Continue evaluation of tutors authorizing package options
- (U) $118 Begin CTA of F-16 TAMS 2 (tutor 9) and EE-1 (tutor 10) tutors
- (U) $1,792 Complete development, operational evaluation, and fielding of F-16 flightline Avionics B shop tutor and continue other tutor authoring software evaluations
- (U) $3,979 Total

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,466	4,270	4,168	TBD
(U) Appropriated Value	4,636	4,270		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reduction	-84	-117		
b. SBIR	-86	-103		
c. Omnibus or Other Above Threshold Reprogramming		-54		
c. Below Threshold Reprogramming	-206			
(U) Adjustments to Budget Years Since FY96 PB			-189	
(U) Current Budget Submit/President's Budget	4,260	3,996	3,979	TBD

(U) Change Summary Explanation:

Funding: SBIR, undistributed general reductions, Omnibus and other above threshold reprogramming, and below threshold reprogrammings (both within the program element and external to it) FY95 and FY96; FY97 includes inflation rate changes.

Schedule: Not Applicable

Technical: Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604243F Mnpwr Pers & Trng Development
PROJECT NO. AND NAME 3818 Maintainance Skills Tutors (MST)	

(U) **C. Other Program Funding Summary ($ in Thousands)** Not Applicable

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) N/A									

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Evaluation of Alt Tutors			X**									
(U) F-16 C Shop Tutor					X**							
(U) F-16 C Shop OPS EVAL & Interim Contractor Support (ICS)			X*			X**		X*				X**
(U) F-16 A Shop Tutor		X*				X**						
(U) F-16 A OPS EVAL & ICS						X*		X**				
(U) F-15 C Shop OPS EVAL & ICS (LAB DEV)		X*			X**							
(U) F-15 A Shop OPS EVAL & ICS (LAB DEV)				X*			X**					
(U) F-16 B Shop Development					X*			X**				
(U) F-16 Tactical Aircraft Maintenance Specialist (TAMS) I Development								X*				X**
(U) F-16 TAMS II Development											X*	

X* = Start
X** = Completion

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604243F Mnpwr Pers & Trng Development
PROJECT NO. AND NAME 3818 Maintainance Skills Tutors (MST)	

(U) A. Project Cost Breakdown ($ in Thousands)

	FY 1995	FY 1996	FY 1997
(U) Software Development	1,357	1,522	2,250
(U) Interim Contractor Support (ICS) software maintenance	252	458	81
(U) Contractor Engineering Support Total	928	549	273
(U) Cognitive Task Analysis Support	1,131	924	541
(U) Govt Logistics Mgt Support	299	290	389
(U) Govt Audio/Visual support	32	33	35
(U) Travel	85	85	160
(U) Misc	176	135	250
(U) Total	4,260	3,996	3,979

(U) B. Budget Acquisition History and Planning Information ($ in Thousands)

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Bolt, Beranek, & Newman (BBN)	SS/CPFF & CPAF	Feb 94	3,678	3,678	2,140	958	580	0	0	3,678
Univ. Pittsburgh	SS/CP	Feb 93	1,489	1,489	1,163	115	211	0	0	1,489
Galaxy Scientific	SS/CPFF	Jan 94	785	785	346	402	37	0	0	785
EMD Contractor TBD	C/CPFF	Aug 96	10,191	10,191	0	0	670	1,290	8,231	10,191

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604243F Mnpwr Pers & Trng Development
PROJECT NO. AND NAME 3818 Maintainance Skills Tutors (MST)	

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Support and Management Organizations										
SPO, SA-ALC, ACC, AETC, SETA	N/A	N/A	7,119	7,119	1,743	1,654	1,574	2,148	TBD	7,119

Test and Evaluation Organizations Not Applicable

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property: Cognitive Task Analysis (CTA) data provided by the SPO to the software development contractors. The data describes the systems/subsystems/components and the faults/problems to be simulated. CTA data collection and analysis performed by the SPO Scientific and Engineering Technical Assistance (SETA) contractor (Operational Technologies (OPTECH)).									
	C/CPFF	Feb 94	Cont	508	1,131	924	541	900	4,004

Support and Management Property: Not Applicable

Test and Evaluation Property: Not Applicable

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)					DATE March 1996	
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604243F Mnpwr Pers & Trng Development					
PROJECT NO. AND NAME 3818 Maintainance Skills Tutors (MST)						
Subtotal Product Development	4,157	2,606	2,422	1,831	9,131	20,147
Subtotal Support and Management	1,743	1,654	1,574	2,148	TBD	TBD
Subtotal Test and Evaluation						
Total Project	5,900	4,260	3,996	3,979	TBD	TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604243F Mnpwr Pers & Trng Development
PROJECT NO. AND NAME 4369 Air Education & Training Management Sys (AETMS)	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
4369 Air Education & Training Management Sys (AETMS)	0	1,010	961	1,021	0	0	0	0	2,992

(U) **A. Mission Description and Budget Item Justification**

AETMS expands the Advanced Training System (ATS) to support technical training and professional education at all AETC training activities, providing a single command-wide training development, delivery, and management system. Commercial hardware and software will yield a reliable and easily maintainable system. AETMS will build upon the existing ATS and other commercial/newly developed software, simplifying development. This project was generated in the transfer of the ATS project from PE 64227F, Training Systems Development, beginning in FY96.

(U) FY 1995 Not Applicable

(U) FY 1996

- (U) $130 Complete software redevelopment of portions of ATS for tech training
- (U) $880 Initiate migration of proven ATS functionality to AETMS architecture
- (U) $1010 Total

(U) FY 1997

- (U) $530 Initiate software development/studies to incorporate professional education functionality
- (U) $150 Install prototype ATS at professional education site
- (U) $281 Continue migration of proven ATS functionality to AETMS architecture
- (U) $961 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604243F Mnpwr Pers & Trng Development
PROJECT NO. AND NAME 4369 Air Education & Training Management Sys (AETMS)	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	1,030	1,006	3,090
(U) Appropriated Value	0			
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions		-20		
b. SBIR				
c. Omnibus or Other Above Threshold Reprogramming				
d. Below Threshold Reprogrammings				
(U) Adjustments to Budget Years Since FY96 PB			-45	-98
(U) Current Budget Submit/President's Budget	0	1,010	961	2,992

(U) Change Summary Explanation:

Funding: AETMS was generated in the transfer of the Advanced Training System from PE 0604227F in FY96. FY96 includes undistributed congressional reductions. FY97 includes inflation rate changes.

Schedule: Not Applicable

Technical: Not Applicable

(U) **C. Other Program Funding Summary ($ in Thousands)**

FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost

(U) **Related RDT&E:**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604243F Mnpwr Pers & Trng Development
PROJECT NO. AND NAME 4369 Air Education & Training Management Sys (AETMS)	

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) 0604227F, Project 3135, Advanced Training System	1,438	0	0	0	0	0	0	0	

(U) **D. Schedule Profile**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Redevelopment for tech training							X**					
(U) Development/Studies for Professional Education										X**		
(U) Migration to AETMS architecture							X*					

X* = Start
X** = Completion

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604243F Mnpwr Pers & Trng Development

PROJECT NO. AND NAME: 4369 Air Education & Training Management Sys (AETMS)

(U) A. **Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Software Development/Studies	0	562	390
(U) Teams	0	139	141
(U) Travel	0	52	40
(U) Training Development	0	20	10
(U) Contract Administration	0	237	230
(U) AETMS	0	0	150
(U) Total	0	1,010	961

(U) B. **Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Loral FSC	C/FFP/IF/ AFT	May 89	35,025	40,958	31,393*	1,133*	701		TBD	33,227
TBD	TBD	TBD						681	TBD	681
Support and Management Organizations										
HSC/YARA							309	280	TBD	589

Test and Evaluation Organizations Not Applicable

* Actual funding for these years came from PE 64227F Training Systems Development, ATS project.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604243F Mnpwr Pers & Trng Development
PROJECT NO. AND NAME 4369 Air Education & Training Management Sys (AETMS)	

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property									
DT III/IV HW & SW	PR	various	various	482*	N/A	N/A	N/A	N/A	482
Support and Management Property: Not Applicable									
Test and Evaluation Property: Not Applicable									
Subtotal Product Development				31,875	1,133	701	681	TBD	TBD
Subtotal Support and Management						309	280	TBD	TBD
Subtotal Test and Evaluation									
Total Project				31,875*	1,133*	1,010	961	TBD	TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604249F Night Precision Attack

PROJECT NO. AND NAME: 2693 LANTIRN

COST ($ In Thousands)	FY 1994 Actual	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2693 LANTIRN	1,490	16,760	8,978	0	4,943	1,140	1,233	1,122	0	573,266

(U) A. Mission Description and Budget Item Justification

The need for Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) is documented in Tactical Air Forces' Statement of Operational Need 302-81, Night Attack Capabilities. LANTIRN responds to that need by providing the capability to conduct close air support and interdiction missions at night and under-the-weather for F-15E and F-16C/D fighter aircraft. LANTIRN provides the capability not only to attack at night at altitudes up to 40,000 ft., but also to attack with precision laser guided weapons at altitudes of up to 25,000 ft. day or night, in conditions of limited visibility. The LANTIRN program includes development and testing of a wide angle raster head-up display, a navigation pod, and a targeting pod. The navigation pod contains a terrain following radar and a fixed Forward-Looking Infra-Red (FLIR) sensor; the targeting pod contains a gimbaled FLIR, a laser designator, an automatic tracker, a missile boresight correlator, and growth provisions for an automatic target recognizer. This Program Element is devoted to Engineering and Manufacturing Development (EMD) of LANTIRN and other Night-Attack related aircraft equipment.

The LANTIRN EMD effort is no longer executable due to funds realignment to higher priority programs, and has been identified for termination. The EMD effort would have added:

1) A Laser Spot Tracking capability to the targeting pod for the F-16 Block 40 Close Air Support program; and
2) 40,000 foot laser firing capability to the targeting pod in order to increase the Laser operating envelope for the F-15E.

Project Type

New Start
X Cancellation
Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604249F Night Precision Attack
PROJECT NO. AND NAME 2693 LANTIRN	

(U) A. Mission Description and Budget Item Justification - Continued

(U) FY 1995

–	(U) $1,597	Completed risk reduction efforts for development of Laser Spot Tracker (LST) to support F-16 Blk 40 Close Air Support program
–	(U) $11,687	Accrued LST and 40,000 foot Laser (40K) obligations (part of which will fund LST and 40K cancellation liability costs)
–	(U) $494	Award Fee contingent liability
–	(U) $1,000	Flight Tested 1997 Operational Flight Program (OFP) software changes resulting from changes in the F-16 and F-15E software suites
–	(U) $1,982	Program office mission support
–	(U) $16,760	Total

(U) FY 1996

–	(U) $3,800	Identified for reprogramming to F-16 PE to support Project Sure Strike (pending Congressional approval)
–	(U) $2,000	Identified for reprogramming to Podded Reconnaissance System PE (pending Congressional approval)
–	(U) $1,061	Continue Flight Testing 1997 OFP software changes resulting from changes in the F-16 and F-15E software suites
–	(U) $560	GFE repair
–	(U) $1,557	Program office mission support
–	(U) $8,978	Total

(U) FY 1997

–	(U) $0	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604249F Night Precision Attack
PROJECT NO. AND NAME 2693 LANTIRN	

(U) **B. Program Change Summary ($ in Thousands)**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	21,436	8,708	4,803	579,330
(U) Appropriated Value	21,672	20,708		
(U) Adjustments to Appropriated Value				
a. Congressional General Reductions	-236	-406		
b. Small Business Innovative Research (SBIR)	-407	-503		
c. Omnibus or Other Above Threshold Reprogramming	-913	-10,821		
d. Below Threshold Reprogrammings (BTR)	-3,356			
(U) Adjustments to Budget Since FY96 PB				
a. O&M Reduction			-24	
b. Zero Balance Transfer			9,000	
c. Classified Bill			-13,779	-6,064
(U) Current Budget Submit/President's Budget	16,760	8,978	0	573,266

(U) Change Summary Explanation:

Funding: In FY95, $236 General Reduction (Travel, FFRDC, Non-FFRDC, Univ Research), $407 SBIR reduction, $913 Omnibus reduction for AQ recruiting bill, and $3,356 BTR reduction ($5 for AQ computer support bill, $23 for classified program PE 21006F, and $3,328 to PE 64733F / BPAC 653006). In FY96, $406 General Reduction, $503 SBIR reduction, $10,600 Reprogramming for classified program, and $221 Reprogramming for Bosnia. In FY97, $24 RDT&E O&M reduction and $9,000 Zero Balance Transfer to RDT&E from LANTIRN Procurement to support Operational Flight Program (OFP) development and Flight Tests, which are activities more appropriately categorized under RDT&E. Subsequently, FY97 RDT&E funds were reduced by $13,779 to pay for a SAF/AQL classified bill, thereby completely zeroing the RDT&E account in FY97.

Schedule: The completion date for the FY95 OFP software release was moved from the third quarter of FY95 to the second quarter of FY96 due to slips related to the F-15 program. The award date for the Laser Spot Tracker (LST) Engineering and Manufacturing Development contract slipped from the third quarter of FY95 to the fourth quarter of FY95 due to restructuring. LANTIRN LST and 40,000 foot laser (40K) development efforts (including related OFPs and Flight Tests) in FY96 and beyond were cancelled due to cuts stemming from SAF/AQL classified bill.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604249F Night Precision Attack
PROJECT NO. AND NAME 2693 LANTIRN	

Technical: LST, 40K, and associated OFPs & Flight Tests deleted due to cuts related to the SAF/AQL classified bill.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604249F Night Precision Attack

PROJECT NO. AND NAME: 2693 LANTIRN

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Aircraft Procurement, AF	16,027	13,766	407	1,031	0	0	0	0	31,231
PE 27249F, LANTIRN Procurement									

(U) D. Schedule Profile

	FY 1994				FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
(U) Organic Depot (Targeting Pod)		X*														
(U) Organic Depot (Support Equipment)		X*														
(U) Final Delivery (Targeting Pod)				X*												
(U) Software release for FY95 OFP (F-16 Block 40/42 & F-15E)										X						
(U) Laser Spot Tracker EMD Contract Award								X*								

* Complete

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604249F Night Precision Attack
PROJECT NO. AND NAME 2693 LANTIRN	

(U) A. **Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) Laser Spot Tracker (LST) risk reduction efforts	1,597		
(U) Accrued LST and 40,000 foot Laser (40K) obligations (part of which will fund LST and 40K cancellation liability costs)	11,687		
(U) Award Fee contingent liability	494		
(U) Identified for reprogramming to F-16 PE to support Project Sure Strike (pending Congressional approval)		3,800	
(U) Identified for reprogramming to Podded Reconnaissance System PE (pending Congressional approval)		2,000	
(U) Flight Test 1997 Operational Flight Program	1,000	1,061	
(U) Government Furnished Equipment repair		560	
(U) Program office mission support	1,982	1,557	
(U) Total	16,760	8,978	

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604249F Night Precision Attack

PROJECT NO. AND NAME: 2693 LANTIRN

(U) B. **Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Martin Marietta	Competitive (CPIF/FPIF/EPA)	Sep 80	353,297	353,297	351,700	1,597	0	0	0	353,297
	Sole Source (CPAF/CPFF)	Jun 95	12,741	12,741	0	12,181	560	0	0	12,741
Miscellaneous			78,700	78,700	78,700	0	0	0	0	78,700
Support and Management Organizations										
Prog Mgmt Sppt				19,786	17,800	1,107	879	0	0	19,786
Travel				14,043	12,490	875	678	0	0	14,043
Test and Evaluation Organizations										
Martin Marietta	Competitive (CPAF/FPIF/EPA)	Sep 80	50,761	50,761	49,500	500	761	0	0	50,761
AFFTC (CTF)	Proj Order			26,200	25,400	500	300	0	0	26,200
AFOTEC	Proj Order			3,500	3,500	0	0	0	0	3,500
Other										
Reprogrammings							5,800	0	8,438	14,238
Government Furnished Property: Not Applicable										
Subtotal Product Development					430,400	13,778	560	0	0	444,738
Subtotal Support and Management					30,290	1,982	1,557	0	0	33,829
Subtotal Test and Evaluation					78,400	1,000	1,061	0	0	80,461
Subtotal Other							5,800	0	8,438	14,238
Total Project					539,090	16,760	8,978	0	8,438	573,266

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604249F Night Precision Attack
PROJECT NO. AND NAME 2693 LANTIRN	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604270F EW Development

COST ($ In Thousands)		FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	97,732	47,066	104,423	89,510	102,087	94,393	54,946	Continuing	TBD
1011	Joint Service Electronic Combat Systems Tester (JSECST)	3,408	7,345	11,163	9,571	0	0	0	0	32,499
2066	EF-111A Upgrade (SIP)	56,327	0	0	0	0	0	0	0	TBD
2272	ALE-47 Countermeasures Dispenser	0	0	0	0	0	0	0	0	0
2462	Compass Call (CC)	4,898	1,281	1,718	1,295	805	788	876	Continuing	TBD
3108	Airlift Defensive Systems (ADS)	3,290	0	0	0	0	0	0	0	0
3891	Advanced IR Countermeasures (AIRCM)	0	38,440	44,052	42,636	57,819	60,824	24,336	TBD	TBD
3896	Adv Strategic & Tactical IR Expendables (ASTE)	8,261	0	0	0	0	0	0	0	0
3945	RF Towed Decoy Systems	0	0	47,490	36,008	43,463	32,781	29,734	Continuing	TBD
4076	On-Board EW System (OBEWS)	108	0	0	0	0	0	0	0	0
4077	Advanced Missile Warning (AMW)	21,440	0	0	0	0	0	0	0	0
5618	F-15 Protective Systems	0	0	0	0	0	0	0	0	0

(U) A. Mission Description and Budget Item Justification

This program element (PE) consolidates engineering development efforts related to Air Force Electronic Warfare (EW) requirements. The EW Development Program objective is to transition advanced development technologies to installed operational capabilities via Engineering and Manufacturing Development (EMD) programs qualifying this as an RDT&E effort. The FY97 BES Descriptive Summary introduced to the PE Project 3945 "RF Towed Decoy Systems," from multiple formerly classified programs. The PE includes five projects (2066, 2272, 3108, 4076, and 5618) which have no RDT&E money beyond FY95. In addition, two other projects (3896 - Advanced Strategic and Tactical Infrared Expendables (ASTE) and 4077 - Advanced Missile Warning (AMW)) are combined under project 3891, Advanced Infrared

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development

(U) **A. Mission Description and Budget Item Justification: - (Continued)**

Countermeasures (AIRCM) Development, beginning in FY96. The components of infrared countermeasures are warning and countermeasures. These components were combined because managing them as a total system is the most efficient and effective way to meet user requirements. This combined project (3891) is not a new start. As a result, only projects 1011, 2462, 3891, and 3945 are shown in detail. Project 2272, ALE-47 Countermeasures Dispenser System; project 5618, F-15 Protective Systems; and project 3108, ADS, completed their approved Engineering and Manufacturing Development (EMD) programs and are in production. The EF-111A retires in FY99 and the EF-111A System Improvement Program (SIP) was canceled in FY95.

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget (FY96 PB)	115,692	50,203	84,111	TBD
(U) Appropriated Value	119,275	50,203		
(U) Adjustments to Appropriated Value				
a. General Congressional Reduction	-1,313	-982		
b. Omnibus/other Above Threshold Reprogramming	-17,760	-1,027		
c. Below Threshold Reprogramming	-230			
d. SBIR	-2,240	-1,128		
(U) Adjustments to Budget Years Since FY96 PB			+20,312	
(U) Current Budget Submit/President's Budget (FY97 PB)	97,732	47,066	104,423	TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development

(U) **B. Program Change Summary ($ in Thousands):- (Continued)**

(U) Change Summary Explanation:

Funding: $17M in FY95 OBEWS funding was sourced for the FY95 Omnibus reprogramming bill. $11M was approved as a source; the remaining $6M was denied and rescinded. The remaining $760K in line b. above from Advanced Missile Warning was taken as a source for the FY95 Omnibus. FY95 AF BTR helped pay for the Hurricane Erin Bill (Eglin AFB). FY96 $1,027K reprogramming for USAF Bosnia bill and for F-16s to Jordan. FY97 PB adjustments to budget include Missile Warning reduction, PBD-driven reductions, and the introduction to the PE of Project 3945 from multiple formerly classified programs.

Schedule: See Project Summaries.

Technical: See Project Summaries.

(U) **C. Other Program Funding Summary ($ in Thousands):** See Project Summaries.

(U) **D. Schedule Profile:** See Project Summaries.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604270F EW Development

PROJECT NO. AND NAME: 1011 Joint Service Electronic Combat Systems Tester (JSECST)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
1011 Joint Service Electronic Combat Systems Tester (JSECST)	3,408	7,345	11,163	9,571	0	0	0	0	32,499

(U) A. Mission Description and Budget Item Justification

(U) The JSECST will fill both an Air Force and Navy operational requirement for a small, adaptable, and highly mobile tester capable of verifying the system level performance of installed electronic countermeasures systems. Present maintenance concepts rely on the built-in-test (BIT) capabilities of the line replaceable units (LRUs) to verify system performance. This method fails to detect failures in LRU interfaces and installed aircraft (Group A) hardware. Particular emphasis will be placed on size and weight since the test set must deploy with the operational unit.

Project Type
New Start
Termination
X Not Applicable

(U) **FY 1995**

- (U) $1,600 Finished preliminary tech assessment/CBA (1600)
- (U) $950 Finished O&M Test Requirements Document development
- (U) $NSP Finalized Operational Requirements Document
- (U) $858 SPO Support
- (U) $NSP Obtained MS II approval for EMD
- (U) $3,408 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 1011 Joint Service Electronic Combat Systems Tester (JSECST)	

(U) **A. Mission Description and Budget Item Justification:** - (Continued)

(U) **FY 1996**

- (U) $NSP RFP Release
- (U) $NSP EMD Source Selection
- (U) $6,511 Begin EMD efforts (Including Test Program Set Development)
- (U) $834 SPO Support
- (U) $7,345 Total

(U) **FY 1997**

- (U) $10,678 Continue EMD Effort
- (U) $485 SPO Support
- (U) $11,163 Total

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	3,508	7,837	11,566	33,863
(U) Appropriated Value	3,508	7,837		
(U) Adjustments to Appropriated Value				
a. General Congressional Reduction		-153		
b. Omnibus/other Above Threshold Reprogramming		-163		
c. Below Threshold Reprogramming	-100			
d. SBIR		-176		
(U) Adjustments to Budget Years Since FY96 PB			-403	-1,364
(U) Current Budget Submit/President's Budget	3,408	7,345	11,163	32,499

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 1011 Joint Service Electronic Combat Systems Tester (JSECST)	

(U) B. Program Change Summary ($ in Thousands):- (Continued)

(U) Change Summary Explanation:

Funding: FY95 AF BTR helped pay Hurricane Erin Bill (Eglin AFB). FY96 $163K reprogramming for USAF Bosnia bill and for F-16s to Jordan. FY97 funding was decreased during the FY97 PB formulation process.

Schedule: None.

Technical: None.

(U) C. Other Program Funding Summary ($ in Thousands):

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Aircraft Procurement, AF	0	0	0	0	12,424	13,621	14,034	0	40,079

(U) PE 27442F(Common ECM) In Service Direct Ground Support Equipment

(U) D. Schedule Profile:

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Draft ORD												
(U) Develop Acquisition Strategy			X									
(U) Prepare Draft RFP				X								
(U) Tech Assessment			X									
(U) Final ORD				X								
(U) MS II Approval				X								
(U) RFP Release					X							
(U) Source Selection						X						
(U) Contract Award						X						
(U) DT&E Start											X	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 1011 Joint Service Electronic Combat Systems Tester (JSECST)	

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604270F EW Development

PROJECT NO. AND NAME: 1011 Joint Service Electronic Combat Systems Tester (JSECST)

(U) **A. Project Cost Breakdown ($ in Thousands):**

	FY 1995	FY 1996	FY 1997
(U) EMD Prep			
(U) Conduct Tech Assessment	1,600		
(U) Conduct cost estimate			
(U) EMD effort (Including TPS Development)		6,511	10,678
(U) SPO support	1,808	834	485
(U) Total	3,408	7,345	11,163

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands):**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
AAI	CPAF	Mar 96	26,254	26,254			6,511	10,678	9,065	26,254
Support and Management Organizations										
ASC/LNA, NAVAIR, Wright Labs		Nov 96	6,245	6,245	1,012	3,408	834	485	506	6,245
Test and Evaluation Organizations										
TBD										
Total Project					1,012	3,408	7,345	11,163	9,571	32,499

Government Furnished Property: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604270F EW Development

PROJECT NO. AND NAME: 2462 Compass Call (CC)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
2462 Compass Call (CC)	4,898	1,281	1,718	1,295	805	788	876	Continuing	TBD

(U) A. Mission Description and Budget Item Justification:

(U) COMPASS CALL (CC) is an EC-130H developed for command and control warfare (C2W) as a stand-off jamming platform to disrupt enemy air defenses and ground operations. **[INFORMATION DELETED]**. It is optimally employed as part of an integrated electronic combat (EC) package as it complements both present and future air, ground, and sea based systems to provide theater commanders with a coordinated jamming platform. This program element provides a continuing technology program to keep the EC-130H current with the rapidly evolving threat.

(U) Ongoing development programs are:

(U) HBS (High Band System) - Integrates HBS countermeasures into CC Block 30 platform. Contractor: MAGNAVOX, Ft Wayne, IN.

(U) P-35 - **[INFORMATION DELETED]**.

(U) HBE (High Band Exciter) - ECP to HBS, **[INFORMATION DELETED]**. Contractor: MAGNAVOX, Ft. Wayne, IN.

(U) TRACS (Tactical Radio Acquisition and Countermeasures) - **[INFORMATION DELETED]**. Contractor: Lockheed-Sanders, Nashua, NH.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 2462 Compass Call (CC)	

(U) A. **Mission Description and Budget Item Justification:** (Continued)

Project Type
New Start
Termination
X Not Applicable

(U) **FY 1995**

–	(U) $2,878	Completed integration of HBS into aircraft
		– CONUS and OCONUS combined flight tests for HBS and JM/SA subsystems
–	(U) $2,020	Continue TRACS EMD
		– **[INFORMATION DELETED]**
		– **[INFORMATION DELETED]**
		– Update MOA with SPM developing agency
		– **[INFORMATION DELETED]**
–	(U) $4,898	Total

(U) **FY 1996**

–	(U) $824	Complete integration of Block 3 upgrades (HBS and JM/SA) on aircraft
		– Conduct flight test of Block 3 upgrades
		– Correct test deficiencies
		– Complete users manuals/training
–	(U) $457	Continue TRACS EMD
–	(U) $1,281	Total

(U) **FY 1997**

–	(U) $485	Support IOT&E of Block 3 upgrades
–	(U) $650	Continue TRACS EMD
–	(U) $583	– Develop counters to evolving threat
–	(U) $1,718	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604270F EW Development

PROJECT NO. AND NAME: 2462 Compass Call (CC)

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	4,898	1,351	1,781	TBD
(U) Appropriated Value	4,898			
(U) Adjustments to Appropriated Value				
a. General Congressional Reductions		-26		
b. Omnibus/other Above Threshold Reprogramming		-14		
c. Below Threshold Reprogramming				
d. SBIR		-30		
(U) Adjustments to Budget Years Since FY96 PB			-63	
(U) Current Budget Submit/President's Budget	4,898	1,281	1,718	TBD

(U) Change Summary Explanation:

Funding: FY96 $14K reprogramming paid USAF Bosnia bill. FY97 funding was decreased during the FY97 PB formulation process.

Schedule: Block 30 integration completion slipped from 3QFY95 to 1QFY96. Development flight test and operational flight test slipped from 3QFY95 to 1QFY96.

Technical: None.

(U) **C. Other Program Funding Summary ($ in Thousands):**

(U) Aircraft Procurement, AF (U) PE 27253F (Compass Call)	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Mods (Compass Call; MN 1001) BA-5	45,227	0	3,000	7,586	7,884	8,058	8,235	Cont.	N/A
(U) Acft Replen Spares & Repairs BA-6	8,469	8,068	1,273	5,549	5,933	6,064	6,192	Cont.	N/A
(U) Acft Initial Spares & Repairs BA-6	14,277	2,488	1	0	8,898	9,105	9,210	Cont.	N/A
(U) Other Charges BA-7	4,010	8,026	0	0	28,310	28,097	50,414	0	N/A
(U) TOTAL	71,983	18,582	4,498	13,368	51,025	51,324	74,051	Cont.	N/A

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 2462 Compass Call (CC)	

(U) **D. Schedule Profile:**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) BLOCK 30 System Integration					X							
(U) TRACS CDR												
(U) TRACS ECP2 (Note 1)												
(U) P-35 ECP 3												
(U) HBE CDR (Note 2)												
(U) Block 30 CONUS Flight Test					*		X					
(U) BLOCK 30 OCONUS Flight Test							X					
(U) AFOTEC OT&E					*					X		
(U) 1st BLK 30 Delivery to ACC							X					

(U) Note 1: TRACS is a continuing program to keep the aircraft current with the evolving threat

(U) Note 2: Preplanned ECP to HBE program completes 2 Qtr FY98 (Additional frequency coverage using new generation amplifiers)

* = Start X = Complete

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 2462 Compass Call (CC)	

(U) **A. Project Cost Breakdown ($ in Thousands):**

	FY 1995	FY 1996	FY 1997
(U) HBE/HBS	1,168	388	484
(U) TRACS	2,020	457	650
(U) P-35	500	97	0
(U) ADCAT	0	0	0
(U) CCMS Ops	930	0	0
(U) Travel	60	49	49
(U) Miscellaneous	220	290	535
(U) Total	4,898	1,281	1,718

(U) NOTE: **[INFORMATION DELETED.]** ADCAT funding was for contract closeout. CCMS operations funding completed a previous program

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands):**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Magnavox	SS/CPAF	2Q			22,739	2,312	388	484	Continuing	TBD
GTE	SS/CPIF	2Q			8,875	1,186	97	0	0	10,121
Sanders	SS/CPIF	2Q			25,556	200	457	650	Continuing	TBD

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 2462 Compass Call (CC)	

(U) B. Budget Acquisition History and Planning Information ($ in Thousands): (Continued)

Performing Organizations: (Continued)

Support and Management Organizations								
Misc (SPO, Labs)	Various	1-4Q	1,618	1,100	242	490	Continuing	TBD

Test and Evaluation Organizations: Air Warfare Center conducts tests using its own funds.

Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property									
Misc	Misc			1,500	100	97	94	Continuing	TBD
Subtotal Product Development				58,670	3,798	1039	1,228	Continuing	TBD
Subtotal Support and Management				1,618	1,100	242	490	Continuing	TBD
Total Project				60,288	4,898	1,281	1,718	Continuing	TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604270F EW Development

PROJECT NO. AND NAME: 3891 Advanced IR Countermeasures (AIRCM)

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3891 Advanced IR Countermeasures (AIRCM)	0	38,440	44,052	42,636	57,819	60,824	24,336	TBD	TBD

(U) A. **Mission Description and Budget Item Justification:**

The operating commands require Advanced Infrared Countermeasures (AIRCM) to increase aircraft survivability against threats that are increasing in number and capability. The synergistic use of AIRCM (missile warning, expendables and directed countermeasures) offers the most protection for the long term. This project focuses on developing an AIRCM suite that can be tailored and integrated into current generation combat, airlift and special operations aircraft. Without the AIRCM suite, survivability of current generation aircraft will decrease due to proliferation of, and improvements in, threat missile systems (e.g. advanced electro-optics, dual infrared and radio frequency seekers). The AIRCM project has two principal thrusts: 1) providing advanced missile warning (subproject 4077 - Common Missile Warning System (CMWS)) with planned growth to Directable Countermeasures; and 2) advanced expendables (subproject 3896 - Advanced Strategic and Tactical Infrared Expendables (ASTE)). AIRCM was formed from the combination of Advanced Missile Warning and ASTE in FY96; total funding for the two previously distinct projects was $21,496M in FY94 and 32,831M in FY95. The subsystems are now being developed in an integrated fashion to optimize the performance of the whole suite. The program plan is an integral part of a Joint Service IRCM program and maximizes commonality across Air Force, Navy, and Army aircraft. We finalized a common (multi-Service) Operational Requirements Document (ORD) with the Army and Navy for the CMWS that also includes links to other Service IRCM requirements and development programs. A common USAF/USN ORD was also approved for ASTE. Both subprojects entered EMD in Jun 95. Internal CMWS installation is planned for the F-16, F-15, and A-10 aircraft, and is a candidate for the C-17 and B-1. A pod/pylon mechanized system is also a candidate for CMWS installation on aircraft capable of carrying a standard electronic attack pod. The ASTE flare will be functionally compatible with existing dispenser systems.

Project Type
New Start
Termination
X Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 3891 Advanced IR Countermeasures (AIRCM)	

(U) A. Mission Description and Budget Item Justification: (Continued)

(U) **FY 1995 The following figures reflect activities associated with projects previously reported as 3108, 3896, and 4077. 3896 and 4077 continue as subprojects of this project in FY96.**

- (U) $3,290 Project 3108
  - (U) $3,290 – Completion of test and evaluation of the AAR-47 improvements program and ALE-47 on aircraft.

- (U) $8,261 Project 3896
  - (U) $ 934 – Mission Support
  - (U) $4,917 – Award and execute EMD contract(s) for advanced decoy development
  - (U) $ 413 – Systems Engineering/Program Management
  - (U) $ 329 – Test and Evaluation
  - (U) $1,023 – Continued engagement modeling and analysis in support of EMD
  - (U) $ 645 – Other Government Costs
- (U) $21,440 Project 4077
  - (U) $7,250 – Advanced Missile Approach Warning System (Group B) EMD Contract
  - (U) $1,900 – F-15 aircraft (Group A) EMD integration
  - (U) $3,600 – F-16 aircraft (Group A) EMD integration
  - (U) $1,000 – A-10 aircraft (Group A) EMD integration
  - (U) $7,690 – Mission and Program Support
- (U) $32,991 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 3891 Advanced IR Countermeasures (AIRCM)	

(U) **A. Mission Description and Budget Item Justification:** (Continued)

(U) **FY 1996**

- (U) $28,323 Major Contracts
- (U) $ 6,117 Support Contracts
- (U) $ 4,000 Test & Evaluation
- (U) $38,440 Total

(U) **FY 1997**

- (U) $30,749 Major Contracts
- (U) $ 5,303 Support Contracts
- (U) $ 8,000 Test & Evaluation
- (U) $44,052 Total

(U) **B. Program Change Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget	0	41,015	70,764	TBD
(U) Appropriated Value	33,881			
(U) Adjustments to Appropriated Value				
a. General Congressional Reductions		-803		
b. Omnibus/other Above Threshold Reprogramming	-760	-850		
c. Below Threshold Reprogramming	-130			
d. SBIR		-922		
(U) Adjustment to budget year since FY96 PB			-26,712	
(U) Current Budget Submit/President's Budget	*32,991	38,440	44,052	TBD

* Reflects funding for projects 3108, 3896, and 4077.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 3891 Advanced IR Countermeasures (AIRCM)	

(U) **B. Program Change Summary ($ in Thousands):** (Continued)

(U) Change Summary Explanation:

Funding: Projects 3896 and 4077 combined into this project beginning in FY96, and the 4077 subproject is renamed the Common Missile Warning System (CMWS). FY95 BTR paid Hurricane Erin bill for Eglin AFB. FY96 $850K reprogramming for USAF Bosnia bill and for F-16s to Jordan. FY97 funding decreased by $25M for realignment to higher Air Force priorities. FY97 funding was decreased during the FY97 PB formulation process.

Schedule: The ASTE Milestone II slipped from Jan 95 to Jun 95 due to user delays in staffing and approving a multi-Service ORD. This also caused the production milestone to slip to FY99.

Technical: The ASTE portion of AIRCM now encompasses both Air Force and Navy requirements for advanced flares and AMC and AFSOC requirements for special material decoys. Due to funding constraints, the ASTE program manager worked with the using commands to restructure the program. The test program was reduced in scope, with greater emphasis placed on results from validated models and from simulation efforts. USD(A&T) directed merger of the former Air Force/Navy Advanced Missile Warning System (AMWS) program with the Army's Advanced Threat Infrared Countermeasures (ATIRCM) program. The resulting ATIRCM/CMWS program will develop a common missile warning system suitable for most non low observable DoD aircraft.

(U) **C. Other Program Funding Summary ($ in Thousands):**

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Aircraft Procurement, AF	0	0	0	0	43,709	78,252	106,940	TBD	TBD
(U) PE 27442F (Missile Warning only) BA-5									
(U) Mods (F-15/F-16 Msl Wrn Sys; MN AMWS)									

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 3891 Advanced IR Countermeasures (AIRCM)	

(U) **D. Schedule Profile:**

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) Project 3108, ADS												
(U) Qualification OT&E			*									
(U) Project 3896, ASTE												
(U) Tactical Roundtable												
(U) Acquisition Strategy Panel		X										
(U) RFP Release			X									
(U) MS II Decision			X									
(U) Project 4077, CMWS												
(U) Pod Demos												
(U) Internal Demos												
(U) Acquisition Strategy Panel												
(U) MS II Decision			X									
(U) EMD Contract Award				X								
(U) Project 3891, AIRCM												
(U) ASTE EMD Contract Award					X							
(U) ASTE PDR							*	X				
(U) ASTE CDR								*		X		
(U) ASTE DT&E										*		
(U) CMWS System Design Review						X						
(U) CMWS PDR							X					
(U) CMWS CDR								X				
(U) CMWS Qual Test											*	
(U) CMWS Platform Integration										*		
(U) CMWS DT&E Preparation												*

* = Start X = Complete

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 3891 Advanced IR Countermeasures (AIRCM)	

(U) **A. Project Cost Breakdown ($ in Thousands):**

	FY 1995	FY 1996	FY 1997
(U) Project 4077/3891			
(U) CMWS Group B	7,250	8,680	6,950
(U) F-15 Aircraft (group A) EMD integration	1,900	8,000	5,500
(U) F-16 Aircraft (group A) EMD integration	3,600	9,300	11,530
(U) A-10 Aircraft (group A) EMD integration	1,000	1,000	3,560
(U) CMWS Mission Support	7,690	4,368	3,489
(U) CMWS System T&E		4,000	8,000
(U) CMWS Other Government Costs		567	
(U) Project 3896/3891			
(U) ASTE Prime Mission Product	4,917	1,343	3,209
(U) ASTE Modeling & Analysis	1,023	314	369
(U) ASTE System Eng/Program Mgt	413		
(U) ASTE System Test & Eval	329		748
(U) ASTE Mission Support	934	829	697
(U) ASTE Other Gov't Costs	645	39	
(U) Project 3108			
(U) Testing	3,290		
(U) Total	*32,991	38,440	44,052

* Project 4077, 3896 and 3108. FY95 funded in PE 64270.

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 3891 Advanced IR Countermeasures (AIRCM)	

(U) B. Budget Acquisition History and Planning Information ($ in Thousands):

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Prime Contractors										
ASTE - Tracor		May 97	10,715	13,979		4,917	1,343	3,209	TBD	11,068
CMWS - Sanders		Nov 97	25,830	25,830		7,250	8,680	6,950	TBD	25,830
Total Prime						12,167	10,023	10,159	TBD	36,898
CMWS Integration (Airframe contractors)			169,290	169,290		6,500	18,300	20,590	TBD	169,290
Support and Management Organizations										
ASC/LN, TEMS, Wright Labs, Naval Surface Warfare Center										
ASTE (Includes DT&E)		May 97	10,520	10,520		3,344	1,182	1,814	TBD	11,417
CMWS		Nov 97	119,160	119,160		7,690	4,935	3,489	TBD	119,160
ADS						3,290	0	0	0	3,290
Total						14,324	6,117	5,303	TBD	133,867
Test and Evaluation Organizations										
CMWS - TBD (AFOTEC or Navy test organization)		May 97	TBD	TBD		0	4,000	8,000	TBD	TBD
Total Project						32,991	38,440	44,052	TBD	340,055

Government Furnished Property: Not Applicable

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 3945 RF Towed Decoy Systems	

COST ($ In Thousands)	FY 1995 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	Cost to Complete	Total Cost
3945 RF Towed Decoy Systems	0	0	47,490	36,008	43,463	32,781	29,734	Continuing	TBD

(U) **A. Mission Description and Budget Item Justification**

This project develops, integrates and tests radio frequency (RF) towed decoy systems on several aircraft. RF towed decoys are low cost, end game countermeasures that provide increased survivability against monopulse, semi-active, and active RF missile threats. The program is developing two classes of decoy systems, the Advanced Airborne Expendable Decoy (AAED) and the Integrated Defensive Electronic Countermeasures (IDECM) Fiber Optic Towed Decoy (FOTD). Both of these efforts are joint programs with the Navy as lead service. Air Force funding pays for unique Air Force development requirements and integration and test on Air Force platforms.

AAED: The Air Force ALE-50 program is developing, integrating, and testing a modified version of the Navy's ALE-50 decoy system for the F-16 and B-1B. The components of the F-16 system include: the F-16 pylon assembly (modified 16S350 pylon), launcher/controller, magazines, canister, towline assembly, and the AAED. The major components of the B-1B system include: the multi-platform launch controller (MPLC), launcher, magazine, canister, towline assembly and the AAED.

IDECM: The Navy's goal in IDECM is to develop an integrated ECM suite for the F/A-18E/F. The Air Force is participating in IDECM to jointly develop a common IDECM techniques generator (TG) and a high power FOTD. Air Force funding pays for unique Air Force development costs under IDECM as well as integration and test on the F-15. If IDECM hardware is determined to be a cost effective solution for the B-1B Defensive System Upgrade Program (DSUP), the DSUP program will fund integration and test of this hardware on the B-1B.

(U) FY 1997 ($ in Thousands):
- (U) $28,400 B-1B AAED
- (U) $1,750 F-16 AAED
- (U) $9,700 USAF IDECM Development
- (U) $4,850 F-15/IDECM Integration
- (U) $2,790 Mission Support
- (U) $47,490 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: March 1996

BUDGET ACTIVITY: 5 - Engineering and Manufacturing Development

PE NUMBER AND TITLE: 0604270F EW Development

PROJECT NO. AND NAME: 3945 RF Towed Decoy Systems

(U) B. Program Change Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	Total Cost
(U) Previous President's Budget				
(U) Appropriated Value				
(U) Adjustments to Appropriated Value				
a. Cong Gen Reductions				
b. SBIR				
c. Omnibus or Other Above Threshold Reprogram				
d. Below Threshold Reprogramming				
(U) Adjustments to Budget Years Since FY 1996 PB				
(U) Current Budget Submit/President's Budget			47,490	

(U) Change Summary Explanation:
Funding: Pre-FY97 fiscal year levels are only available in classified documentation.

(U) C. Other Program Funding Summary ($ in Thousands)

	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	To Compl	Total Cost
(U) Aircraft Procurement, AF			45,601	109,024	128,054	92,941	118,332	TBD	TBD
(U) PE 27442F									

(U) D. Schedule Profile

	FY 1995				FY 1996				FY 1997			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) B-1B 1st Flight Readiness Review									X			
(U) F-16 AAED Milestone III									X			
(U) F-15/IDECM Integration Contract Award											X	

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 3945 RF Towed Decoy Systems	

(U) **A. Project Cost Breakdown ($ in Thousands)**

	FY 1995	FY 1996	FY 1997
(U) B-1 AAED EMD			28,400
(U) F-16 AAED EMD			1,750
(U) USAF IDECM Development			9,700
(U) F-15 IDECM Integration			4,850
(U) Mission Support			2,790
(U) Total			47,490

(U) **B. Budget Acquisition History and Planning Information ($ in Thousands)**

Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Organizations										
Prime Contractors										
B-1 AAED - Rockwell/ Raytheon		Nov 96	13,890	13,890				13,890	TBD	TBD
F-16 AAED - Lockheed-Martin/Raytheon		Nov 96	1,750	1,750				1,750	TBD	TBD
USAF IDECM Development - Sanders		Jan 97						9,700	TBD	TBD
F-15 IDECM Integration - McAir/Northrop/Sanders		July 97						4,850	TBD	TBD

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 3945 RF Towed Decoy Systems	

(U) B. Budget Acquisition History and Planning Information ($ in Thousands): (Continued)

Performing Organizations: (Continued)

Support and Management Organizations							
ASC/LN/YD							
AAED	Oct 96	1,790	1,790	1,790	TBD	TBD	
IDECM	Oct 96	1,000	1,000	1,000	TBD	TBD	
Total				2,790	TBD	TBD	
Test and Evaluation Organizations							
AFFTC	Jan 97	10,620	10,620	10,620			
AFOTEC	Jan 97	3,890	3,890	3,890	TBD	TBD	
Total Project				47,490	TBD	TBD	

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands)

Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Product Development Property									
Support and Management Property									

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)	DATE March 1996
BUDGET ACTIVITY 5 - Engineering and Manufacturing Development	PE NUMBER AND TITLE 0604270F EW Development
PROJECT NO. AND NAME 3945 RF Towed Decoy Systems	

(U) B. Budget Acquisition History and Planning Information Continued ($ in Thousands): (Continued)

Government Furnished Property: (Continued)

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 1995	Budget FY 1995	Budget FY 1996	Budget FY 1997	Budget to Complete	Total Program
Test and Evaluation Property									
Subtotal Product Development							30,190		
Subtotal Support and Management							2,790		
Subtotal Test and Evaluation							14,510		
Total Project							47,490		