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VOLUME II

Supporting Data FY 1979
Budget Estimate

Submitted to Congress January 1978

Descriptive Summaries Of The

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RESEARCH DEVELOPMENT TEST & EVALUATION
Army Appropriation FY 1979

DEPARTMENT OF THE ARMY DEPUTY CHIEF OF STAFF
FOR RESEARCH DEVELOPMENT AND ACQUISITION
RDTE PROGRAMS AND BUDGET DIVISION

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Descriptive Summaries for program elements of the Research, Development, Test, and Evaluation, Army program, FY 1979, prepared to provide information for Congressional committees on each program element to be financed during FY 79 or FY 80.

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VOLUME II

DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS

OF THE

RESEARCH, DEVELOPMENT, TEST, AND EVALUATION, ARMY PROGRAM

FY 1979

JANUARY 1978

Department of the Army
Deputy Chief of Staff for Research, Development, and Acquisition

FOREWORD

These volumes have been prepared to provide information on the US Army Research, Development, Test, and Evaluation Program for Congressional Committees during the Fiscal Year 1979 hearings. This information is in addition to the testimony given by US Army witnesses.

These volumes contain a descriptive summary for each program element to be financed during FY 1979. Descriptive Summaries for projects within the program elements to be financed during FY 1979 for $5.0 million or more appear on buff colored pages immediately following the applicable program element. Where there are several items under development within a project, a separate summary has been provided for each item that exceeds $5.0 million during FY 1979. A Test and Evaluation Section is provided for all major weapon systems.

There are twenty-nine major weapon systems descriptive summaries appearing in Volumes II and III. Major weapon systems are identified by an asterisk in the Table of Contents. The formats and contents of these volumes are in accordance with guidelines and requirements of the Congressional Committees insofar as possible. Information previously provided in the SAC Data Book is consolidated into these volumes. The SAC Data Book information appears at the beginning of each program element descriptive summary.

A direct comparison of FY 1977, FY 1978, FY 1979, and FY 1980 data in this Program Element Listing with data shown in the Program Element Listing dated January 1977 will reveal significant differences. Many of the differences are attributable to the following factors:

a. Restructuring of the FY 1977 and FY 1978 programs for comparability to the FY 1979 program structure.

b. Reclassification to provide greater visibility and contribute to the effective management of the RDTE program such as the following:

(1) RDTE Headquarters Management
(2) Joint Tactical Command and Control Communications
(3) Aircraft Electronic Warfare Self Protection Systems
(4) Further extension of the Single Program Element Funding Concept.

c. An FY 1978 net reduction of $9.555 million resulting from the manpower/spaces reduction imposed by Congress.

The funding information used in these volumes corresponds to that contained in the President's Budget. Procurement data is shown where applicable for items in engineering or operational development. Military construction data is shown where applicable.

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FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.33.04.A
Title: Ballistics Missile Defense Advanced Technology Program
DoD Mission Area: #321 - Ballistic Missile Defense
Budget Activity: #3 - Strategic Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	102664	107297	113510	120855	Continuing	Not Applicable
D215	Ballistic Missile Defense Advanced Technology	102664	107297	113510	120855	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Ballistic Missile Defense (BMD) Advanced Technology Program is a vigorous research and development effort designed to exploit new and emerging technologies - seeking better and less costly ways to perform ballistic missile defense. The US is faced with the possible loss, by the mid-1980's, of its strategic supremacy over the Soviet Union; specifically, there is a growing Soviet threat to our strategic deterrent force. Every possible alternative and combination should be considered to maximize the level of national survival and retaliatory capability.

C. BASIS FOR FY 1979 RDTE REQUEST: The budget request for the BMD Advanced Technology Program is designed to maintain the pace of BMD advanced development needed to keep the US's technological lead and to aggressively search for and exploit innovative new concepts as a guard against technological surprise. The program will continue to emphasize experimentation on futuristic concepts which extend our technological bounds and have the potential of providing fundamentally new approaches to ballistic missile defense. The broad scope of the Advanced Technology Program and the intrinsic complexity of such developments call for significant efforts in each technology - radar, optics, interceptors, discrimination and data processing - to allow necessary hardware development and field experiments to validate laboratory and study results. Major milestones anticipated in FY79 include major improvements in optical sensors and enhanced capability to detect, discriminate, and track reentry vehicles; to handle complex BMD problems with distributed microprocessors; and to defend against nuclear ballistic missiles without employing nuclear interceptors.

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The BMD Advanced Technology Program is a vigorous, broad research effort on the technology of all BMD components and functions including reentry phenomenology, advanced discrimination techniques, computers, advanced interceptor missiles, optical and radar sensors and the continuing assessment of new technologies. The objectives of this program are to: provide the advanced technological foundation for future BMD systems concepts, emphasizing approaches which could yield fundamental breakthroughs BMD capability; provide the technological basis for substantial improvements in nearer-term BMD systems; avoid technological surprise by Soviet BMD developments; and assist in the design and evaluation of US strategic offensive systems by continuing exchange of information of their penetrativity and by technological assessments of future Soviet BMD capability. The

US BMD Advanced Technology Program has in recent years placed increasing emphasis upon exo-atmospheric technologies to augment terminal defense elements and technological upgrading of terminal defense concepts involving homing non-nuclear kill interceptors and distributed defense components.

F. RELATED ACTIVITIES: The Ballistic Missile Defense Advanced Technology Program is fully integrated and coordinated with related programs being sponsored by the Air Force, the Navy, Defense Advanced Research Projects Agency (DARPA), Defense Nuclear Agency (DNA), Energy Research and Development Administration (ERDA), and other Army Commands and Laboratories as well as the Ballistic Missile Defense Systems.

G. WORK PERFORMED BY: The five major contractors are: Massachusetts Institute of Technology, Lincoln Laboratory, Lexington, MA; The Boeing Company, Seattle, WA; Martin Marietta Corporation, Orlando, FL; McDonnell Douglas Corporation, Huntington Beach, CA; and System Development Corporation, Huntsville, AL. There will be approximately one hundred additional contractors and other government agencies for an additional estimated dollar value of $76.2 million. In-house developing organization responsible for the program is the Ballistic Missile Defense Advanced Technology Center, Huntsville, AL.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Demonstrated technology to intercept maneuvering vehicles through an advanced terminal interceptor program. Demonstrated technology for Defense of Minuteman which is now designated as the Systems Technology Program (STP). Major technology elements included the use of large, high powered commercial data processors, small netted radars, an improved interceptor missile, and new discrimination techniques. Provided the technological basis (culminating in FY77) for the layered defense concept which was added to the STP. This technology rests on demonstrated performance of Long Wavelength Infrared (LWIR) sensors in the exoatmosphere. Developed initial discrimination schema for LWIR sensors which offer significant improvements to discriminate the warhead from accompanying chaff and penetration aids. Pursued the development of a technology base which offers the potential of Non-Nuclear Kill (NNK) devices in ballistic missile defense. High technology engagement constructs in both the endo and exoatmospheric regimes have been synthesized based upon the emergence of non-nuclear kill technology, LWIR optical sensors, the success of the Fly Along Infrared (FLIR) flight experiments, Homing Intercept Technology (HIT), guidance and control technology, and micro-data processing capabilities.

2. FY 1978 Program: The FY78 BMD Advanced Technology Program is designed to continue advancements in the state-of-the-art in conventional BMD radars, data processing and interceptors while actively seeking and investigating new componentry and techniques which offer a potential for revolutionizing ballistic missile defense. Emphasis in exoatmospheric optical discrimination, designation and tracking; passive and active (laser) optical signature data collection; non-nuclear kill technology (warhead and fuzing); endoatmospheric homing technology; laser/millimeter wavelength technology; and high energy beam experiments in FY78 will move us closer to determining the feasibility of using missile-borne or ground-based optical sensors to overcome sime of the limitations of ground-based radars. Elimination of the requirement for nuclear warheads would provide a more responsive, less costly defense; such an achievement will require significant improvements in target location, guidance, control and fuzing accuracy as well as development of explosive fragmentation warheads capable of destroying threatening reentry vehicles. The program continues to emphasize experimentation of futuristic concepts which have the potential of providing fundamentally new approaches to ballistic missile defense. The efforts on high energy beam technology, though low level and moderately fundedm provide the best safeguard against a

Soviet breakthrough which could negate our offensive strength.

3. FY 1979 Planned Program: The FY 79 program is structured to address each Ballistic Missile Defense technology area in the contexts of overall program objectives. The Discrimination Technology Program includes analytical studies, laboratory experiments and field measurements for the development and verification of advanced discrimination techniques applicable for operation in boost, midcourse and terminal reentry regimes. The program emphasizes the use of advanced radar and optical (active and passive) sensors. The Radar Program will continue to be a broadly based technology effort covering the major frequency regimes (microwave, millimeter and micrometer) and stressing cost reduction, rapid deployment, component hardening, and improved information gathering. The Optics Technology Development Program in FY 79 includes completion of verification testing and evaluations of near term optical sensors; pursuit of the first technology development of optical mosaic exoatmospheric sensors; investigation of the feasibility of applying high-energy lasers (HEL) as BMD weapons, and continuation of effort on development of optical sensors for employment in the atmosphere. The Interceptor Technology Program will continue ongoing advanced development in high-performance interceptor requirements, Exoatmospheric Homing Interceptor-Borne Integrated Technology Program (EXHIBIT) computer simulation for the Systems Technology Program (STP) Homing Overlay Experiment (HOE), new BMD homing and non-nuclear kill system constructs, and new technology innovations. The critical needs and problems posed by BMD threats (real time-multiplicity of targets, etc.) has necessitated four unique areas of research in computer science and engineering which are being pursued by Ballistic Missile Defense Advanced Technology Center. These are the development of advanced computing hardware technology, real-time BMD algorithms technology, software engineering technology, and data processing configuration and application analysis. Investigation of high-energy beam technology for weapons application in BMD will continue. Evaluation of new technological initiatives and requirements to guide technology programs will continue. Efforts will continue to use current and evolving technology to achieve a rapidly deployable BMD. The increased funding allows for inflationary increases and sustain studies and analyses for new concepts and technologies while a greater portion of the budget is required for hardware development.

4. FY 1980 Planned Program: Complete the definition of the non-nuclear kill technology engagement constructs in both the endo and exoatmospheric regimes to effect increased emphasis on integration of the construct technology programs and interfaces between the regimes. Institute an evolving process of technology selection, evaluation and high pay-off assessment of candidate new technology programs. In Discrimination Technology, the program will emphasize the experimental acquisition analysis of over-the horizon radar and passive submillimeter radiation data to detection and discriminate Ballistic Missiles early in the boost phase, plan for acquisition of data useful in development of midcourse regime detection and discrimination techniques, and emphasize schemes for use of a combination of candidate BMD sensors in the terminal regime. The Radar Program will complete evaluation of a number of hardened antenna concepts; test the performance of millimeter wavelength solid state transmitter/receiver modules; demonstrate operation of a prototype laser radar transmitter, and complete development of a 250 MHz digital signal processor. The Optics Technology Program will provide for the continued development of mosaic sensor technology, design of optical sensors, evaluation of lasers as BMD weapons, and exploration of promising advanced optical concepts and techniques. In Interceptor Technology, emphasis will remain with technology developments related to the endo and exo homing guided, non-nuclear Kill system constructs. In Data Processing, technology required to support advanced Ballistic Missile Defense concepts will be pursued. In addition, research to advance the state-of-the-art in computing technology through innovative concepts will be initiated.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.33.08.A

Title: Ballistic Missile Defense Systems Technology Program (BMDSTP)

DoD Mission Area: #321 - Ballistic Missile Defense

Budget Activity: #3 - Strategic Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	100000	106188	114000	120840	Continuing	Not Applicable
D991	Ballistic Missile Defense Systems Technology	100000	106188	114000	120840	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the conduct of BMD systems technology research and development activities which will maintain a capability to initiate design/development of a deployable BMD system, if directed; and conduct systems definition studies and testing of selected components in a systems context to provide for more cost effective and responsive BMD systems.

C. BASIS FOR FY 1979 RDTE REQUEST: Provides for continuation of the validation program associated with terminal BMD systems, and the updating of these BMD concepts with on-going BMD systems technology improvements whihc enhance cost, time, and utility considerations. During this period the Systems Technology Radar and associated Data Processor at the Kwajalein Missile Range will be gathering data on dedicated Intercontinental Ballistic Missile targets and targets-of-opportunity for validation of critical systems issues. Additional effort which will be conducted during this period includes the conduct of comprehensive studies of a layered BMD system$(using terminal defense in a combination with a defense overlay); testing of an Advanced Digital Signal Processor (ADSP) which will be incorporated into the Systems Technology Test Facility (STTF), continued investigations and procurement of candidate data processing subsystem upgrades for evolving constructs, definition of key systems issues and design associated with a Homing Overlay Experiment (HOE) to validate the capability of exo-atmospheric interceptors employing non-nuclear warheads, investigation of further upgrades to the STTF, and continuation of system requirement studies for low altitude defense concepts for potential targets.

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: Initiated in FY 1971, the program (which was at that time desingated as Site Defense) was designed to accomplish the technical and engineering tasks required to achieve a credible capability to defend MINUTEMAN or other high value targets in case Soviet ballistic missile force improvements became a threat to the US MINUTEMAN force. FY 1975 and FY 1976 Congressional budget authorization hearings resulted in guidance which reoriented the program from prototype demonstration to Systems Technology advancement. The presently planned program, now designated the Ballistic Missile Defense Systems Technology Program, was initiated as a follow-on the Site Defense program. The primary objective of the program is to retain a US posture where a full-scale development program incorporating the most advanced available technology could be initiated with an acceptable lead time and cost. The program is investigating cost effective systems capable of defending a variety of nationally strategic

targets with primary emphasis on defense of MINUTEMAN. This program continues to provide benefits to the US Strategic Arms Limitation community and negotiators, to the US strategic offensive nuclear arms research and development community, and to the US ballistic missile intelligence community, but primarily, it insures that the US will be capable, if needed, of providing a defense against nuclear attack.

F. RELATED ACTIVITIES: Related activities include testing at the Kwajalein Missile Range, 6.53.01.A; and the Ballistic Missile Defense Advanced Technology Program, 6.33.04.A.

G. WORK PERFORMED BY: Contractors: The major contractors are: McDonnell-Douglas Astronautics Company, Huntington Beach, CA; TRW, Inc., Redondo Beach, CA; Control Data Corporation, Minneapolis, MN; General Electric Company, Syracuse, NY; Martin Marietta Corporation, Orlando, FL; and Teledyne Brown Engineering Company, Inc., Huntsville, AL. Government: US Army Ballistic Missile Defense Systems Command, Huntsville, AL. In addition to the foregoing, during the period of August-September 1978 an associate contractor will be competitively selected for the HOE Interceptor effort.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Site Defense prototype development specifications for major subsystems were developed and design and fabrication of these subsystems were initiated. By the end of FY 1976, most of the prototype demonstration hardware had been fabricated and program restructuring to reorient emphasis in the program from prototype demonstration to advancement of systems technology had been completed. Fabrication of the initial hardware required for the Systems Technology Test Facility (STTF) was completed and shipped to the Kwajalein Missile Range by the end of FY 7T. Radar/data processor software integration testing was conducted at the Kwajalein Missile Range beginning early in FY 1977 with target-of-opportunity missions occurring in the second half of the fiscal year. System level dedicated target mission planning for validation of terminal defense critical technical issues continued. Component upgrade activity continued with emphasis on the data processor and the Advanced Digital Signal Processor (ADSP) investigation and analyses of requirements for defending a variety of strategic national assets. Definitive effort on mid-course and low altitude defenses continued. Competitive contracts were executed for a program definition study of a mid-course interceptor which will be used in a Homing Overlay Experiment (HOE).

2. FY 1978 Program: In FY 1978 the initial bulk filter and discrimination test activity will be initiated. Mission planning for the first series of system level dedicated target missions, primarily to support the validation of the key terminal defense technical issues, will be essentially completed and preparation for the first dedicated target mission scheduled for early FY 1979 will be well under way. Comprehensive studies will be undertaken on a layered defense capability (terminal, or underlay, defense in combination with a defense overlay) to counter the anticipated threat. Terminal defense component upgrade effort and Advanced Digital Signal Processor (ADSP) effort will continue. Definitive effort for the Homing Overlay Experiment, optics adjunct and low altitude terminal defense programs will continue. Investigation and definition of requirements for defense of strategic national value targets will be pursued.

Program Element: #6.33.08.A Title: Ballistic Missile Defense Systems Technology Program (BMDSTP)

DoD Mission Area: #321 - Ballistic Missile Defense Budget Activity: #3 - Strategic Programs

3. FY 1979 Planned Program: Efforts leading toward completion of the Terminal Validation Program at the Systems Technology Test Facility (STTF) will continue. Data will be gathered on three dedicated MINUTEMAN targets and numerous targets-of-opportunity using the full precommit software capability. String testing of the Advanced Digital Signal Processor (ADSP) will be conducted at the contractor's, General Electric (GE), plant and the final hardware will be shipped to the STTF in the last of the fiscal year. Work will continue on design and implementation of data processing system hardware configurations to meet advanced deployment requirements. Work will continue on development of the STTF upgrades. This selected hardware will be emplaced into the STTF following completion of the terminal validation program. The associate contractor for the Homing Overlay Experiment (HOE) interceptor will begin and development activities. System effort will continue with design requirements and systems analysis activities to support a planned HOE Systems Design Review (SDR) early in FY79. Design efforts will continue to be conducted on the layered defense concept and on Low Altitude Defense. Systems studies and analyses will continue at approximately the same level as in FY78.

4. FY 1980 Planned Program: The Terminal Validation Program at the STTF will be completed and upgrades to the STTF equipment, such as the ADSP, will be incorporated into the radar and the data processor. Two dedicated target missions will be conducted to evaluate the effectiveness of the upgraded system. DPS hardware upgrades will continue toward implementation of computer hardware and associated software development to replace the existing central computer. Detailed design and development work will be under way for HOE and initial hardware fabrication of components will begin. Design efforts on layered defense and Low Altitude Defense (LOAD) will continue, as will system studies and analyses.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.35.A

Title: Worldwide Military Command and Control System (WWMCCS) Architecture

DoD Mission Area: #331 - Strategic Command, Control, and Communications (C^3)

Budget Activity: #3 - Strategic Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	9	556	700	811	Continuing	Not Applicable
M150	WWMCCS Architecture - Army Command and Control Master Plan (AC^2MP)	9	556	700	811	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This advanced development program is in support of the Army's portion of the WWMCCS Architecture, directed to be accomplished by the Deputy Secretary of Defense. This effort consists of studies and analyses in the development, simulation, planning and evaluation of equipment and techniques to define a total Army command and control system configuration. The Army currently has no single guidance document addressing command and control requirements for developing and fielding systems in the 1980's and beyond. The objective of this effort is to develop a single coherent policy guidance document for the transition of existing tactical and strategic command and control to those that will be required in the 1980's and beyond. This document will present a comprehensive, cost effective command and control program which will result in substantial cost savings by establishing a balanced capability to satisfy system requirements. This approach allows maximum use of off the self procurement and minimizes RDTE expenditures. Overall effort relates to, and will interface with current initiatives underway with the WWMCCS Selected Architecture, European Command and Control and Communications study, and US Army, Europe (USAREUR) Command and Control information study.

C. BASIS FOR FY 1979 RDTE REQUEST: The FY 1979 RDTE effort is a continuation of the prior years. The FY79 effort will address tactical and strategic requirements to meet mission objectives. It will evaluate equipments presently in the field, as well as those programed for deployment, to determine their ability to meet the command, control and communications requirements of commanders. The 1979 effort will further focus on General Nuclear War, Post Attack, and Reconstitution Phases.

Program Element: #6.37.35.A

Title: Worldwide Military Command and Control System (WWMCCS) Architecture

DoD Mission Area: #331 - Strategic Command, Control, and Communications (C^3)

Budget Activity: #3 - Strategic Programs

Major Program Milestones	Date
Army Command and Control System (ACCS) Theater Nuclear Architecture	Oct 1977
ACCS Program Guidelines	Feb 1978
ACCS Theater Conventional Architecture	Feb 1978
Crisis Situation Architecture	Jul 1978
Post-Attack Architecture	Jul 1978
ACCS Architecture Alternatives	Jul 1978

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The Army was tasked by Office of the Secretary of Defense, Telecommunications and Command and Control, on 14 March 1976 to undertake its own Architectural study to assess all elements of the Army which contribute to force command and control, and to define future Army command, control, and communications requirements above the tactical level. Effort is designed to address the interface requirements between WWMCCS and the Army's strategic and tactical command and control systems. Program will evaluate the techniques and equipment required to enhance the survivability, interoperability, reliability, flexibility, security, and overall integration of command and control elements.

F. RELATED ACTIVITIES: Results from Program Element 3.31.45.A, EUCOM Command, Control, and Communications Systems, study effort are used as input data to this program. Additionally, efforts of Program Element 3.20.53.A, National Military Command System wide Support are related. Each of these studies addresses a different portion of the command, control, and communications environment. To insure maximum results are obtained and duplication of efforts avoided, taskings for these studies are managed by ODCSOPS, Headquarters, Department of the Army.

G. WORK PERFORMED BY: The Director, Telecommunications and Command and Control, Deputy Chief of Staff for Operations and Plans, (DCSOPS), Department of the Army, is the Program Manager. The Air Force Systems Command, through its Electronic Systems Division at L. G. Hanscom Air Force Base, MA, is responsible for contract administration. The International Business Machine (IBM) Corporation, Federal Systems Division, Arlington, VA, is the contractor for the Army Command and Control Master Plan.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The Army Command and Control Master Plan commenced in June 1976 under Program Element 6.51.01.A, Studies and Analyses. The contractor provided a detailed work plan which described the flow of the efforts necessary

to achieve an architecture and a plan for its subsequent implementation. The plan contained details of the subtasks to be performed, subtask interrelationships, inputs required from the Government, key milestones and deliverables, and a schedule for performance and resources to be applied.

2. FY 1978 Program: The FY 1978 program will complete the second phase of the plan development, to include crisis situations, nuclear, conventional and general war. The major subtask of the 1978 effort will be to (1) define issues to permit architectural alternatives to be structured; (2) create situation/options details required to define courses of action available for each strategic mode and to specify the types of information that must be available at each mode; (3) develop specific guidance and detailed evaluation techniques for the strategic architecture project; (4) develop alternative solutions to satisfy performance requirements necessary to determine the degree of support the solutions provide for each situation/option in specific threat environment.

3. FY 1979 Planned Program: Continuation of the 1978 effort on the crisis situations, post attack, and reconstitution architecture. The efforts will lead to initial phases of development of the Army Command and Control Systems Master Plan and development of an implementation plan. Further efforts will continue to support the European Command and Control Implementation Plan and the WWMCCS Selected Architecture. The funding increase over FY 1978 is for support of the European Scenario of *the master plan and enhancements* to the WWMCCS Selected Architecture.

4. FY 1980 Planned Program: This effort will finalize the initiations of the Army Command and Control Master Plan and recommend an implementation strategy. The remaining subtask is an assessment of the command and control requirements of the US Commander, Central Army Group (CENTAG), when NATO forces revert to his control. The completed effort will present a coherent picture of command and control under peacetime and wartime scenarios.

5. Program to Completion: The extent and duration of this program is related to findings and recommendations derived from the completed Army Command and Control Master Plan. It is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.03.A
DoD Mission Area: #341 - Battlefield

Title: Nuclear Munitions
Budget Activity: #3 - Strategic Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT						
	Quantities						
D205	LANCE Adaption Kit						
D385	Improved 155mm Nuclear Projectile						
D663	Improved 8-Inch Nuclear Projectile						

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The mission of the Theater Nuclear Force is to deter both nuclear and conventional attack by enemy forces and, should deterrence fail, to support the defense of the theater. This mission requires nuclear weapon effectiveness, response and control that exceeds the capabilities of weapons based on 1950's technology. This program element is the foundation of the program to modernize the Army's theater nuclear weapons by improving the nuclear warheads for the LANCE missile, and the 8-inch and 155mm artillery fired atomic projectiles (AFAP).

C. BASIS FOR FY 1979 RDTE REQUEST:

Additional funds are required to maintain in-house personnel and contractors on this program through program slips imposed by congressional restriction on the release of procurement funds. A bulk of the initial engineering design testing and required redesign, will be done in FY 1979 on the fuze, projectile body, and rocket motor case for the XM785, 155mm nuclear projectile. Additional funds are required to accelerate this project in accordance with the Secretary of Defense Amended Program Decision Memorandum for FY 1979. See Descriptive Summaries for project D663 and D385 following.

Program Element: #6.46.03.A
DoD Mission Area: #341 - Battlefield

Title: Nuclear Munitions
Budget Activity: #3 - Strategic Programs

Major Milestones

LANCE Mod 3 Initital Operational Capability
Improved 155mm Nuclear Projectile Initial Operational Capability
Improved 8-inch Nuclear Projectile Initial Operational Capability

D. OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Missile Procurement, Army LANCE*						
Quantity						
Ammunition Procurement, Army 155mm*						
Quantity						
Ammunition Procurement, Army 8-inch*						
Quantity						
Department of Energy-Defense Programs (DoE-DP) (formerly Energy Research and Development Agency, formerly Atomic Energy Commission)						
LANCE Warhead	***	***	***	***	***	***
155mm Projectile	***	***	***	***	***	***
8-inch Projectile	***	***	***	***	***	***

* DoD Nuclear Weapon Components only.
** Warhead quantities exceed classification of this document.
*** DoE-DP budget figures exceed classification of this document.

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is modernization of the Army's theater nuclear weapons, specifically nuclear projectiles in FY 1979 and the out-years. Engineering development of improved 8-inch and 155mm nuclear projectiles will be accomplished. Major areas of effort by the Army are miniaturization and packaging of arming and fuzing functions, certification of ballistic similitude, and redesign of rocket motor parts. Unique solutions to engineering design problems are required for the 8-inch and 155mm nuclear projectiles. The capabilities of the improved projectiles will include

, increasing the area of lethal coverage, improving delivery precision, and simplifying logistic support and operator assembly and testing. These improvements will provide nuclear projectiles that are more effective, more reliable and more responsive to the dynamics of the modern battlefield. The XM753, 8-inch nuclear projectile will replace the M422 projectile which uses late 1940 nuclear technology. The XM785, 155mm nuclear projectile will replace the M454 projectile
The potency of firepower provided by theater nuclear weapons and the bridge to strategic systems they provide are two of the most important elements that deter a Warsaw Pact attack in Central Europe.

F. RELATED ACTIVITIES: The development of improved nuclear projectiles is a joint Department of Defense (DoD) and Department of Energy-Defense Programs (DoE-DP) undertaking. In addition, the 8-inch nuclear projectile will use the rocket motor developed for the XM650 conventional 8-inch projectile. The 155mm nuclear projectile will use the rocket motor propellant grain developed for the M549 conventional 155mm projectile. Much of the electronic technology and production expertise developed for the 8-inch fuze will be applicable to the 155mm fuze. A budget line for funding the procurement of Army components for the XM785 will be established in the FY 1980 budget cycle.

G. WORKED PERFORMED BY: US Army Research and Development Command (ARRADCOM), Dover, NJ; Harry Diamond Laboratories, Adelphi, MD; Army Materiel and Mechanics Research Center, Watertown, MA; Ballistics Research Laboratory, Aberdeen, MD; Department of Energy-Defense Program activities and contractors in Germantown, MD; Albuquerque, NM; Amarillo, TX; Kansas City, MO; Los Alamos, NM; Las Vegas, NV; Livermore, CA. See also project D385, Improved 155mm Nuclear Projectile, and D663, Improved 8-inch Nuclear Projectile, Descriptive Summaries following.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Limited redesign of the LANCE warhead adaption kit to support the in-process production change to the improved version, Mod 3 (reduced blast/enhanced radiation warhead). All studies detailing the DoD interface with Department of Energy-Defense Programs (DoE-DP) have been completed. Most of the laboratory and field testing of the Mod 3 warhead and adaption kit was completed. The Nuclear Weapon System Safety Committee review of the W70-3, LANCE Mod 3 warhead, was completed. See also project D385, Improved 155mm Nuclear Projectile, Descriptive Summary, and project D663, Improved 8-inch Nuclear Projectile, Descriptive Summary, following.

2. FY 1978 Program: Complete final testing and type classify Army components for the W70-3, LANCE Mod 3 warhead. Initiation of production will be delayed by Congressional restrictions on the use of DoE procurement funds that were

appropriated. See also project D385, Improved 155mm Nuclear Projectile, Descriptive Summary, and project D663, Improved 8-inch Nuclear Projectile, Descriptive Summary, following.

3. FY 1979 Planned Program: RDTE should have been completed on the LANCE Mod 3 Adaption Kit but due to a difference in DoD and Department of Energy (DoE) funding of hardware for joint flight tests, some tests may be postponed due to the Congressional restriction on the use of DoE production funds. See also project D385, Improved 155mm Nuclear Projectile, Descriptive Summary, and project D663, Improved 8-inch Nuclear Projectile, Descriptive Summary, following.

4. FY 1980 Planned Program: continue engineering development for the XM785 Improved 155mm nuclear projectile. See project D663, Improved 8-inch Nuclear Projectile, and D385, Improved 155mm Nuclear Projectile, Descriptive Summaries, following.

5. Program to Completion: Achieve Initial Operational Capability for the XM785 improved 155mm nuclear projectile. If advanced development proves technical feasibility of tactical earth penetrating warheads, they may be developed for PERSHING II application. The program for an earth penetrator has not been defined at this time.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D385 Title: Improved 155mm Nuclear Projectile
Program Element: #6.46.03.A Title: Nuclear Munitions
DoD Mission Area: #341 - Battlefield Budget Activity: #3 - Strategic Programs

A. DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is development of a new, improved 155mm nuclear projectile, the XM785. It will replace the current M454 nuclear projectile.

The 155mm nuclear projectile is particularly important to NATO forces

The cost of adding 8-inch units to their force structure is exceedingly high. With a new 155mm projectile in addition to the 8-inch nuclear projectile, the survivability of the allied tactical nuclear forces will be enhanced by compounding and complicating enemy targeting. The number of nuclear delivery systems will increase by the dual capable 155mm howitzers planned for the Allied Forces Central Europe force structure. The nuclear capability is an operational bonus because it requires no change in force structure of weapons, communications equipment, and manpower spaces beyond the artillery needs for the conduct of conventional fire missions. The XM785 can be fired from the new US and NATO 155mm howitzers

It will take advantage of technology developed in the 8-inch nuclear projectile program in the areas of fuzing, rocket propulsion, and ballistic similitude with conventional ammunition. State-of-the-art technology in large scale circuit integration will be used to reduce component size for packaging the fuzing and safing functions in the smaller projectile volume. Security will be enhanced by use of built-in disablement devices and a Multiple Code Coded Switch (MCCS). The MCCS is a Permissive Action Link (PAL) command and control device with 1 million possible codes, which locks up arming circuits to prevent unauthorized use. It will lock permanently if wrong codes are repeatedly inserted. Activation of the disablement or lock-up of the MCCS will require factory rebuild to permit use of the weapon. The new XM785 will increase in yield over the M454 that will produce increase in the radius of lethal military effect At the same time the improved accuracy and the low yield will permit effective employment in the highly populated European environment with targeting constraints designed to limit civilian damage and casualties. Because of its mobility, light armor protection, and proliferation on the battlefield, dual capable tube-artillery is the most flexible, survivable and responsive of theater nuclear delivery systems.

B. RELATED ACTIVITIES: The Department of Energy, Defense Programs (DoE-DP) will develop the nuclear warhead. A joint DoE/DoD project officers group will coordinate the integrated DoE/Army development effort. The XM785 will use the rocket motor propellant grain and the propellant charges developed for the M549 conventional 155mm projectile. It will also employ fuze technology and

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Project: #D385 Title: Improved 155mm Nuclear Projectile
Program Element: #6.46.03.A Title: Nuclear Munitions
DoD Mission Area: #341 - Battlefield Budget Activity: #3 - Stragegic Programs

rocket motor joint technology developed and engineered for the 8-inch projectile. England, Germany, and Italy have completed development and are now beginning production on a new 155mm howitzer, the FH70, which will be compatible with the new nuclear projectile.

C. WORK PERFORMED BY: US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; Harry Diamond Laboratories, Adelphi, MD; Army Materiel and Mechanics Research Center, Watertown, MA; ARRADCOM, Aberdeen, MD; Department of Energy, Defense Programs laboratories either Lawrence Livermore Laboratory, Livermore, CA or Los Alamos Scientific Laboratory, Los Alamos, NM and the Sandia Laboratories either in Livermore, CA or Albuquerque, NM. For other typical contractors that might be engaged later in engineering development, see project D663 Descriptive Summary following.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Subsequent to the Public Works Subcommittee hearings on the FY 1977 Energy Research and Development Agency (now Department of Energy-Defense Programs) Appropriation Act, DoE and DoD were directed to jointly reassess the 155mm nuclear projectile requirement in light of the approved 8-inch nuclear projectile and the LANCE Mod 3 warhead production. The "155mm Artillery Field Atomic Projectile Modernization Analysis" report was provided to Congress in February 1977. The Army requested DoE-DP participation in a joint engineering development program for an improved 155mm projectile in May 1977 and DoD forwarded the request to DoE in October 1977. The Secretary of Defense directed in his FY 1979 Amended Program Decision Memorandum (APDM) that the Initial operational capability date for the improved 155mm nuclear projectile be accelerated.

2. FY 1978 Program: This program is a new start in FY 1978. A joint DoE-DP/Army development schedule will be established and the design interfaces in the projectile negotiated. Work done on the fuze for the XM753 8-inch nuclear projectile components forms the basis to begin advanced development for the XM785 fuze. The development emphasizes application of large scale integrated circuit technology to reduce the size of the 8-inch fuze components for use in the 155mm projectile. Because the 8-inch fuze development is essentially completed in FY 1978, it is expected that the 155mm program will transition from advanced development to full scale development in mid FY 1978. Other areas being emphasized include metallurgical development work on the projectile body and rocket motor, and integration of the Army effort with the DoE-DP warhead development effort. All necessary experimental work will have been performed and the proposed system will be ready for full scale development.

Project: #D385 — Title: Improved 155mm Nuclear Projectile
Program Element: #6.46.03.A — Title: Nuclear Munitions
DoD Mission Area: #341 - Battlefield — Budget Activity: #3 - Strategic Programs

3. FY 1979 Planned Program: This will be the first full year of full scale development. Activities will include flight testing of initial engineering development prototype fuze models and DoE-DP warhead components to prove structural integrity in the high g-force environment of internal cannon ballistics. Funding increase is based on experience gained with the XM753, 8-inch nuclear projectile extrapolated to an accelerated nuclear warhead development program.

4. FY 1980 Planned Program: Department of Energy and Army hardware designs will be fixed and released for production of items for development test and operational tests that lead to type classification of hardware.

5. Program to Completion: Engineering development will continue to permit Development Test II/Operational Test II testing to begin in late FY 1981

6. Major Milestones:

	Date
a. Joint Department of Energy-Defense Programs/ Department of Defense Development begins (Phase III)	Dec 1977
b. Validation In-Process Review	
c. Development Testing/Operational Testing	
d. Development Acceptance In-Process Review	
e. Initial Delivery of War Reserve Projectiles	

7. Resources ($ in thousands):

	FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Cost
RDTE,A:Funds						
Quantities						
Ammunition Procurement, Army:Funds						
Quantities						

* Warhead quantities exceed classification of this document.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #3.20.53.A

Title: National Military Command Systemwide Support -- Communications

DoD Mission Area: #331 - Strategic Command, Control, and Communications (C^3)

Budget Activity: #3 - Strategic Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Project	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	2614	4600	4000	1300	12714
D163	National Military Command Systemwide Support - Communications	0	2614	4600	4000	1300	12714

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This advanced development program is in support of the Worldwide Military Command and Control System (WWMCCS) Selected Architecture. This is a study and analysis effort of transportable command, control, and communication facilities for support of headquarters in the Pacific, Europe, and the Readiness Command. This effort will define the communications, command, and support requirements necessary to develop and test a prototype system before proceeding with procurement. This is related to the Army's mission in that the knowledge and expertise developed in this program can be applied to resolve the shortfalls in the Army's command, control, and communications systems. During rapidly moving crises or wartime situations, the ability of the highest command authority to communicate with the lowest executing forces is the most important element of command and control. A need exists to develop transportable C^3 facilities that can fulfill this requirement. This program will identify, develop, and test a prototype system to meet this need.

C. BASIS FOR FY 1979 RDTE REQUEST: The FY 1979 program is a continuation of the studies initiated in FY 1978. The results of these studies and analysis will be used to produce the initial prototype systems for test and evaluation prior to procurement. The major subelements to be completed in FY 1979 prior to procurement are: Mix and Sizing Alternative studies; Systems Hardware/Integration study; and Electromagnetic Pulse/Radiation Effects. FY 1979 funds will be used in the initial phase of developing the prototype systems.

Program Element: #3.20.53.A Title: National Military Command Systemwide Support - Communications

DoD Mission Area: #331 - Strategic Command, Control, And Communications (C^3) Budget Activity: #3 - Strategic Programs

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Other Procurement, Army						
Funds	0	0	0	15700	35900	56100
Quantities	*	*	*	*	*	*

* Number of diverse items.

E. DETAILED BACKGROUND AND DESCRIPTION: This program is the result of tasking by Deputy Secretary of Defense on 24 June 1976, in which the Army was appointed cognizant component to develop a "Rapid Reaction Deployable Command and Control and Communications Facilities" (R^2DC^3) in support of the Commanders-in-Chief of Pacific, Europe, and the Commander, US Army Readiness Command. The capabilities to be incorporated into this facility were secure voice and graphics conferencing; jam-resistant secure communications via satellite automatic text message handling; automatic data processing (ADP), support facilities; and communications necessary for entry into Worldwide Military Command and Control System (WWMCCS). The initial effort of this program is to conduct those necessary studies and analyses to define the magnitude of the capabilities above, develop a package through mix and sizing so that it meets the transportable requirements, ensure interface with existing systems, and test and evaluate a prototype system. This guidance specified that the effort should focus on those items (communications, Automatic Data Processing, facilities) currently in the inventory with minimum or no new equipment development. Funding support for this program started in FY 1978.

F. RELATED ACTIVITIES:

* Automatic Text Message Handling	Navy	Currently being held in abeyance pending Congressional decision.
* JAM Resistant Secure Communications	Army	Part of the Defense Satellite Communications System (DSCS)
* Secure Voice and Graphics Conferencing	DCA	Utilizes the DSCS satellite.
Airborne Command and Control Center	USAF	Must be interoperable.
Army Command and Control Master Plan	Army	Will define European interface requirements.

* Hardware equipment for the R^2DC^3 facilities are being developed under these activities.

G. WORK PERFORMED BY: Contractor to be selected. In-house developing organization is US Army Communications Command, Fort Huachuca, AZ.

Program Element: #3.20.53.A

Title: National Military Command Systemwide Support - Communications

DoD Mission Area: #331 - Strategic Command, Control, and Communications (C^3)

Budget Activity: #3 - Strategic Programs

II. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Not Applicable.

2. FY 1978 Program: The initial effort will be a systems definition study; transportability analysis/feasibility study; and mix and sizing alternatives study. The hardware integration and facility design efforts will begin.

3. FY 1979 Planned Program: The FY 1979 program will complete the hardware integration and facility design efforts started in FY 1978 and recommend a system configuration as a candidate prototype. Also, the initial procurement of items to develop the prototypes will begin. Increased funding over FY 1978 provides for procurement of prototype equipments needed for evaluation of system configuration.

4. FY 1980 Planned Program: The FY 1980 program will concentrate on completion of the prototype model and a comprehensive test and evaluation program. This program will provide a final recommended systems configuration and provide the basis for procurement actions to field this capability.

5. Program to Completion: The RDTE portion of this effort is planned for completion in FY 1980; however, the extent and duration of this program is dependent on the findings and recommendations of the test and evaluation program and the decision to initiate full scale procurement.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #3.31.45.A
DoD Mission Area: #331 - Strategic Command Control, and Communications (C^3)

Title: EUCOM Command, Control, and Communications Systems (EUCOM C^3 Systems)
Budget Activity: #3 - Strategic Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT						
DH58	EUCOM C^3 Systems						

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports a continuing study effort in response to the Deputy Secretary of Defense tasking for Army to examine the entire Command, Control, and Communications structure in Europe and propose options for improvement. Effort also includes

and the analysis of the European portion of the command and control requirements of the Army Command and Control Master Plan (AC^2MP). A Joint Chief of Staff (JCS) study was initiated in 1974 on the C^3 picture in Europe. This study identified 96 C^3 deficiencies requiring research, development and acquisition initiatives. This effort will analyze each deficiency and recommend the most cost-effective means of improving the European C^3 posture. Specifically, the plan will address inadequate interoperability with NATO systems, limited C^3 survivability during crisis, and requirements for hardened C^3 facilities.

C. BASIS FOR FY 1979 RDTE REQUEST: Continuation of FY 1978 effort to analyze C^3 deficiencies previously identified; and, develop a plan for shared facility systems, such as power, life support, external/internal communications, and automatic data processing, required to meet Funding will continue development of plans required to improve the survivability and interoperability of C^3 facilities in Europe.

Program Element: #3.31.45.A
DoD Mission Area: #331 - Strategic Command Control, and Communications (C^3)

Title: EUCOM Command, Control, and Communications Systems (EUCOM C^3 Systems)
Budget Activity: #3 - Strategic Programs

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement, Army					
Funds					
Quantities					
Military Construction, Army					

* Number of various items of equipment.

E. DETAILED BACKGROUND AND DESCRIPTION: Deputy Secretary of Defense Memorandum, 14 March 1974, directed the Joint Chiefs of Staff (JCS), with the Army as Executive Agent, to examine the entire Command, Control, and Communications (C^3) picture in Europe and to propose options for improvement. The study was initiated in April 1974 and a final report, identifying deficiencies requiring research, development, and acquisition initiatives, was submitted to JCS in August 1975. The JCS completed their review in February 1976 and submitted their comments to the Secretary of Defense (SECDEF). Since then, the report and its 96 recommendations has served as a baseline for actions undertaken to improve the many aspects of European C^3. As a related action, Deputy Secretary of Defense Memorandum, 24 June 1976, directed the Secretary of the Army to plan for the

Tasks accomplished under this program are essential in defining and analyzing C^3 requirements necessary to establish an efficient and survivable C^3 system in the European environment.

Program Element: #3.31.45.A
DoD Mission Area: #331 - Strategic Command Control, and Communications (C^3)

Title: EUCOM Command, Control, and Communications Systems (EUCOM C^3 Systems)
Budget Activity: #3 - Strategic Programs

F. RELATED ACTIVITIES: Efforts accomplished under this program are used as a part of the input data to a related study and configuration prototype evaluation currently being developed under Program Element 6.37.35.A, Worldwide Military Command and Control System (WWMCCS) Architecture. Each of these studies addresses a different portion of the Command, Control, and Communications environment. To insure that maximum results are obtained from these studies tasking is managed by ODCSOPS, Headquarters, Department of the Army.

G. WORK PERFORMED BY: International Business Machine (IBM), Incorporated, Rosslyn, VA; Developing Organization - US Army Communications Command, Ft Huachuca, AZ.

H. PROGRAM ACCOMPLISHEMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The 1976 effort was the initial European C^3 Study; the FY 1977 effort was the

and the formulation of theater nuclear alternatives for the Army Command and Control Master Plan.

2. FY 1978 Program: The FY 1978 program analyzes the results of the

Specific areas are: Communication Security (COMSEC) design of methods, equipment and procedures for necessary COMSEC

3. FY 1979 Planned Program: The FY 1979 planned program will follow-up those efforts started in FY 1978, specifically, and European Analysis of Army C^3 requirements. The decrease in FY 1979 funds from FY 1978 is due to the anticipated completion of major study efforts on the COMSEC interfaces, communications interoperability, and ADP facilities.

4. FY 1980 Planned Program: Major effort will be to finalize study results and produce a comprehensive transition plan for proceeding to an orderly procurement program. Any unresolved and unforecasted requirement arising during FY 1979 will be completed at this time.

Program Element: #3.31.45.A
DoD Mission Area: #331 - Strategic Command Control, and Communications (C^3)

Title: EUCOM Command, Control, and Communications Systems (EUCOM C^3 Systems)
Budget Activity: #3 - Strategic Programs

5. Program to Completion: The extent and duration of this program is dependent upon the findings and recommendation of the Worldwide Military Command and Control System (WWMCCS) Selected Architecture, US Army Command, Control and Information Systems (CCIS) study, and the Army Command and Control Master Plan (AC^2MP). Known and scheduled tasks will be completed by FY 1980. Any additional findings or expanded taskings may result in continuation of effort beyond 1980.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.32.15.A
Title: Joint Survivability Investigations
DoD Mission Area: #448 - Aircraft Survivability
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	475	581	600	600	Continuing	Not Applicable
D079	Joint Survivability Investigations	475	581	600	600	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element supports the Army portion of interservice efforts to insure that the latest aircraft nonnuclear survivability technology is available for incorporation into design, decisions and coordination. The Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) complements ongoing separate Service work and provides the vehicle for cross Service survivability equipment development. The JTCG/AS was formally chartered in June 1971 under the aegis of the Joint Army Materiel, Navy Material, Air Force Logistics and Air Force Systems Command commanders to insure that the latest aircraft nonnuclear survivability technology would be available for incorporation into the design of new aircraft. This project responds to the Memorandum of Agreement on Aircraft Survivability Equipment (ASE) for use on Helicopters and Low/ Slow Fixed Wing Aircraft signed 29 Sep 1977 by General Officers from the four Services.

C. BASIS FOR FY 1979 RDTE REQUEST: Research efforts will support the Tri-Service Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) program approved by the Joint Logistics Commanders with emphasis on to determining the vulnerability of personnel in aircrew stations to laser weapons effects. This work will include the development and refinement of laser vulnerability analysis procedures, preparation of a materials effects data matrix, maintenance of a test data bank of laser effects and the development of a Tri-Service standard for the measurement of electro-optical (EO) signatures and data formatting.

D. OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #6.32.15.A
DoD Mission Area: #448 - Aircraft Survivability

Title: Joint Survivability Investigations
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: The Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) is specifically chartered to: (1) implement interservice efforts to reduce vulnerability of aeronautical systems in a nonnuclear threat environment; (2) coordinate research and advanced development efforts which contribute to the reduction of aeronautical systems vulnerability; and (3) maintain close liaison with Services to insure that all survivability research and development data and systems criteria are made available to the developers of new aircraft. The JTCG/AS subgroups are: Technology Research and Development, Vulnerability Assessment, Survivability Assessment, Design Criteria and Industrial Interface, Countermeasures, and Laser Effects/Threat Assessment. In 1972, the JTCG/AS established a Tri-Service aircraft nonnuclear survivability program, Test and Evaluation, Aircraft Survivability (TEAS). Joint tasks were coordinated and proposed to fill research and development (R&D) voids. TEAS was approved by the Deputy Director of Defense Research and Engineering, Test and Evaluation. TEAS was provided $10 million in DOD funds for three years (FY 1973-75). The TEAS program was a technology oriented program whose goals were: (1) conduct vulnerability experiments to strengthen the data base for vulnerability analysis and vulnerability reduction; (2) evaluate design prototype hardware by tests and analyses; (3) develop engineering theory and criteria useful for design; and (4) develop improved computer techniques to predict aircraft subsystem failure and damage effects based on empirical testing. This program complemented separate Service work. The design criteria, specification and documentation projects developed the design criteria, specifications, military standards and other documentation now being used by the Services in contracts for future aeronautical systems and technology support projects.

F. RELATED ACTIVITIES: The program complements other Army exploratory and advanced development aircraft survivability efforts conducted under Program Elements (PE) 6.22.09.A, Aeronautical Technology, 6.37.11.A/D852, Aircraft Survivability Equipment; and 6.37.11/D653, Aircraft Electronic Warfare Self-Protection Equipment. The basis for the program is the Five Year Plan of the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS). The highest priority efforts within the plan are the basis for the program for each fiscal year which is then approved by the Joint Logistics Commanders. Duplication of effort is eliminated through joint reviews by the JTCG/AS and the Service responsible for each effort. The Five Year Plan, prepared and coordinated with Service staffs, includes only survivability efforts required to complement ongoing Service efforts and to continue to develop survivability as a design discipline in response to user requirements and threat documentation.

G. WORK PERFORMED BY: Work will be performed at US Army Materials and Mechanics Research Center, Watertown, MA, US Army Applied Technology Laboratory, Fort Eustis, VA; US Army Ballistic Research Laboratories, Aberdeen Proving Ground, MD; Naval Air Systems Command, Washington, DC; Air Force Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH.

Program Element: #6.32.15.A
DoD Mission Area: #448 - Aircraft Survivability

Title: Joint Survivability Investigations
Budget Activity: #4 - Tactical Programs

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: During FY 1977 this program accomplished survivability and vulnerability assessment methodologies, design criteria and hardware feasibility studies and investigations. FY 1977 efforts also included aircraft engine vulnerability baseline tests, laser vulnerability analysis procedures, determination of damage tolerances and the characterization of battle damage to composite structures. Prior year accomplishments included the development of design enhancement features contributing to flight control systems concept development of the AH-1G, UH-1 and OH-58 helicopters. A hydraulic ram damage limitation feature was developed for protecting the Air Force and Navy A-7 aircraft engine inlet duct. This design feature is also being adapted to protect the fuel tank inlet duct interface on the F-18 aircraft.

2. FY 1978 Program: Develop and refine laser vulnerability analysis procedures, develop Tri-Service standard for the measurement of electro-optical (EO) signature and formatting of data; develop design criteria for jam-proof flight controls components; develop battle damage tolerant composite joint design for modular fiber reinforced airframe construction; assemble data of vulnerability of personnel to laser weapons effects for use in determining cockpit area protection equipments.

3. FY 1979 Planned Program: Continuation of programs to develop composite joint design for modular fiber reinforced airframe construction; develop systems and component probability of damage given a hit ($P_{D/H}$) estimation techniques; develop/refine laser vulnerability analysis procedures and preparation of materials effects data matrix; develop Tri-Service standard for the measurement of EO signatures and for formatting of data; determine vulnerability of personnel in aircrew stations to laser weapons effects. Increased funding in FY 1979 reflects the Army's level of funding of this Tri-Service program as determined by the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) in accordance with guidance from the Under Secretary of Defense for Research and Engineering (USDRE).

4. FY 1980 Planned Program: All Service funds are provided to JTCG/AS headquartered at the Naval Air Systems Command, Washington, DC. The Army portion of JTCG/AS FY 1980 program will include vulnerability/survivability assessment study efforts, engine vulnerability baseline tests, and vulnerability reduction efforts in developing ballistically tolerant composite joints, subject to approval of the FY 1980 program by the Joint Logistics Commanders in consonance with user requirements and threat documentation.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.33.01.A
DoD Mission Area: #414 - Field Army Air Defense

Title: Division Air Defense Gun
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2178	16973	75717	23119	66632	182441
	Quantities						4
D648	Division Air Defense Gun	2178	16973	75717	23119	66632	182441

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides necessary development prototyping, and evaluation effort to define and develop a new weapon to meet Army requirements for low altitude air defense in the forward maneuver area during the mid-1980 time period. Current air defense system in the field and under development cannot provide the forward maneuver units of Army divisions the necessary protection.

C. BASIS FOR FY 1979 RDTE REQUEST: Funds will permit continuation of the accelerated competitive development program to provide a radar directed, medium caliber (35 or 40mm) self-propelled gun that will significantly improve the divisional short range, low altitude air defense capability in the 1980's. Two contractors will continue pre-production prototype development in preparation for delivery to the Army, two systems each for competitive testing and selection of one contractor for initial production. The requested level of funding is required to enable contractors to complete the accelerated competitive development effort in 29 months. Major milestones are:

Major Milestones:	Date
Initiate Development	Jan 1978
Complete Prototype Evaluation	Jul 1980
Complete Engineering Development	Apr 1981
Activate First Gun Battalion	

Program Element: #6.33.01.A Title: Division Air Defense Gun

DoD Mission Area: #414 - Field Army Air Defense Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

Weapons and Tracked Combat Vehicles Procurement, Army	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Funds	0	0	0	0	2436000	2436000
Quantities (Fire Units)	0	0	0	0	618	618

Note: Due to a $7.1M FY 78 RDTE funding reduction, the DIVAD Gun development program has been extended from 24 to 29 months. After the Secretary of Defense approves the DIVAD program, a revised procurement funding profile will be required.

E. DETAILED BACKGROUND AND DESCRIPTION: The new Air Defense Gun development program (Project #D648) is the culmination of several years of effort by the Army to define its short range air defense requirements which established the need for a new air defense gun. This requirement was established March 1977 with the approval of a Required Operational Capability (ROC) document for a new air defense gun in the medium caliber (30-40mm) range which could adequately meet the threat of the 1980s. This gun will give divisional maneuver forces a quick reacting weapon system that can effectively engage pop up targets such as helicopters armed with antitank guided missiles and high speed low flying aircraft at distances of up to The system will be mounted on a tank chassis to provide compatible mobility with maneuver forces and will have a full solution fire control system with an optical backup to provide an all environment (i.e., electronic countermeasures and adverse weather) capability. The system will have a rapid changeover capability to provide ground support fires if required and if the air situation permits.

F. WORK PERFORMED BY: The program is managed by the Project Manager for Army Gun Air Defense Systems, Armament Research and Development Command, Dover, NJ. General Dynamics, Pomona Division, and Ford Aerospace & Communications Corporation, Aeronutronic Division, have been selected for competitive development. Contracts will be awarded when the program is approved by the Secretary of Defense.

G. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The Gun Low Altitude Air Defense System (GLAADS) test bed was delivered to the Army in September 1975. The purpose of the test bed was to demonstrate through use of off-the-shelf hardware, the extent to which current technology could be used in the design of a modern Gun Air Defense System. Testing was concluded in December 1975. The major conclusion of the test was that a second order digital fire control could be integrated with an air defense gun to provide a

capability to effectively engage maneuvering targets. In April 1977 the Secretary of Defense approved development of the Division Air Defense (DIVAD) Gun subject to completion of a Cost and Operational Effectiveness Analysis (COEA) and a Defense Systems Acquisition Review Council (DSARC) review of proposal costs prior to contract award. The COEA was completed in September 1977. The Request for Proposal (RFP) was released in April 1977 with five contractors responding.

2. FY 1978 Program: Gun prototype hardware fabrication will commence with two contractors building two systems each. The increase in funding over 1977 is required to purchase hardware immediately for fabrication of prototypes. The development phase requires the delivery of first items to the Government in 29 months after contract award. Contractors will have to rapidly establish their management staffs and increase their work forces significantly to support the scope of this effort.

3. FY 1979 Planned Program: Prototype fabrication will continue. The large funding increase over 1978 results from continuing prototype fabrication effort under the accelerated development program and from the preparation for developmental and operational testing. The RFP for the initial production contract should be released in late 1979.

4. FY 1980 Planned Program: Prototype delivery is scheduled for April 1980 with Development Test/Operational Test (DT/OT) scheduled from May through July 1980. The final producibility, engineering, and planning (PEP) effort and the maturation phase to correct problems identified during the DT/OT will start in August 1980.

5. Program to Completion: The initial production contract for the first 200 systems will be awarded in the first quarter of FY 1981. The PEP and maturity phase, including check test will be completed in March 1981. Ammunition production facility expansion will begin in the first quarter of FY 1981. Delivery of first production systems will begin in June 1982. Follow-on production contracts for 418 systems will be awarded during the third quarter of FY 1982. The first gun battalion will be fielded in Program completion is estimated for FY 1987.

Program Element: #6.33.01.A
DoD Mission Area: #414 - Field Army Air Defense

Title: Division Air Defense (DIVAD) Gun
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data: The DIVAD Gun program features an accelerated "hands off" acquisition approach designed to achieve an Initial Operational Capability (IOC) in the minimum possible time at an affordable cost. In keeping with this approach, a combined development test/operational test (DT/OT) of three months duration will be conducted jointly by the US Army Operational Test and Evaluation Agency (OTEA), the US Army Materiel Systems Analysis Agency (AMSAA), and the US Army Test and Evaluation Command (TECOM), to provide the data necessary to permit selection of one of two competing systems for production. Contractor test data collected during the thirty days preceeding the combined DT/OT will be provided for evaluation and comparison with DT/OT data. A check test following the Maturation Phase will test logistic and training equipment developed by the contractor during this phase and will test corrections incorporated into the system as a result of DT/OT.

1. Development Test and Evaluation: Two development contractors will be selected by the Source Selection Evaluation Board early in FY 1978. At the end of the 29-month development program, each contractor will deliver two "prototypes for production" for the combined DT/OT. The combined DT/OT will be conducted in three phases: combined DT/OT nonfire tracking phase; combined DT/OT live fire phase; and an OT nonfire maneuver phase. Testing will be conducted in various conditions of visibility, electronic countermeasures (ECM), target type (including ground targets), target maneuver, and range. Throughout the exercise, user personnel will operate the equipment under varied operational conditions. A provisional DIVAD platoon composed of two sections, each having two fire units (one fire unit of each competing system), will be evaluated. To the maximum extent possible, evaluation will be concurrent with the testing effort, with final evaluation following completion of testing. The prototypes tested will be as mature as possible, ready for production following a short maturation phase after the winning system is selected. Detailed test plans will be developed after contract award scheduled in early FY 1978. DT/OT is scheduled to begin in May 1980. The critical issues to be addressed during the combined DT/OT are:

a. Mission Performance:

(1) How effectively does the DIVAD Gun, when operated by typical user personnel, detect, track, identify, engage, and damage or destroy hostile aircraft and ground targets?

(2) How is system operational effectiveness affected by varying conditions of weather, terrain, day/night visibility, degraded battlefield visibility, and electronic warfare?

(3) How well and how safely can the crew perform the operational functions necessary for effective employment of the DIVAD Gun system?

b. Vulnerability/Survivability: How well can the DIVAD Gun system survive the spectrum of battlefield threats?

c. Supportability:

(1) What are the system and major subsystem reliability, availability, and maintainability and what is the impact on operational performance?

(2) Is the planned logistical support concept adequate to support the DIVAD Gun system?

(3) What is the extent of NATO commonality and/or US Armed Forces commonality of components and ammunition?

d. Deployability: Is the DIVAD Gun system tactical mobility and strategic deployability commensurate with the expected operational requirements?

e. Personnel, Training, Organization, and Doctrine:

(1) Are the proposed personnel selection criteria adequate to provide personnel capable of operating and maintaining the DIVAD Gun system?

(2) Is the proposed training package adequate to provide qualified operators and maintenance personnel for the DIVAD Gun system?

2. Operational Test and Evaluation: The combined development test/operational test (DT/OT) will be conducted at the Ft. Bliss, TX/White Sands Missile Range, NM, area. Typical user personnel will operate the equipment while contractors will provide the majority of maintenance during the test. The comments and critical issues addressed in paragraph 1 above apply for the combined DT/OT. Additionally, the OT nonfire maneuver phase will allow maximum free play in an operational setting and will address the following additional critical issues:

a. Are proposed DIVAD organizations adequate to support 24-hour operations under all expected conditions of weather, terrain, countermeasures, and supported unit tactical operations?

b. Are proposed doctrine, tactics, and techniques appropriate for employment of the DIVAD Gun? How well do DIVAD Gun units interface with each other, with defended elements, and with other SHORAD/MANPADS elements?

Program Element: #6.33.01.A
DoD Mission Area: #414 - Field Army Air Defense

Title: Division Air Defense (DIVAD) Gun
Budget Activity: #4 - Tactical Programs

3. System Characteristics:

SELECTED CHARACTERISTICS	OBJECTIVES
Acquisition Radar	- Capable of detecting fixed wing aircraft at and helicopters at
Track Radar	- Capable of tracking aircraft to at least
Optical System	- Back-up to radars (equivalent accuracy).
Cannon	- 30, 35, or 40mm.
Identification of Friend or Foe (IFF)	- MARK XII, Mode 4 compatible.
Chassis	- M48A5 in inventory.
Dual Power Source	- Back-up to prime power unit.
Reaction Time	- Not greater than from target unmask.
Ammunition	- High Explosive (HE) air defense round with self-destruct capability; training/practice round.
Communications	- Standard radios.
Crew Size	- Minimum of 3 men.
Environment	- No hazardous environmental stresses.
Transportability	- C-5A transportable.
Range	-
Probability of Hit	- Nonmaneuvering target: Maneuvering target: Not degraded more than from above criteria against maneuver.
Probability of Kill (Given Hit)	- K-kill; A-kill;
Fire Control	- Digital computer.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.33.03.A
DoD Mission Area: #413 - Fire Support

Title: SSM Rocket Systems
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	6869	46445	70800	74200	118300	317994
D216	Terminal Guidance Technology	0	0	8000	12900	58700	79600
D564	Area Fire Support Rocket - GSRS	6869	46445	62800	61300	59600	238394

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The General Support Rocket System (GSRS) is a multiple rocket launcher system designed to supplement conventional cannon artillery. The mission of the weapon system is neutralization and/or suppression of massive enemy indirect fire support and air defense capabilities, particularly during surge periods when the rate of targets acquired exceeds available cannon weapons fire support. Direct support artillery fire power for the maneuver units will be degraded if it has to assist the general support artillery in the counterbattery and air defense suppression roles. Development of the terminal guidance capability will permit the attack of the point targets.

C. BASIS FOR FY 1979 RDTE REQUEST: In September 1977, the Army signed two development contracts for competitive prototypes of the GSRS. In FY 1979 the initial development phase will be nearly complete including contractor component and system testing. Government Development and Operational Testing (DT/OT) will begin toward the end of the fiscal year. The Terminal Guidance Technology project provides for air frame and infrared dual color seeker development.

Major Milestones	Date
Start Development Test I (DT I)	Aug 79
Start Operational Test I (OT I)	Sep 79

prototypes for competition in FY 1979. The results of technological efforts in terminal guidance within other program elements over the past six or seven years support the development of the terminal homing option. Prototype tests using infrared seekers were completed in September 1977.

F. RELATED ACTIVITIES: There is no development program within the other services relative to the General Support Rocket System (GSRS). There has been significant interest in GSRS expressed by NATO allies, particularly Germany and the United Kingdom. Strong efforts are being made to establish standardization of the system within the NATO alliance. The US and Germany are currently negotiating a Declaration of Intent to establish a cooperative development program which has the potential to result in a single system capable of meeting the operational requirements of both countries.

G. WORK PERFORMED BY: In FY 1976, five contracts for concept definition studies were performed by: Boeing Company, Seattle, WA; Emerson Electric, St. Louis, MO; Martin-Marietta Corporation, Orlando, FL; Northrup Corporation, Anaheim, CA; and Vought Corporation, Warren, MI. On 16 September 1977, the Army signed competitive development contracts with Vought Corporation and Boeing Company to build three prototype systems each for delivery in FY 1979. The Army also has contracts with the Harry Diamond Laboratory, Adelphi, MD to develop the warhead fuze and with FMC Corporation, San Jose, CA to develop the launcher vehicle.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Completed Concept Formulation Studies in November 1976. Initiated design and interface efforts for warhead fuze. Completed full-scale mock-up of launcher vehicle. Initiated prime contracts for system.

2. FY 1978 Program: Initial Engineering Development Flight Tests. Continuation of the 29-month Validation Phase of development.

3. FY 1979 Planned Program: Completion of contractor Engineering Development and Advanced Development Tests. Delivery of three complete prototype systems with rockets and pods from each contractor. Delivery of one additional launch vehicle for mobility testing. Initiation of government Development and Operational Tests. Initiation of development effort for dual color infrared (IR) seeker and for the airframe of the terminal guidance project. Funding increase in FY 1979 over FY 1978 is due to the increased amount of deliverable items, the amount of testing to be accomplished, and the initiation of the terminal guidance project.

Program Element: #6.33.03.A
DoD Mission Area: #413 - Fire Support

Title: SSM Rocket Systems
Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Missile Procurement, Army	0	0	0			
Quantities (Rockets)	0	0	0			
Initial Spares	0	0	0			

E. DETAILED BACKGROUND AND DESCRIPTION: The General Support Rocket System (GSRS) is the result of a continuing effort begun in FY 1971. The Institute for Land Combat and the Army Materiel Concept Agency, in a study of the 1980-1990 Battlefield, recommended that a study be conducted for a Rapid Fire Area Saturation System. The study was completed in early CY 1974 and described two short range unguided multiple rocket launcher systems. In late FY 1974, a preliminary cost effectiveness comparison of General Support Rocket System candidates was conducted by a US Army Training and Doctrine Command (TRADOC) Joint Working Group supported by US Army Materiel Development and Readiness Command (DARCOM) resources. The result of this effort strongly favored a short range, simple to operate, economical multiple launched unguided rocket system. Concurrently, preparation of an Army requirements document was initiated. In the second quarter of FY 1975 the Assistant Secretary of the Army (Research and Development) directed that the Army conduct a complete study of the artillery system. The study report, issued in December 1974, included a thorough analysis of the General Support Rocket System (GSRS) and concluded that a relatively small, short range free rocket could perform the counterbattery, air defense suppression mission in a cost effective manner. Based on the results of these studies, an agreement was concluded between the Training and Doctrine and Army Materiel Commands in April 1975 which provides for the conduct of activities necessary to complete concept formulation and technology demonstration phases of the General Support Rocket System (GSRS). The agreement, approved by Department of the Army in September 1975, stated the initial goal as refinement of system characteristics, conduct of tests necessary to reduce risk, and establishment of confidence levels sufficient for commitment to a full scale development based on optimized system parameters, proof of technical feasibility, and investigation of eventual operational doctrine and procedures. The agreement recommended that a Special Study Group (SSG) determine system characteristics. At the direction of Department of Army a Special Study Group was formed in November 1975 and developed a complete concept formulation package. The SSG results were presented to the Defense Systems Acquisition Review Council (DSARC) in January 1977. In February 1977, the Secretary of Defense authorized the Army to proceed with development of the system and directed the Army to study ways to accelerate the production phase so that an earlier Initial Operational Capability (IOC) could be achieved. The Army was also directed to continue discussions with NATO with the goal of gaining their participation in the GSRS program, to prepare a plan for terminal homing options, to reevaluate the vehicle selected, and to conduct a study to investigate the potential of GSRS to deliver scatterable mines. In April 1977, a special Army Systems Acquisition Review Council (ASARC) approved an accelerated development program with an IOC in Contracts for the initial 29-month Validation Phase of development were signed 16 September 1977 with Vought Corporation and Boeing Company. The two companies will deliver

Program Element: #6.33.03.A
DoD Mission Area: #413 - Fire Support

Title: SSM Rocket Systems
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: Completion of the Validation Phase of development. Begin Maturation Phase of development concurrently with initial production if the Validation Phase has proven the system ready. During the Maturation Phase, minor design changes as indicated during validation will be accomplished and the production qualification tests will be completed. Continue development of terminal homing option.

5. Program to Completion: Complete Maturation Phase in FY 1982. Achieve Initial Operational Capability with one battalion in Complete development of terminally guided munition warhead in FY 1984.

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Program Element: #6.33.03.A
DoD Mission Area: #413 - Fire Support

Title: General Support Rocket System (GSRS) Terminal Homing
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation: Contracts for the General Support Rocket System (GSRS) were signed with Boeing Company, Seattle, WA, and Vought Corporation, Dallas, TX, on 16 Sep 77 for the Competitive Development Phase of the GSRS program. Development test and evaluation by the contractors will begin in FY 1978 and by the government in FY 1979. Objectives of Development Test I (DT I) are as follows:

a. Engineering Design Tests - provide reliability and safety margin data; determine natural and induced environmental effects; establish performance levels; select and qualify components; conduct selected severe qualification and hazard classification tests; conduct launch hazard analysis; and identify technical risks and achievable solutions.

b. Advanced Development Verification Tests - obtain human factors and ground support equipment performance data in a simulated arctic and desert environment; identify system emissions, effluents, and wastes; perform system demonstration flights; and evaluate the potential of the prototype design for Operational Test I (OT I) testing and for entry into the Maturation/Initial Production Phase.

The Production Qualification Test (PQT) in the Maturation Phase will assure that engineering is complete and that all significant design problems are in hand. Testing will provide for the development of the firing tables, for a safety confirmation, and to verify correction of problem areas previously identified which necessitated engineering changes during the Maturation Phase.

2. Operational Test and Evaluation: General Support Rocket System (GSRS) OT I, scheduled to begin in 4th quarter, FY 1979, will be conducted in three phases covering a six week period. Two candidate GSRS systems will be tested. Phases I and II will be devoted to training, pilot testing and nonfiring exercises at Ft Sill, OK. Phase III will be a combined DT/OT I at White Sand Missile Range (WSMR), NM during which 12 rockets will be fired from each of the candidate systems by typical user troops. The objectives of OT I are to: obtain data to assess operational effectiveness; provide information on reliability, availability, and maintainability (RAM); provide information on operational survivability of the GSRS as a result of signature, mobility, emplacement, and displacement; and provide information on human factors, safety, training, doctrine, organization, tactics, and the adequacy of the proposed logistical concepts to support GSRS to the extent that existing hardware and support package will permit.

Program Element: #6.33.03.A
DoD Mission Area: #413 - Fire Support

Title: General Support Rocket System (GSRS) Terminal Homing
Budget Activity: #4 - Tactical Programs

3. System Characteristics:

Operational/Technical Characteristics		Objective	Demonstrated Performance
Range			Footnote 1/
Reaction Time:	Fire 1st round		Footnote 1/
	Fire Launcher Load		
	Displace		
	Reload		
Accuracy			Footnote 2/
Reliability:	Rocket		Footnote 2/
	Launcher, Mean Cycle Between Failures		
	Launcher, Mean Kilometers Between Failures		
Achieved Availability			Footnote 2/
Maintainability, Launcher (Mean-Time-To-Repair)			
Organizational Level			Footnote 2/
Direct Support/General Support Levels			

1/ To be demonstrated during Development Test (DT) I/Operational Test (OT) I.
2/ Initial data to be gathered during DT I/OT I; demonstration of performance will continue through maturation and system fielding.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D216 Title: Terminal Guidance Technology
Program Element: #6.33.03.A Title: SSM Rocket Systems
DoD Mission Area: #413 - Fire Support Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: By 1986, Warsaw Pact Forces are expected to improve the operational capability in Europe by adding a significant number of self-propelled field artillery weapons to their extensive number of self-propelled air defense systems, tanks, and armored personnel carriers. The highly mobile armored maneuver force, supported in depth by self-propelled field artillery and air defense systems, varying in weapons ratios of 3:1 to 7:1 relative to friendly forces, represent a concentration of forces which will require a stand-off terminal homing attrition capability to effectively combat this thrust. This capability will reduce ammunition costs and ease the logistical burden of friendly forces. The initial development effort toward a terminal homing option for the General Support Rocket System (GSRS) will begin in FY 1979. Prototype development in other programs supports the start of this effort. The conceptual system has been through exploratory development and has been vigorously tested over the past six or seven years. Testing of dual color infrared seekers (IR) from three contractors was completed in September 1977.

B. RELATED ACTIVITIES: The terminally guided submissile (TGSM) to be developed in the project has possible application to the Army Assault Breaker System, Program Element Number 6.33.20.A and to the Air Force Wide Area Antiarmor Munition (WAAM). The Office of the Under Secretary of Defense for Research and Engineering is monitoring these programs to insure integration and avoid duplication of effort.

C. WORK PERFORMED BY: In-House: US Army Missile Research and Development Command; GSRS Project Manager will direct.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Not Applicable.

2. FY 1978 Program: Not Applicable.

3. FY 1979 Planned Program: Initiation of development of a terminal homing option for GSRS to provide the capability to combat hard point targets in the enemy armored maneuver force. Concept Definition contracts will be funded to study the TSGM technical requirements, TGSM components and subsystems, and make recommendations concerning the specific design of the TGSM. An Advanced Development contract will then be let for the development and integration of the TGSM prototype components and subsystems. Advanced TGSM technology work will continue in parallel.

Project: #D216 — Title: Terminal Guidance Technology
Program Element: #6.33.03.A — Title: SSM Rocket Systems
DoD Mission Area: #413 - Fire Support — Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: Complete system design; conduct system integration and test simulation; and conduct helicopter drop tests, wind tunnel tests, sled tests and payload dispersal system tests.

5. Program to Completion: Integrate the terminally guided munition warhead with the General Support Rocket System and conduct system flight tests in FY 1981. Complete development in FY 1984. Achieve Initial Operational Capability in

6. Major Milestones:

	Date
In-Process Review	FY 1981
Development Test/Operational Test	FY 1983
Initial Operational Capability	

7. Resources ($ in thousands):

	FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Costs
RDTE,A	0	0	8000	12900	58700	79600

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D564 Title: Area Fire Support Rocket - GSRS
Program Element: #6.33.03.A Title: SSM Rocket Systems
DoD Mission Area: #413 - Fire Support Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: The General Support Rocket System (GSRS) is the result of a continuing effort begun in FY 1971. The Institute of Land Combat and the Army Material Concept Agency, in a study of the 1980-1990 Battlefield, recommended that a study be conducted for a Rapid Fire Area Saturation System. The study was completed in early CY 1974 and described two short range unguided multiple rocket launcher systems. In late FY 1974, a preliminary cost effectiveness comparison of General Support Rocket System (GSRS) candidates was conducted by a US Army Training and Doctrine Command (TRADOC), Joint Working Group supported by US Army Materiel Development and Readiness Command (DARCOM) resources. The result of this effort strongly favored a short range, simple to operate, economical multiple launched unguided rocket system. Concurrently, preparation of an Army requirements document was initiated. In the second quarter of FY 1975 the Assistant Secretary of the Army (Research and Development) directed that the Army conduct a complete study of the artillery system. The study report, issued in December 1974, included a thorough analysis of the General Support Rocket System (GSRS) and concluded that a relatively small, short range free rocket could perform the counterbattery, air defense suppression mission in a cost effective manner. Based on the results of these studies, an agreement was concluded between TRADOC and DARCOM in April 1975 which provides for the conduct of activities necessary to complete concept formulation and technology demonstration phases of the General Support Rocket System (GSRS). The agreement, approved by Department of the Army in September 1975, stated the initial goal as refinement of system characteristics, conduct of tests necessary to reduce risk, and establishment of confidence levels sufficient for commitment to a full scale development based on optimized system parameters, proof of technical feasibility, and investigation of eventual operational doctrine and procedures. The agreement recommended that a Special Study Group (SSG) determine system characteristics. At the direction of Department of Army a Special Study Group (SSG) was formed in November 1975 and developed a complete formulation package. The SSG results were presented to the Defense Systems Acquisition Review Council (DSARC) in January 1977. In February 1977, the Secretary of Defense authorized the Army to proceed with development of the system and directed the Army to study ways to accelerate the production phase so that an earlier Initial Operational Capability (IOC) could be achieved. The Army was also directed to continue discussions with NATO with the goal of gaining their participation in the GSRS program, to prepare a plan for terminal homing options, to reevaluate the vehicle selected, and to conduct a study to investigate the potential of GSRS to deliver scatterable mines. In April 1977, a special Army Systems Acquisition Review Council (ASARC) approved an accelerated development program with an IOC in
Contracts for the initial 29-month Validation Phase of development were signed 16 September 1977 with Vought Corporation and Boeing Company. The two companies will deliver prototypes for competition in FY 1979.

Project: #D564 Title: Area Fire Support Rocket - GSRS
Program Element: #6.33.03.A Title: SSM Rocket Systems
DoD Mission Area: #413 - Fire Support Budget Activity: #4 - Tactical Programs

B. RELATED ACTIVITIES: There is no development program within the other services relative to the General Support Rocket System (GSRS). There has been significant interest in GSRS expressed by NATO allies particularly Germany and the United Kingdom. Strong efforts are being made to establish standardization of the system within the NATO alliance. The US and Germany are currently negotiating a Declaration of Intent to establish a cooperative development program which has the potential to result in a single system capable of meeting the operational requirements of both countries.

C. WORK PERFORMED BY: In FY 1976, five contracts for concept definition studies were performed by: Boeing Company, Seattle, WA; Emerson Electric, St. Louis, MO; Martin-Marietta Corporation, Orlando, FL; Northrup Corporation, Anaheim, CA; and Vought Corporation, Warren, MI. On 16 September 1977, the Army signed competitive development contracts with Vought Corporation and Boeing Company to build three prototype systems each for delivery in FY 1979. The Army also has contracts with the Harry Diamond Laboratory, Adelphi, MD to develop the warhead fuze and with FMC Corporation, San Jose, CA to develop the launcher vehicle.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Completed Concept Formulation Studies in November 1976. Initiated design and interface efforts for warhead fuze. Completed full-scale mock-up of launcher vehicle. Initiated prime contracts for system.

2. FY 1978 Program: Engineering Development Flight Tests will be initiated. The 29-month Validation Phase of development will be continued.

3. FY 1979 Planned Program: Contractor Engineering Development and Advanced Development Tests will be completed. Three complete prototype systems with rockets and pods from each contractor will be delivered. One additional launch vehicle for mobility testing will also be delivered. Government Development and Operational Tests will be initiated. Funding increase in FY 1979 over FY 1978 is due to the increased amount of deliverable items and the amount of testing to be accomplished.

4. FY 1980 Planned Program: Completion of the Validation Phase of development. Begin Maturation Phase of development concurrently with initial production if the Validation Phase has proven the system ready. During the Maturation Phase, minor design changes as indicated during Validation will be accomplished and the Production Qualification Tests will be conducted.

5. Program to Completion: Complete Maturation Phase in FY 1982. Achieve Initial Operational Capability (IOC) with one battalion in

Project: #D564 Title: Area Fire Support Rocket - GSRS
Program Element: #6.33.03.A Title: SSM Rocket Systems
DoD Mission Area: #413 - Fire Support Budget Activity: #4 - Tactical Programs

6. Major Milestones:

	Date
Army Systems Acquisition Review Council (ASARC) I	Dec 76
Defense Systems Acquisition Review Council (DSARC) I	Jan 77
Special ASARC	Apr 77
Development Contracts (2)	Sep 77
Start Development Tests (DT I)	Aug 79
Start Operational Tests (OT I)	Sep 79
Complete Development Tests/Operational Tests (DT/OT) I	Oct 79
ASARC III	Dec 79
DSARC III	Jan 80
Maturation/Production Contract Award (1)	Feb 80
ASARC IIIa	Jul 82
DSARC IIIa	Aug 82
Initial Operational Capability (IOC)	

7. Resources ($ in thousands):

	FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Costs
RDTE,A	6869	46445	62800	61300	59600	238394
Quantities						654 Rockets 16 Launchers
Missile Procurement, Army						
Funds	0	0	0	48500	2589100	2637600
Quantities:						
Rockets	0	0	0	1764		
Initial Spares	0	0	0	1400		

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.33.07.A
DoD Mission Area: #413 - Fire Support

Title: Air Defense Suppression Missile
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	499	0	5000	10826	103000	121629
	Quantities						
	Radar Frequency Target Acquisition Device						12
	Seekers						210
D860	Air Defense Suppression Missile	0	0	5000	10826	103000	118826
D680	US/FRG Bilateral Study	499	0	0	0	0	2803

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Defense Suppression Missile system will provide the Advanced Attack Helicopter (YAH-64) the capability to detect, localize, and defeat or suppress hostile radar controlled air defense weapons at or near the forward edge of the battle area. This capability will reduce the threat, and thereby increase the survivability of the YAH-64 and all other friendly aircraft operating over the battlefield. This capability is being developed to meet the air defense threat of the time frame. This threat includes The Air Defense Suppression Missile system elements to be developed under this program are a Radar Frequency (RF) target acquisition device and an air defense suppression seeker for the HELLFIRE modular missile.

C. BASIS FOR FY 1979 RDTE REQUEST: Requested funds provide for awarding contracts, after competitive procurement and proposal evaluation, to initiate advanced development (AD) of the RF target acquisition system and for a missile seeker based on the results of current studies to determine the type seeker most suitable for the air defense suppression mission.

Major Milestones	Date
Army/Defense Systems Acquisition Review Council (ASARC/DSARC) I	Feb 79
AD Contract Award	Mar 79
Operational Test (OT) I	Nov 81
ASARC/DSARC II	Feb 82

Program Element: #6.33.07.A
DoD Mission Area: #413 - Fire Support

Title: Air Defense Suppression Missile
Budget Activity: #4 - Tactical Programs

Major Milestones (cont)	Date
Engineering Development (ED) Contract Award	Mar 82
Operational Test (OT) II	Aug 84
Army/Defense Systems Acquisition Review Council (ASARC/DSARC) III	Oct 84
Production Contract Award	Nov 84
Initial Operational Capability	

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

Missile Procurement, Army	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Funds	0	0	0	0	To be determined	To be determined
Quantities	0	0	0	0	To be determined	To be determined

E. DETAILED BACKGROUND AND DESCRIPTION: The Air Defense Suppression Missile system will consist of a missile, Radar Frequency (RF) target acquisition device on-board the helicopter, and a missile fire control system. The missile will be capable of homing to the target(s) on target emissions and will contain a warhead capable of defeating air defense systems using

The RF target acquisition device will detect operating air defense radars, identify them by their signal characteristics, indicate azimuth direction to the radar antenna, and classify targets according to the threat imposed. The RF acquisition device will be used to select targets, align the helicopter, point the missile seeker toward the target, and/or cue elements of the Advanced Attack Helicopter's (YAH-64) Target Acquisition Designation System (TADS) to the target. The fire control system will permit the gunner to select a target, lock a missile seeker on the target, and fire the missile. All elements required for the Air Defense Suppression Missile system are currently being developed as part of the HELLFIRE engineering development (ED) program and the YAH-64 ED program except for the missile seeker and the RF acquisition device. These elements will be developed under this program.

F. RELATED ACTIVITIES: Air Defense Suppression is related to Air Force, Navy and other systems which utilize similar technology. Coordination is effected through technology coordination groups, liaison visits, and exchange of analyses and simulation results. The exploratory prototype programs were conducted under Program Element (PE) 6.23.03.A, Missile Technology. An Infrared fire-and-forget seeker is programed for FY 1980 start under PE 6.33.16.A, Heliborne Missile Guidance Technology. This seeker is also a candidate for the air defense suppression mission. If this seeker technology is selected it could lead to a joint Service development. The HELLFIRE modular missile is being developed under PE 6.43.10.A, and the Advanced Attack Helicopter (YAH-64) under PE 6.42.07.A.

G. WORK PERFORMED BY: HELLFIRE Program Office, US Army Missile Research and Development Command (MIRADCOM), Redstone Arsenal, AL.

Program Element: #6.33.07.A
DoD Mission Area: #413 - Fire Support

Title: Air Defense Suppression Missile
Budget Activity: #4 - Tactical Programs

R. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: A contract was awarded in FY 1972 to General Dynamics for infrared (IR) signature measurements for type targets. The Army contracted for two radar signal sources which were delivered and used for target signature collection for radar frequency (RF) seekers. One of these radars was used as a target during the prototype demonstration. The FY 1972 efforts also included contracting for an RF seeker (US Navy) and an infrared (IR) seeker (Martin-Marietta). On 26 October 1972, the Army signed contracts with North American Rockwell and Martin-Marietta for competitive prototypes. The prototype effort was to provide a feasibility demonstration of a dual mode, helicopter launched, missile for air-to-ground attack of the radar-controlled air defense gun. The missile sensor was a dual mode, RF/IR seeker. The sensor was designed to home on the radar emissions of the target and then transfer its guidance, while in flight, to the IR seeker. The seeker was fabricated and tested on existing missiles (North American Rockwell used the HORNET missile, Martin-Marietta used an in-house 6-inch diameter missile). The contracts provided for a 10-round flight test program by each contractor, of which seven rounds were to be helicopter-launched. The prototype flight tests by the two contractors was completed by 31 December 1973 and of the 10 firings were successful. In December 1974, the program was terminated and no further efforts were initiated in FY 1975, FY 1976 or FY 197T. An exploratory development (ED) program was initiated in FY 1977, directed towards resolving the type of missile seeker most suitable for the air defense suppression mission. Seekers under consideration (all passive) are RF only IR only and dual mode RF/IR. The objective of the effort is to determine the relative effectiveness of a HELLFIRE missile in an air defense suppression role for each of the candidate seekers. The results of the effort are expected to be available during the 2nd quarter FY 78. Project SUCCESSOR, a joint US/FRG study of PATRIOT, was successfully concluded in December 1977. The study strongly indorsed PATRIOT as a replacement for NIKE HERCULES in central Europe.

2. FY 1978 Program: Not applicable.

3. FY 1979 Planned Program: In the 2nd quarter FY 1979, after competitive procurement and proposal evaluation, contracts will be awarded to initiate advanced development (AD) of the RF target acquisition system and if the results of seeker studies due in FY 1978 have clearly resolved the type seeker most suitable for the air defense suppression mission, the missile seeker development will also be initiated. If the type seeker has not been determined, a separate Government/independent contractor effort (approx 6 months) will be initiated to determine the type of missile seeker to be developed. Other FY 1979 activities (by the Government) will consist of initiation of simulation design and design of RF-emitting targets to perform an evaluation of the RF acquisition system and the seeker.

4. FY 1980 Planned Program: In FY 1980, AD of the RF acquisition system will be continued and development of the missile seeker will be initiated. Initial hardware deliveries of the RF acquisition system will be made in the 4th quarter FY 1980. Simulation design and target design and fabrication will be continued and completed. A system integration effort will be initiated

with the HELLFIRE Modular Missile System prime contractor consisting of system, interface, and simulation analyses. Procurement will be initiated for training missiles, launchers, and related hardware required for engineering development and operational tests.

5. Program to Completion: Government tests of the radar frequency (RF) acquisition system will begin during 1st quarter FY 1981 including captive flight tests. Tests of the seeker will be merged with tests of the RF acquisition systems and a six-month technical test and evaluation program will be conducted. Operational Test (OT) I will begin during 4th quarter FY 1981. A Cost and Operational Effectiveness Analysis (COEA) will be completed during 1st quarter FY 1982. Engineering development (ED) will be initiated in FY 1982 and consist of initiation of the seeker RF acquisition system design effort, procurement of missiles and launchers from the HELLFIRE prime contractor, initiation of system integration activities, and development of test plans. Seekers and RF acquisition systems will be delivered by the seeker and RF acquisition system contractors to the HELLFIRE prime contractor for system integration and tests in FY 1984. The HELLFIRE prime contractor will also complete fabrication of missiles and launchers required for system integration tests to be conducted in FY 1984. ED will be completed in FY 1984.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.33.17.A
DoD Mission Area: #414 - Field Army Air Defense

Title: GRASS BLADE
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	9015	13459	27200	18279	7000	80953
D112	GRASS BLADE	9015	13459	27200	18279	7000	80953

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Program content is SECRET "Limited Distribution - Special Access Required", precluding further description in this summary. Access to GRASS BLADE information is controlled by the Deputy Chief of Staff for Research, Development, and Acquisition.

C. BASIS FOR FY 1979 RDTE REQUEST: Continue RDTE effort.

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: Not Applicable.

F. RELATED ACTIVITIES: This project is related to work in other Army technology programs.

G. WORK PERFORMED BY: Both in-house and with contracts.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Details may be provided upon request.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.33.18.A
DoD Mission Area: #414 - Field Army Air Defense

Title: Army/Navy Area Surface to Air Missile (SAM) Technology
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1300	3292	5300	6000	Continuing	Not Applicable
DF33	Army/Navy Area SAM Technology	1300	3292	5300	6000	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports Joint Army/Navy technology development of common subsystems for use in area defense surface-to-air (SAM) missile systems. Development will be pursued through prototype hardware level of testing to provide a common base for Army and Navy area SAM advancements. Timely introduction and demonstration of new technology is required in order to meet an air defense threat that is increasing in technical quality and quantity.

C. BASIS FOR FY 1979 RDTE REQUEST: Requested funds provide for continuation of the 3-year program initiated in FY 1977 to develop and demonstrate lightweight, low cost prototype phased array antennas using PIN diode phase shifter technology for AEGIS (S-Band) and PATRIOT (C-Band) radars. Two new programs will be initiated for Army and Navy air defense systems. The first is a program for development of a modular multimode guidance unit for existing and second generation Army and Navy area air defense missiles. The second is a program for improvement of missile warheads and fuzes to attain a higher probability of kill with a single missile against highly maneuverable targets. This unique technology effort will place emphasis on methods of concentrating more fragments of higher velocity in the direction of the target and examine the fuze and missile seeker interface to provide additional targeting information to the warhead. State-of-technology in several key areas relative to generic deficiencies in current area SAM systemswill be investigated. Areas to be investigated include: adaptive signal processors, noncooperative IFF, and low probability of intercept radar.

D. OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #6.33.18.A
DoD Mission Area: #414 - Field Army Air Defense

Title: Army/Navy Area Surface to Air Missile (SAM) Technology
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: This program is structured as a logical step in promoting realistic and achievable commonality between Army and Navy systems. This program provides a logical path into advanced joint development for those technologies which correct common or similar deficiencies in area defense surface-to-air missiles. It is aimed at promoting translation of technology into common subsystems and basic components. Heavy emphasis is to be placed in this program on prototype hardware demonstration and critical experiments to provide an early assessment of technical risk.

F. RELATED ACTIVITIES: Missiles/Rocket Components, Program Element 6.33.13.A. Missile Technology, Program Element 6.23.03.A. The NAVY component of the joint effort is Program Element 6.33.18.N.

G. WORK PERFORMED BY: The Applied Physics Laboratory/Johns Hopkins University, Laurel, MD, the Naval Surface Weapons Center, White Oak Laboratory, Silver Spring, MD, and the US Army Missile Research and Development Command, Huntsville, AL, will provide Government support for the program. The Hughes Aircraft Corporation, Fullerton, CA, will perform the lightweight, low cost antenna array program.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: This program was a new start in FY 1977. In FY 1976 and FY 197T, the Program Memorandum establishing the program was drafted and staffed through the Army and Navy chains of commands to the Under Secretary for Defense Research and Engineering, and approved in Jan 1977. Army and Navy personnel initiated a program, through competitive procurement, to design, fabricate and test a low cost, lightweight phased array antennas for AEGIS (S-Band) and for PATRIOT (C-Band) radars using PIN diode phase shifter technology. The contract for this effort was awarded to the Hughes Aircraft Corporation in Sep 1977. The ASAR (Advanced Surface to Air Ramjet) program was initiated in early FY77, to test flightweight engines and study their applicability to future area defense programs. The second phase of this program will be a Navy only program with inputs into their long range, dual mission missile program. System investigations of candidate multimode guidance units were initiated in preparation for a FY 1978 new start for development of multimode guidance capability for existing and second generation Army and Navy area defense missiles.

2. FY 1978 Program: Continue the 3-year program to develop and demonstrate lightweight, low cost prototype phased array antennas using PIN diode phase shifter technology for AEGIS (S-Band) and PATRIOT (C-Band) radars. Initiate and complete a concept definition phase for development of a multimode modular guidance unit for existing and second generation Army and Navy area air defense missiles. Investigate state-of-technology in several key areas relative to

generic deficiencies in current area SAM systems. Areas to be investigated include: Advanced warheads and fuzes, adaptive signal processors, and noncooperative Identification, Friend or Foe (Radar). Direct support for concept definition of alternatives required to counter the Stand-Off Aerial Jammers will also be initiated.

3. FY 1979 Planned Program: Complete fabrication and testing of the lightweight low cost antenna arrays. Deliver the (C-Band) antenna to the PATRIOT Fire Control group No. 2 site for integration and systems testing to be accomplished under the PATRIOT Program. Deliver the (S-Band) antenna to the AEGIS Combat System Engineering Development Site for integration and systems testing to be accomplished under the AEGIS Program. Initiate the program to develop and demonstrate a modular multimode guidance unit for area air defense missiles. Initiate a new program to improve surface-to-air missile warheads and fuses.

4. FY 1980 Planned Program: Continue the modular multimode guidance unit demonstration effort. Design, fabrication and testing of warhead and fuze prototype hardware will be initiated. Initiate investigations for future programs.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.33.19.A
Title: Conventional Airfield Attack Missile (CAAM)
DoD Mission Area: #422 - Interdiction
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	1484	5000	2000	To Be Determined	To Be Determined
	Quantities						Not Applicable
DH22	Conventional Airfield Attack Missile (CAAM)	0	1484	5000	2000	To Be Determined	To Be Determined

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The CAAM reentry vehicle (RV) concept is designed to provide a long range missile capable of disrupting the enemy's use of main operating base airfields by dispensing conventional ammunition concrete penetrating explosives to damage runways. The CAAM will take advantage of the accurate meter Circular Error Probable (CEP)) PERSHING II guidance technique. CAAM represents a potentially effective means of reducing Soviet/Warsaw Pact aircraft sorties by forcing the Pact to use alternate sod fields (dispersed operating bases) that have less support capability, fewer air defenses, and do not have protective hangarettes. The dispersed operating bases provide a better opportunity for US/NATO aircraft to destroy Soviet/Warsaw Pact aircraft on the ground. Under the direction of the Office of the Secretary of Defense (OSD) a Cost and Operational Effectiveness Analysis (COEA) is being conducted to validate the mission need and determine the best CAAM delivery system. PERSHING is one of the delivery systems being considered. The results of the COEA will be considered at the PERSHING II Defense Systems Acquisition Review Council (DSARC) II in June 1978.

C. BASIS FOR FY 1979 RDTE REQUEST: During FY 1979, assuming a favorable decision for PERSHING II at DSARC II in June 1978, efforts will continue to finalize a CAAM RV design, less dispensing tests.

Major Milestones	Date
Start CAAM Development	Oct 77
COEA Complete	Feb 78
PERSHING II DSARC II	Jun 78
Decision on pursuit of CAAM	NLT Oct 78
CAAM Program Definitized	Nov 78

D. OTHER APPROPRIATION FUNDS: To be determined based on the results of COEA.

Program Element: #6.33.19.A
DoD Mission Area: #422 - Interdiction

Title: Conventional Airfield Attack Missile (CAAM)
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: Consideration has been given to providing PERSHING with a CAAM capability as far back as the mid-1960s. However, because of the system's large Circular Error Probable (CEP) of meters, it was not believed to be cost effective. A CAAM was believed to be a means of reducing the Soviet/Warsaw Pact sortie rate by forcing aircraft off their main operating air bases, at least temporarily, thereby forcing the use of dispersed operating bases that have less support capability, no hangarettes and less air defenses. The reduction in sortie rate and aircraft exposure at these alternate, soft airfields could help US/NATO gain needed air superiority. It was not until the advent of the PERSHING II Radar Area Correlating Terminal Guidance technique with its projected meter CEP that interest was regenerated in PERSHING as a delivery vehicle for a CAAM. Funds were placed in the FY 1978 budget to initiate a feasibility demonstration of the PERSHING CAAM. The Office of the Secretary of Defense (OSD) funded the Institute for Defense Analysis (IDA) to conduct a Cost and Operational Effectiveness Analysis (COEA) to determine if CAAM is cost effective and determine the best delivery system for a CAAM. This analysis is scheduled for completion during February 1978. The results of the IDA study will influence the future of PERSHING CAAM by providing an input to the Defense Systems Acquisition Review Council (DSARC) decision process.

F. RELATED ACTIVITIES: The CAAM will take advantage of the PERSHING II Full Scale development effort in FY 1979 (Program Element (PE) 6.33.11.A). Close coordination is being maintained with the Air Force on Advanced Ballistic Reentry Developments and the Ground Launched Cruise Missile, another CAAM delivery system candidate. Prior year efforts in Surface-to-Surface Missile PERSHING (PE 2.21.62.A) and Radar Area Correlation (PE 6.23.03.A), under the US Army Materiel Development and Readiness Command, have been conducted by the same project manager selected to develop this project.

G. WORK PERFORMED BY: US Army Missile Research and Development Command, Redstone Arsenal, AL; and Martin-Marietta, Orlando, FL.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: None. Program is an FY 1978 new start.

2. FY 1978 Program: The submunition for the reentry vehicle (RV) will be selected and the design specification prepared. Wind tunnel tests will be conducted to obtain data for input to the PERSHING II program to support compatibility between the PERSHING II RV guidance and the CAAM. The submunition dispensing technique will be selected. Deployment options will be analyzed and the plan for the rest of the CAAM program will be detailed based on the results of the PERSHING II DSARC II.

3. FY 1979 Planned Program: Based on a favorable decision on PERSHING II at DSARC II in FY 1978, the increased FY 1979 funds provide for continuation of the CAAM submunition to be designed, wind tunnel tests to be completed, additional PERSHING II RV guidance compatibility analysis to be conducted and design work to be started on the submunition dispensing system.

Program Element: #6.33.19.A
DoD Mission Area: #442 - Interdiction

Title: Conventional Airfield Attack Missile (CAAM)
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: The efforts started in the previous fiscal years will be continued during FY 1980 in preparation for the aircraft-delivered reentry vehicle submunition dispensing tests to be conducted prior to completion of the feasibility demonstration program.

5. Program to Completion: To be determined based on the decision following the PERSHING II Defense Systems Acquisition Review Council II and program progress.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.33.20.A 1/ Title: ASSAULT BREAKER (NATO)
DoD Mission Area: #422 - Interdiction Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	0	10300	To Be Determined*	To Be Determined*	To Be Determined*
D302	Assault Breaker	0	0	10300	To Be Determined	To Be Determined	To Be Determined

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: ASSAULT BREAKER is a concept for the rapid attrition and annihilation of Pact forces which are not in direct engagement with NATO forces. Assault Breaker is a weapon system that
Considering a corps facing an attacking force
strength of and assuming a NATO corps under attack can
Assault Breaker would attack the men and material in the remaining
divisions over a time period as short as hours at ranges as far as (based upon Pact doctrine) beyound the FEBA.

C. BASIS FOR FY 1979 RDTE REQUEST: To conduct necessary analysis and technology demonstrations to support the concept definition study.

D. OTHER APPROPRIATION FUNDS: To be determined based on the results of the FY79 and 80 efforts.

1/ Joint Army/Air Force Program (Air Force PE #6.46.13.F).

*NATO Initiatives outyear funding are identified in PE 6.51.10.D, NATO Initiatives.

Program Element: #6.33.20.A
DoD Mission Area: #422 - Interdiction

Title: ASSAULT BREAKER (NATO)
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: The goal of this program is to identify those system elements required to increase the capability to attack the enemy under day/night, good/adverse weather and focus on capitalizing on as many existing programs as possible to demonstrate the system concept. The Assault Breaker concept requires Several launch platforms, delivery systems, midcourse guidance techniques and terminal effects munitions will be considered for the concept. The Assault Breaker concept will require Army/Air Force Assets to provide a complete systems approach. The program planned for FY 1979 and 1980 will be to identify and coordinate systems requirements and conduct a technology demonstration.

F. RELATED ACTIVITIES: The Assault Breaker work will take advantage of on-going Advanced Research Project Agency Tactical Technology (Program Element (PE) 6.27.02.E) efforts, Missile Technology (PE 6.23.03.A), Terminally Guided Submunition work, complementary Air Force/US Army Missile Research and Development Command efforts, and Air Force activity 6.46.13.F.

G. WORK PERFORMED BY: Current plans are for a Joint Army/Air Force Project office to manage the effort. Work to be accomplished by government laboratories and contractors will be determined.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Not Applicable.

2. FY 1978 Program: Not Applicable.

3. FY 1979 Planned Program: Effort is to identify mission needs and technical issues concerning command and control; submunition dispensing techniques; and terminally guided submunition refinements leading to a proof of concept demonstration.

4. FY 1980 Planned Program: Although not funded, it is planned, based on the results of the technology demonstration, that system hardware integration and missile flights will be conducted to prove system capability to accomplish the mission need.

5. Program to Completion: To be determined based on technology demonstration results.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.36.08.A
DoD Mission Area: #412 - Close Combat

Title: Weapons and Ammunition
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2917	4791	500	445	Continuing	Not Applicable
D160	Infantry Munitions	1353	679	0	445	Continuing	Not Applicable
D009	60mm Ammunition	0	0	500	0	0	500
D161	Tank Ammunition	1564	2659	0	0	0	4223
D162	Tank Target Practice	0	1453	0	0	0	1453

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports studies, design and development of more reliable and effective munitions for infantry, mortar and tank gun systems. This program element provides for: development of a 60mm smoke round to provide battlefield obscuration for the lightweight company mortar system type classified July 1977 with only a high explosive cartridge; and development of cartridge 105mm XM774 fired from the M68 cannon mounted on the M60 series, M48A5 and the proposed XM1 Tank. This cartridge is cheaper in cost and superior in penetration performance over cartridges M392, M728 and M735. A target practice round XM797 utilized as a companion to the M735 and XM774 cartridges that will accommodate training exercises out to the required ranges, and a 30mm high explosive dual purpose cartridge for use with a launcher attached to the M16A1 rifle will also be developed.

C. BASIS FOR FY 1979 RDTE REQUEST: To provide for RDTE efforts for 60mm smoke cartridge. Activities will include basic design of components, i.e., Burster, Shell Body, Filler, and Fuze. Pilot testing will be conducted to determine effectiveness of smoke patterns generated by filler material and the capability to obscure the varied targets.

D. OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #6.36.08.A
DoD Mission Area: #412 - Close Combat

Title: Weapons and Ammunition
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: Four projects are being pursued under this program. However, only the initiation of development of the 60mm smoke cartridge for the Lightweight Company Mortar (LWCM) System recently type classified will be supported in FY 1979. Projects D161 and D162 will be transferred into full scale engineering development under Program Element 6.46.02.A Project DG21. The concept for this 60mm smoke round envisions multiple smoke producing subunits, randomly dispersed on a target so as to quickly produce an obscuring smoke of five minutes or longer. The advanced development phase will be completed in FY 1978 for the FIN stabilized cartridge (XM774) used with the 105mm tank gun systems. This round will be superior in terminal effectiveness to the stockpiled cartridges M392, M728, and M735. Development of a companion target practice cartridge will be started in FY 1978. This cartridge design will utilize several of the components similar to those used on the M735 and XM774 concepts.

F. RELATED ACTIVITIES: Projects in this program are supported by exploratory development programs under Program Elements 6.26.03, Large Caliber and Nuclear Technology and 6.26.18, Ballistics Technology. Developments in this program are compatible with US Marine Corps requirements, and are closely coordinated to preclude duplication of effort. To avoid proliferation of programs within each of the Tri-Services, all new programs are coordinated with appropriate joint technical coordinating groups.

G. WORK PERFORMED BY: In-house agencies include US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; ARRADCOM, Edgewood, MD. Contractors include Honeywell, Minneapolis, MN; Chamberlain Manufacturing Corporation, Waterloo, IA; Battelle-Northwest Laboratories, Richland, WA; Sandia Livermore Laboratories, Livermore, CA; Rockwell International, Denver, CO; National Lead Company of Ohio, Fernald, OH; Flinchbaugh Products, Incorporated, Red Lion, PA.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: RDTE efforts conducted under other projects included the multiple warhead projectile. Projectile shapes were streamlined for extended range. Advanced development of 105mm, 155mm, and 8 inch artillery projectiles with an improved high-explosive fill was completed. An investigation was made toward desensitizing standard high explosive fills. Advanced development of dual-purpose ammunition (anti-personnel and anti-armor) continued. A soft-recoil mechanism for towed and self-propelled guns was tested. A field test demonstration of candidate gun systems for the XM1 tank was conducted. A US 105mm system and a German 120mm system were both found to warrant further evaluation. These programs are being pursued under a separate Program Element 6.36.16.A Tank Gun Cooperative Development. A dual-purpose Grenade for use on rifle-mounted launchers was initiated. Development of a 40mm training round for safer and less costly training was completed. The design of the XM774 cartridge for tank guns was validated.

2. FY 1978 Program: Fabrication and formal developmental testing of the improved 105mm tank gun projectile XM774 will continue throughout the year. Development will be initiated for a tank gun target practice round captioned cartridge, 105mm, target practice XM797.

Program Element: #6.36.08.A
DoD Mission Area: #412 - Close Combat

Title: Weapons and Ammunition
Budget Activity: #4 - Tactical Programs

3. FY 1979 Planned Program: Development of the 105mm tank gun cartridge XM774 will be completed under project DG21 Tank Ammunition and will be type classified Standard in 2QFY 1979. Development of a 60mm smoke round will be initiated for the lightweight company mortar system. Decrease from FY 1978 funding attributable to transition of Projects D161 and D162 into Program Element 6.46.02 Weapons and Ammunition.

4. FY 1980 Planned Program: The Army has interest in development of an improved multi-shot launcher subsystem attachment to the M16A1 rifle system. Training and Doctrine Command (TRADOC) is conducting exercises involving several candidate systems one of which is the 30mm multi-shot launcher. Testing and evaluation of this candidate is scheduled during late FY 1978 and a requirement document will be established to support advanced development.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.36.12.A
DoD Mission Area: #412 - Close Combat

Title: Advanced Multipurpose Missile
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	1936	8100	32208	226792	259000
	Quantities						350
D097	Advanced Heavy Antitank Missile System (AHAMS)	0	1936	7100	32208	226792	259000
D289	Advanced Heavy Antitank Missile System (AHAMS) (NATO)	0	0	1000	(To be determined)		

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The AHAMS is planned to be the Army's next Infantry heavy antiarmor missile system. It will have new and improved capabilities in countermeasures and smoke environments; it will feature a faster, longer-range missile which will defeat advanced armor and will have a secondary self-defense capability against attack helicopters. The missile system will be crew-portable with application to all current and future TOW configurations. Threat advantages in numerical superiority, armored vehicle protection, and countermeasures dictate a capability not inherent in current infantry antitank systems. A plan has been initiated to encourage a NATO cooperative effort through both industry and Government channels.

C. BASIS FOR FY 1979 RDTE REQUEST: FY 1979 funds will initiate the advanced development effort of two competitive contracts to conclude in a fly-off in FY 1981-82. These funds will be used for engineering design, fabrication, assembly and test of key components of each contractor's proposed system. This will include wind tunnel tests of missile airframes, static motor tests of the propulsion subsystems, warhead tests, and laboratory test of acquisition/guidance hardware. In addition, government personnel will monitor contracts, develop the program plan, evaluate test results, provide funding control and overall management of the AHAMS program.

Major Milestones	Date
Army Systems Acquisition Review Council (ASARC)/ Defense Systems Acquisition Review Council (DSARC) I	Oct-Nov 78

D. OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #6.36.12.A
DoD Mission Area: #412 - Close Combat

Title: Advanced Multipurpose Missile
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: Analysis of intelligence reports, Soviet military literature, and the results of the October 1973 Middle East War have pointed to key requirements needed in an antiarmor missile system to enable our infantry forces to defeat a numerically superior force in the environment expected on the future battlefield. The Antiarmor Mission Element Need Statement (MENS) provides the generalized requirement for this system. Under the guidance of OMB Circular A109, the concept formulation phase is underway and will be completed in FY78. Mission oriented study contracts to examine alternative technologies and system concepts will be awarded to a number of contractors in January 1978. Some of the key improvements will be defeat of projected threat advanced armor vehicles, rapid engagement of multiple targets, improved performance in battlefield aerosols (rain, fog, dust, smoke, etc.) and continued operation in a sophisticated electronic and electro-optical countermeasures environment. A secondary capability of self air defense against attack helicopters will be incorporated in the development process insofar as this capability does not detract from the primary antitank mission.

F. RELATED ACTIVITIES: TOW Missile System (PE 2.37.24.A), Advanced Munitions Project (PE 6.33.13.A), Defense Advanced Research Projects Agency (DARPA) technology investigations and missile technology (PE 6.23.03.A). This system is planned to be a phased in replacement for the TOW system in the time frame. As such, the Advanced Heavy Antitank Missile System will be compatible with existing and planned TOW platforms. Technologies from related activities will be examined for application to this system during concept formulation and advanced development.

G. WORK PERFORMED BY: US Army Missile Research and Development Command (MIRADCOM), Redstone Arsenal, Alabama, with contractors to be selected competitively.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Monitored and analyzed the results of exploratory development tests of acquisition/guidance hardware, warheads and propellants. Evaluated results of smoke and coutermeasures tests and reports describing the operation of a number of acquisition/guidance techniques. Developed and issued a Concept Definition Request for Proposal (RFP) to industry.

2. FY 1978 Program: Complete concept formulation and prepare to enter advanced development. Includes monitoring up to six Concept Definition contracts, support to the AHAMS Special Task Force (Cost and Operational Effectiveness Analysis (COEA), Tradeoff Determinations (TOD), Tradeoff Analysis (TOA), and preparation for Army Systems Acquisition Review Council (ASARC)/ Defense Systems Acquisition Review Council (DSARC) I. Initiate discussions with NATO allies relative to possibilities for a cooperative effort.

Program Element: #6.36.12.A
DoD Mission Area: #412 - Close Combat

Title: Advanced Multipurpose Missile
Budget Activity: #4 - Tactical Programs

3. FY 1979 Planned Program: Initiate advanced development program. Award two competitive contracts and provide overall program management. Work to be accomplished in this year include: System design, fabrication, assembly and test of key components. Coordinate development work with NATO allies.

4. FY 1980 Planned Program: Continue advanced development.

5. Program to Completion: Complete Development Test/Operational Test I and continue into engineering development.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D097 Title: Advanced Heavy Antitank Missile System (AHAMS)
Program Element: #6.36.12.A Title: Advanced Multipurpose Missile
DoD Mission Area: #412 - Close Combat Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: Analysis of intelligence reports, Soviet military literature, and the results of the October 1973 Middle East War have pointed to key requirements needed in an antiarmor missile system to enable our Infantry forces to defeat a numerically superior force in the environment expected on the future battlefield. The Antiarmor Mission Element Need Statement (MENS) provides the generalized requirement for this system. Under the guidance of OMB Circular A109, the concept formulation phase is underway and will be completed in FY78. Mission oriented study contracts to examine alternative technologies and system concepts will be awarded to a number of contractors in January of 1978. Some of the key improvements will be defeat of projected threat advanced armor vehicles, rapid engagement of multiple targets extended range improved performance in battlefield aerosols (rain, fog, dust, smoke, etc.) and continued operation in a sophisticated electronic and electro-optical countermeasures environment. A secondary capability of self air defense against attack helicopters will be incorporated in the development process insofar as this capability does not detract from the primary antitank mission. There are many existing and emerging technologies that will satisfy these requirements. Acquisition/guidance technologies have been evaluated in exploratory development tests under varying environmental conditions. Proven technologies include forward looking infrared acquisition devices, laser beamrider guidance, laser semi-active guidance and infrared imaging terminal homing seekers. Emerging technologies that show promise and may be demonstrated in the near future include millimeter wave and optical fiber acquisition/guidance. New warhead designs and materials have demonstrated improved performance under laboratory test conditions. Propellants have been demonstrated for improved performance and low signature in static tests. Computer simulations have shown that expected performance improvements can be obtained with projected system concepts. The technology base supports components application to an advanced development program. A plan to obtain a cooperative effort with our NATO allies has been initiated. This plan entails a two-pronged approach through industry and government channels. The concept definition Request for Proposal requires industry to provide their plans to establish a cooperative effort. Discussions relative to the Advanced Heavy Antitank Missile System (AHAMS) have been initiated by US representatives in the appropriate NATO arenas. Letters have been prepared for Under Secretary of Defense for Research and Engineering release to request an information exchange with the development communities of the British, French and German Ministries of Defense.

B. RELATED ACTIVITIES: TOW Missile System (PE 2.37.24.A), Advanced Munitions Project (PE 6.33.13.A), Defense Advanced Research Projects Agency (DARPA) technology investigations and missile technology (PE 6.23.03.A). This system is planned to be a phased

in replacement for the TOW system in the time frame. As such, the Advanced Heavy Antitank Missile System will be compatible with existing and planned TOW platforms. Technologies from related activities will be examined for application to this system during concept formulation and advanced development.

C. WORK PERFORMED BY: US Army Missile Research and Development Command (MIRADCOM), Redstone Arsenal, AL, with contractors to be selected competitively.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Monitored and analyzed the results of exploratory development tests of acquisition/guidance hardware, warheads and propellants. Evaluated results of smoke and countermeasures tests and reports describing the operation of a number of acquisition/guidance techniques. Developed and issued a Concept Definition Request for Proposal (RFP) to industry.

2. FY 1978 Program: Complete concept formulation and prepare to enter advanced development. Includes monitoring up to six Concept Definition contracts, support to the AHAMS Special Task Force (Cost and Operational Effectiveness Analysis (COEA), Tradeoff Determinations (TOD), Tradeoff Analysis (TOA), etc.,) and preparation for Army System Acquisition Review Council/Defense System Acquisition Review Council (ASARC/DSARC) I.

3. FY 1979 Planned Program: *Initiate advanced* development program. Award two competitive contracts and provide overall program management. Work to be accomplished in this year includes: System design, fabrication, assembly and test of key components.

4. FY 1980 Planned Program: Continue advanced development.

5. Program to Completion: Complete Development Test/Operational Test I and continue into engineering development.

6. Major Milestones:

ASARC/DSARC I	Oct-Nov 78

Project: #D097 — Title: Advanced Heavy Antitank Missile System (AHAMS)
Program Element: #6.36.12.A — Title: Advanced Multipurpose Missile
DoD Mission Area: #412 - Close Combat — Budget Activity: #4 - Tactical Program

7. Resources ($ in thousands):

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Cost
RDTE, A: Funds	0	1936	7100	32208	226792	268036

E. Test and Evaluation Data: (To be determined).

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.36.16.A
DoD Mission Area: #412 - Close Combat

Title: Tank Gun Cooperative Development
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)[1/]

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2050	1400	8100	35800	46600	93950
D060	Tank Gun Cooperative Development	2050	1400	5700	17300	22500	48950
D287	Tank Gun Integration	0	0	2400	18500	24100	45000

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the cooperative test and evaluation of the Federal Republic of Germany (FRG) 120mm smooth bore gun system, the United Kingdom (UK) 120mm rifled bore gun system, and the US standard 105mm gun system. Should evaluation show one of the 120mm gun systems to be more combat effective than the US standard 105mm system firing improved ammunition and a decision is made to select one of the candidate 120mm gun systems for future incorporation into the XM1 tank, this program provides for US development of the selected system including six (6) rounds of ammunition, and integration of that system into the XM1 tank. This program is required to assure the availability of a future tank main armament system for the XM1 tank to counter the long-term armor threat.

C. BASIS FOR FY 1979 RDTE REQUEST: Initial development testing (DT 1) of the 120mm gun with Armor Piercing Fin Stabilized Discarding Sabot Tracer (APFSDS-T) and High Explosive Antitank Multiple Purpose Tracer (HEAT-MP-T) ammunition will be completed. The Required Operational Capability (ROC), interface constraints with the XM1 tank system and Coordinated Test Program (CTP) for the 120mm gun will be established. Development contracts for APFSDS-T and HEAT-MP-T projectiles will be awarded and in-house fabrication of the cannon and ammunition will be initiated. Coordinated integration of the 120mm gun system into the XM1 tank will continue. Major milestones in FY 1979 are as follows:

Milestones	Date
Tank main armament decision	2Q FY78
Start US development of selected 120mm gun and Ammunition	3Q FY78
Initiate integration of 120mm gun into XM1 tank	3Q FY78

Refurbish one XM1 Tank Full Scale Engineering Development (FSED) vehicle for contractor testing	FY79
Refurbish six FSED vehicles for development and operational testing (DT II/OT II)	FY80
Type classify 120mm gun and Armor Piercing Fin Stabilized Discording Sabot Tracer (APFSDS-T) Ammunition	3QFY81
Complete DT II/OT II of 120mm gun XM1 Tank	FY81

D. OTHER APPROPRIATION FUNDS: Not applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: This program is an outgrowth of the 1975 Tripartite (United States, United Kingdom and Federal Republic of Germany - US, UK and FRG) Tank Main Armament Evaluation, a continuing analysis of future armor threats and recognition of NATO harmonization/standardization efforts. This Program Element consists of two projects, D060 - Tank Gun Cooperative Development and D287 - Tank Gun Integration, and was established in response to Congressional guidance which specified that testing and evaluation of alternative 120mm gun systems should be conducted as a parallel program, separate and apart from the funding of the XM1 program. The objectives of this program are to evaluate candidate main armament systems, determine the best follow-on main armament system for the XM1 tank to counter the long-term armor threat and develop the selected system for future incorporation on the XM1 tank. Should a 120mm gun system be selected, project D287 provides for integration of the selected system into the XM1 tank system.

F. RELATED ACTIVITIES: This program is related to Program Element (PE) 6.46.20.A, Tank XM1; PE 6.36.08.A, Weapons and Ammunition and dependent upon technology developed under PE 6.26.18.A, Ballistics Technology and 6.26.03.A, Large Caliber and nuclear Technology. Previous funding was provided under PE 6.36.08.A, Weapons and Ammunition.

G. WORK PERFORMED BY: US Army Armament Research and Development Command, Dover, NJ; the US Army Test and Evaluation Command, Aberdeen, MD; and Chrysler Corporation, Warren, MI.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: A comprehensive Tripartite (US, UK and FRG) Tank Main Armament Evaluation was conducted in FY 1975 to determine the performance of each country's candidate system against a wide spectrum of armor arrays and evaluate the combat effectiveness of each against the known and postulated enemy armor threat. The evaluation included testing of additional developmental items to identify the growth potential of the competing systems. The evaluation demonstrated the capability of the US 105mm system with improved ammunition to counter near and mid-term threats, concluded that of the three

calibers tested (105mm, 110mm and 120mm) the 120mm provided the best basis for future development of advanced tank weapon systems, and recommended that an optimal main armament system, considering both smooth and rifled bore designs, but based initially on the FRG 120mm system, be developed. In July 1976, the US entered into separate agreements for tests of 120mm smooth and rifled bore main armament systems developed by the FRG and UK respectively. Also in July 1976, the US agreed to an Addendum to a 1974 Memorandum of Understanding with the Federal Republic of Germany (FRG) concerning LEOPARD 2/XM1 Tank harmonization. The Addendum specified a decision on a 120mm gun configuration by 15 January 1977. Limited comparative firing trials were conducted in December 1976 at Aberdeen Proving Ground, MD. However, the results were not conclusive and Congressional guidance on the XM1 tank program precluded a US gun decision by 15 January 1977. Accordingly, on 12 January 1977 the US and the FRG agreed to postpone a US gun decision until 30 December 1977 to permit additional tests and evaluation of candidate systems. US unique performance requirements for a 120mm armament system were established and furnished to the FRG and the United Kingdom (UK) for their consideration in planning and conducting their test programs. US provided observer teams to observe critical portions of the UK and FRG national testing. Analysis of technical data on candidate systems and comparison against established US requirements continued.

2. FY 1978 Program: Evaluation of candidate tank main armament systems with Armor Piercing Fin Stabilized Discarding Sabot Tracer (APFSDS-T) and High Explosive Antitank Multiple Purpose Tracer (HEAT-MP-T) rounds will be completed to support selection of a future main armament system for the XM1 tank in mid-January 1978. If a 120mm gun is selected, this decision will be submitted to the Congress by 1 February 1978 with an appropriate reprograming request for FY 1978 funds to support US development of the selected system and to initiate integration of that system into the XM1 tank. Subsequent to Congressional approval of the reprograming request, translation and adaptation of design information to achieve compatability with US production base facilities and industrial equipment will start concurrent with off-shore procurement of guns and ammunition to support initial development testing (DT I) and integration activities. Redesign of those portions of the XM1 tank hull and turret effected by incorporation of a 120mm gun system, including the main gun mount, turret drive equipment and ammunition storage areas, will be initiated. Procurement actions for materiel required to refurbish one XM1 Full Scale Engineering Development (FSED) vehicle for contractor testing will be initiated.

3. FY 1979 Planned Program: Using hardware procured from the foreign developer, if a 120mm gun system is selected, DT I of the 120mm gun with Armor Piercing Fin Stabilized Discarding Sabot Tracer (APFSDS-T) and High Explosive Antitank Multiple Purpose Tracer (HEAT-MP-T) cartridges will be completed. Development contracts to US producers for APFSDS-T and HEAT-MP-T projectiles, HEAT-MP fuzes, and non-metallic (combustible) cartridge cases will be awarded. In-house fabrication of 120mm cannon and ammunition to support development testing (DT II) and integration activities will be initiated. Integration of the selected system into the XM1 tank will continue with the design, fabrication and preliminary testing of developmental hardware. One XM1 FSED vehicle will be refurbished for contractor testing and testing initiated. Procurement actions for materiel required to refurbish six FSED vehicles for development and operational testing (DT II/OT II) of a 120mm gun XM1 tank system will be initiated. Funding increase over FY 1978 reflects costs of awarding development contracts, in-house fabrication of guns and ammunition, conduct of development testing and design, fabrication and tests of materiel required for integration of the larger gun system into the XM1 tank.

Program Element: #6.36.16.A
DoD Mission Area: #412 - Close Combat

Title: Tank Gun Cooperative Development
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: Fabrication by US producers of 120mm guns and ammunition to support development and operational testing (DT II/OT II) of the gun and ammunition and integration activities will continue. DT II/OT II of the gun and Army Piercing Fin Stabilized Discarding Sabot Tracer (APFSDS-T) cartridge will start. Contractor testing of one XM1 Full Scale Engineering Development (FSED) vehicle with a 120mm gun system will be completed. Refurbishing of six XM1 FSED vehicles with a 120mm gun system and manufacture of ballistic test hardware to support DT II/OT II of the 120mm gun XM1 tank system will be completed.

5. Program to Completion: Engineering development testing (DT II/OT II) of the 120mm gun with the APFSDS-T and High Explosive Antitank Multiple Purpose Tracer (HEAT-MP-T) rounds will be completed and the system type classified in FY 1981 with the APFSDS-T cartridge and in FY 1982 with the HEAT-MP-T cartridge. Engineering development of the Target Practice Discarding Sabot Tracer (TPDS-T) and HEAT-TP-T training rounds will continue in FY 1981, DT II/OT II will be completed and these two cartridges type classified in FY 1982. DT/OT I of the Antipersonnel (APERS) & smoke cartridges will be completed in FY 1981; fabrication of hardware quantities for DT II/OT II will be completed in FY 1982 and DT II/OT II will start; DT II/OT II will be completed and these items type classifed in FY 1983. DT II/OT II of the 120mm gun XM1 tank will be completed in FY 1981. Production planning aspects for the developmental program will be completed and a Technical Data Package (TDP) prepared for a 120mm gun XM1 tank. If a 120mm gun is selected, facilitization and procurement actions will be initiated leading to production of a 120mm gun XM1 tank in FY 1983.

1/ Funding requirements are contingent upon selection of 120mm gun system and final program definition.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D060 Title: Tank Gun Cooperative Development
Program Element: #6.36.16.A Title: Tank Gun Cooperative Development
DoD Mission Area: #412 - Close Combat Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: This program is an outgrowth of the 1975 Tripartite (United States, United Kingdom and Federal Republic of Germany - US, UK, and FRG) Tank Main Armament Evaluation, a continuing analysis of future armor threats and recognition of NATO harmonization/standardization efforts. The objectives of this program are to evaluate candidate main armament systems, determine the best follow-on main armament system for the XM1 tank to counter the long-term armor threat and develop the selected system for future incorporation on the XM1 tank.

B. RELATED ACTIVITIES: This program is related to Program Element (PE) 6.46.20.A, Tank XM1; PE 6.36.08.A, Weapons and Ammunition, and dependent upon technology developed under PE 6.26.18.A, Ballistics Technology, and 6.26.03.A, Large Caliber and Nuclear Technology. Previous funding was provided under PE 6.36.08.A, Weapons and Ammunition.

C. WORK PERFORMED BY: US Army Armament Research and Development Command, Dover, NJ; and the US Army Test and Evaluation Command, Aberdeen, MD.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: A comprehensive Tripartite (US, UK and FRG) Tank Main Armament Evaluation was conducted in FY 1975 to determine the performance of each country's candidate system against a wide spectrum of armor arrays and evaluate the combat effectiveness of each against the known and postulated enemy armor threat. The evaluation included testing of additional developmental items to identify the growth potential of the competing systems. The evaluation demonstrated the capability of the US 105mm system with improved ammunition to counter near and mid-term threats, concluded that of the three calibers tested (105mm, 110mm, and 120mm) the 120mm provided the best basis for future development of advanced tank weapon systems, and recommended that an optimal main armament system, considering both smooth and rifled bore designs, but based initially on the FRG 120mm system be developed. In July 1976, the US entered into separate agreements for tests of 120mm smooth and rifled bore main armament systems developed by the FRG and UK respectively. Also in July 1976, the US agreed to an Addendum to a 1974 Memorandum of Understanding with the FRG concerning LEOPARD 2/XM1 Tank harmonization. The Addendum specified a decision on a 120mm gun configuration by 15 January 1977. Limited comparative firing trials were conducted in December 1976 at Aberdeen Proving Ground, MD. However, the results were not conclusive and Congressional guidance on the XM1 tank program precluded a US gun decision by 15 January 1977. Accordingly, on 12 January 1977 the US and the FRG agreed to postpone a US gun decision until 30 December 1977 to permit additional tests and evaluation of candidate systems. US unique performance requirements for a 120mm armament system were established and furnished to the FRG and the UK for their consideration in planning and conducting their test programs. US

provided observer teams to observe critical portions of the UK and FRG national testing. Analysis of technical data on candidate systems and comparison against established US requirements continued.

2. FY 1978 Program: Evaluation of candidate tank main armament systems with Armor Piercing Fin Stabilized Discarding Sabot Tracer (APFSDS-T) and High Explosive Antitank Multiple Purpose Tracer (HEAT-MP-T) rounds will be completed to support selection of a future main armament system for the XM1 tank in mid-January 1978. If a 120mm gun is selected, this decision will be submitted to the Congress by 1 February 1978 with an appropriate reprograming request for FY 1978 funds to support a US development program on the selected system. Subsequent to Congressional approval of the reprograming request, translation and adaptation of design information to achieve compatibility with US production base facilities and industrial equipment will start concurrent with off-shore procurement of guns and ammunition to support development testing, (DT I). Advanced planning for development of training cartridges and for conceptual development of the antipersonnel (APERS) and smoke cartridges will be initiated.

3. FY 1979 Planned Program: Using hardware procured from the foreign developer, if a 120mm gun is selected, DT I of the 120mm gun with the Armor Piercing Fin Stabilized Discarding Sabot Tracer (APFSDS-T) and High Explosive Antitank Multiple Purpose Tracer (HEAT-MP-T) cartridges will be completed. The required operational capability (ROC) and the coordinated test program for the 120mm gun will be established, as will the interface constraints with the XM1 tank system. Development contracts to US producers for APFSDS-T and HEAT-MP-T projectiles, HEAT-MP fuzes, and non-metallic (combustible) cartridge cases will be awarded. In-house fabrication of development quantities of cannon and ammunition will be initiated. The validation phase of development for training rounds and conceptual development of antipersonnel (APERS) and smoke rounds will be started. Funding increase over FY 1978 reflects costs of awarding development contracts, in-house fabrication of gun and ammunition family and conduct of development testing.

4. FY 1980 Planned Program: Fabrication by US producers of guns, APFSDS-T cartridges and HEAT-MP-T cartridges for the second phase of development and operational testing (DT/OT II) will be completed. DT/OT II of the gun and APFSDS-T cartridge will start. DT/OT I of two training rounds, Target Practice Discarding Sabot Tracer (TPDS-T) and High Explosive Antitank Target Practice Tracer (HEAT-TP-T) will be completed. Development contracts will be awarded and fabrication of hardware for DT II/OT II of these two rounds will be initiated. The conceptual phase of development for the APERS and smoke cartridges will be completed and the validation phase of development for these two rounds will start.

5. Program to Completion: Engineering development testing (DT II/OT II) of the 120mm gun with the APFSDS-T and HEAT-MP-T rounds will be completed and the system type classified in FY 1981 with the APFSDS-T cartridge and in FY 1982 with the HEAT-MP-T cartridge. Engineering development of the TPDS-T and HEAT-TP-T training rounds will continue in FY 1981; DT II/OT II will be completed and these two cartridges type classified in FY 1982. DT/OT I of the APERS & smoke cartridges will be completed in FY 1981; fabrication of hardware quantities for DT II/OT II will be completed in FY 1982 and DT II/OT II will start. DT II/OT II will be completed and these items type classified in FY 1983.

Project: #D060 Title: Tank Gun Cooperative Development
Program Element: #6.36.16.A Title: Tank Gun Cooperative Development
DoD Mission Area: #412 - Close Combat Budget Activity: #4 - Tactical Programs

6. Major Milestones:

	Date
Evaluation of candidate 120mm gun systems.	1QFY78
Selection of 120mm gun configuration.	2QFY78
Start validation phase of gun, APFSDS-T and HEAT-MP-T. 1/	3QFY78
Start advanced development of TPDS-T, HEAT-TP-T, APERS and Smoke. 1/	1QFY79
Complete DT I of gun and APFSDS-T.	2QFY79
Complete DT I of HEAT-MP-T.	3QFY79
Complete conceptual phase of APERS and Smoke (IPR I). 1/	1QFY80
Complete DT II/OT II of gun and APFSDS-T.	2QFY81
Type classify gun and APFSDS-T.	3QFY81
Complete DT II/OT II of HEAT-MP-T.	4QFY81
Type classify HEAT-MP-T.	1QFY82
Complete DT II/OT II of TPDS-T and HEAT-TP-T.	1QFY82
Type classify TPDS-T and HEAT-TP.	2QFY82
Complete DT II/OT II of APERS and Smoke.	2QFY83
Type classify APERS and Smoke.	3QFY83

7. Resources ($ in thousands): 2/

	FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Costs
RDTE,A	2050	1400	5700	17300	22,500	48,950

1/ Armor Piercing Fin Stabilized Discarding Sabot Tracer (APFSDS-T); Target Practice Discarding Sabot Tracer (TPDS-T); High Explosive Anti-Tank Multipurpose Tracer (HEAT-MP-T); High Explosive Anti-Tank Target Practice Tracer (HEAT-TP-T); Anti-Personnel (APERS); In Process Review (IPR).

2/ Funding requirements are contingent upon selection of a 120mm gun system and final program definition.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.36.24.A
Title: Mobility
DoD Mission Area: #442 - Logistics/General Combat Support
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	0	1753	10240	Continuing	Not Applicable
DH17	High Mobility Weapons Carrier	0	0	1353	2500	2000	5853
DH64	High Mobility Tactical Vehicle	0	0	100	2000	Continuing	Not Applicable
D154	Vehicle Rearm System	0	0	300	5740	2423	11163

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for conceptual and experimental test-bed vehicles oriented towards perceived tactical requirements. These vehicles incorporate new and advanced components. Vehicles funded under this program will also represent revolutionary approaches towards fulfilling future Army requirements for logistical and other combat support vehicles through innovative employment of commercially available items. These vehicles provide cargo carrying capability and other functions that permit a modern Army to have the supplies vital to continued operations. Advanced mobility concepts and unique battlefield survivability features looking at broad areas of protection will be developed to determine feasibility and effectiveness. This program will serve as a means of accurately defining new system requirements in conjunction with the Army user community.

C. BASIS FOR FY 1979 RDTE REQUEST: Funds requested provide for: development of an Integrated Tube Launched Optically Tracked Wire Guided Missile (TOW) antitank missile/high mobility vehicle weapon system that will provide a significant increase in antitank capabilities to non-mechanized infantry units such as airmobile; initial efforts for a total system approach to resupplying combat vehicles, tanks and self-propelled artillery, with prepackaged ammunition. This new factory-to-vehicle approach will greatly reduce ammunition handling time by combat troops and will greatly increase combat utilization factors for combat units. Requested funds will also enable completion of efforts examining new approaches to cargo/vehicle requirements being satisfied by essentially commercial tracks.

Milestones	Date
Release Request for Proposal (RFP) for High Mobility Weapons Carrier (HMWC)	October 1978
Award Competitive Contracts for HMWC	January 1979
Being Shoot-Off for HMWC	September 1979

Program Element: #6.36.24.A
DoD Mission Area: #442 - Logistics/General Combat Support

Title: Mobility
Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The Army has a continuing requirement for tactical support vehicles. This program is a continuation of the effort to provide an inventory of proven integrated subsystems for low risk and low lead time exploitation through the integration, to the maximum extent possible, of commercially available items. This program also examines unique approaches to resolving existing logistical problems created through the resupply of combat elements while under fire.

F. RELATED ACTIVITIES: This program is related to all of the Army's research and development programs connected with tactical and special purpose vehicles. Programs of primary interest are: Program Element (PE) 6.26.01.A, Tank and Automotive Technology; PE 6.11.02.A, Project AF22, Research in Vehicle Mobility; PE 6.21.05.A, Materials; PE 6.36.21.A, Vehicle Engine Development. Duplication of effort is avoided by review and coordination of programs at all Army management levels.

G. WORK PERFORMED BY: US Army Tank and Automotive Research and Development Command, Warren, MI, has the responsibility for implementation of this program. Contractors will be selected January 1978.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: In FY 1976 initial work on the Armored Cavalry Vehicle was conducted in this program element. The integration of the TOW missile with the BUSHMASTER 25mm cannon into a single weapons station was examined. This program resulted from the Armored Reconnaissance Scout Vehicle program which examined numerous high mobility vehicle concepts to include wheeled approaches.

2. FY 1978 Program: Not Applicable.

3. FY 1979 Planned Program: A new approach to weapon system development in the High Mobility Weapons Carrier Program will be initiated. Vehicles already developed or in an advanced stage of development by commercial firms will be integrated with the TOW antitank missile system and will engage in a competitive shoot-off. The funding requested supports the procurement of four vehicles each from two competitors. This approach, if successful, will permit the Army to obtain a highly mobile antitank vehicle for non-mechanized infantry in a minimum amount of time and at minimum development costs. Testing of the High Mobility Tactical Tracks that was previously in P.E. 6.26.01.A, Tank Automotive Technology, will be completed. Commercial practices are being followed to permit the maximum possible utilization of commercial components. This program will provide alternatives for a 10 ton high mobility logistics support vehicle. The Vehicle Rearm System will examine a lengthened infantry armored personnel carrier M113A1 modified for the resupply of combat vehicles in forward areas. These rearm vehicles will be the first recent efforts by the Army to examine new methods of resupplying front line vehicles and permitting this resupply to take place under armor protection. This capability greatly reduces the vulnerability of both combat vehicles and resupply vehicles to enemy indirect fire while engaging in the very dangerous act of resupplying with ammunition.

Program Element: #6.36.24.A
DoD Mission Area: #442 - Logistics/General Combat Support

Title: Mobility
Budget Activity: #4 - Tactical Program

4. FY 1980 Planned Program: Developmental work on the High Mobility Weapons Carrier, which will move into initial procurement at the end of the year will be completed. The High Mobility Weapons Carrier will be examined for other perceived roles through modifications to the basic vehicle. The Vehicle Rearm System will continue with completion of evaluation of extended M113A1s which incorporate a lengthened hull and additional roadwheels.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.36.27.A
Title: Combat Support Munitions
DoD Mission Area: #449 - Chemical and Biological Defense/ Chemical Warfare
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2777	1985	2346	3528	Continuing	Not Applicable
DE82	Flame, Smoke and Incendiary Material	2777	1985	2346	3528	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is required for the advanced development, investigation, evaluation and study of promising smoke material and weapon systems. Advanced Soviet surveillance and weapon guidance systems require that the Army develop various obscuration capabilities which operate across the infrared spectrum as well as in the visible spectrum. Also, the Army requires improved large area smoke systems to replace its bulky inefficient smoke generators and smoke pots which were developed during World War II. This program will support the development of a large area screening capability, an improved smoke warhead for a ground launched rocket, and an improved smoke grenade for infrared screening of armored vehicles.

C. BASIS FOR FY 1979 RDTE REQUEST: Funds are needed to continue evaluation of high priority rapid smoke systems for protection of armored vehicles, and advanced development (AD) on promising new smoke weapon systems with primary emphasis on artillery and mortar projectiles. Advanced development (AD) will be completed on improved: (1) 155mm Screening Smoke Projectile; (2) Cartridge, 81mm Screening Smoke and (3) Cartridge, 60mm Smoke Screening. AD will be initiated on a prototype Large Area Screening System and a Ground Launched Rocket Improved Smoke Warhead. These efforts will enhance the Army's armored vehicle survivability on the battlefield.

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this program element is to conduct advanced development of promising new and improved flame, incendiary and smoke weapon systems with primary emphasis on artillery and mortar projectiles and on improved smoke projectile systems for all armored vehicles. Advanced development (AD) is also provided for riot control agent and munitions,

devices and equipment for both tactical use and controlling civil disturbances. These projects were originally part of Program Element 6.36.18.A, Weapons and Ammunition.

F. RELATED ACTIVITIES: Development under this project is supported by research being conducted under Program Element 6.26.22.A, Chemical Munitions and Combat Support. Coordination is maintained with other Services to preclude duplication of effort. This program supports engineering development under Program Elements 6.46.09, Combat Support Systems, and 6.46.02, Weapons and Ammunition. Coordination and cooperation is maintained with the United Kingdom, Canada, and the Federal Republic of Germany.

G. WORKED PERFORMED BY: In-house work by US Army Chemical Systems Laboratory, Edgewood, MD; Dugway Proving Ground, UT; US Army Large Caliber Weapons Systems Laboratory, Dover, NJ; Benet Laboratories, Watervliet, NY; and Harry Diamond Laboratories, Adelphi, MD. Contractors are Buck KG, W. Germany, and others to be determined.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Under Program Element 6.26.22.A, a concept of improved screening materials and munitions was developed and demonstrated in August 1975. Work was done at Chemical Systems Laboratory, Edgewood, MD on the use of wicks imbedded in white phosphorous (WP) to improve the burning characteristics and smoke generating capability of 155 WP WICK projectiles. Because of instability problems the program was reoriented to a competitive advanced development program between red phosphorus (RP) and WP. In FY 197T, a contract was awarded to Buck, KG, Germany, to fill 81mm mortar shells with a red phosphorus mixture. In FY 1977, advanced development (AD) was initiated on an improved 81mm Mortar Smoke Round under Program Element 6.36.27.A. Also, competitive AD commenced on the 155mm WP and RP Smoke Projectiles with the best design to be selected for competition during Development Test (DT) I/Operational Test (OT) I. Competitive AD between the two projectiles was terminated in 4QFY77 when the WP WICK projectile demonstrated instability in flight. The RP filled projectile was selected as the design for improvement of the 155mm Smoke Projectile.

2. FY 1978 Program: DT I/OT I will be conducted on the RP design for the 155mm Smoke Screening Projectile. Development of component/systems hardware for the improved 81mm Mortar Smoke Round will continue. Design studies will be conducted to select approaches for components/systems prototype to be experimentally tested. Technical data packages for each round (81mm & 155mm) will be prepared and a Validation In-Process Review (VAL-IPR) conducted for the 81mm Mortar.

3. FY 1979 Planned Program: Initiate warhead design for the Ground Launched Rocket Improved Smoke warhead (GLRS). Design parameters for a prototype Large Area Screening System will be evaluated. A prototype system will be manufactured under contract and experimental field tests conducted.

Program Element: #6.36.27.A Title: Combat Support Munitions
DoD Mission Area: #449 - Chemical and Biological Defense/ Chemical Warfare Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: Continue advanced development on smoke, materials and systems. Principal effort will be on the following programs: GLRS, Infrared Defeating Grenade Launcher System, Large Area Screening System and 105mm Smoke Projectile.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.36.28.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Ammunition Development
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1774	3970	7473	9514	Continuing	Not Applicable
D007	Field Artillery Ammunition Development	1774	3589	5142	5546	Continuing	Not Applicable
D276	Improved Conventional Ammunition	0	381	2331	3968	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports design and development of more effective munitions for Field Artillery Systems. Included are improved conventional munitions, training projectiles, and a gun propulsion program to improve the cannon, propelling charge, and projectile interface. Successful completion will provide more lethal munitions and improved cannon tube life.

C. BASIS FOR FY 1979 RDTE REQUEST: To provide for: Continued advanced development of an 8-inch high explosive projectile, XM711; development of inexpensive indirect fire mortar and artillery training projectiles; continuation of a gun propulsion technology program initiated in FY 1978; continued development of the multi-purpose submunition; and initiation of advanced development of the Sense and Destroy Armor Munition (SADARM).

D. OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #6.36.28.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Ammunition Development
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: This program supports two projects in munitions advanced development. Project D007 Field Artillery Ammunitions development provides for: development of the XM711, high explosive (HE) 8-inch projectile which will provide increased lethality over the current standard HE projectile and will be ballistically similar to the M509, 8-inch improved conventional munition (ICM) projectile; development of artillery and mortar training projectiles for low cost, realistic training with significant annual savings in training munitions costs; and, a gun propulsion technology program which will support the rational design and development of ammunition through study of the interface problems between the charge, projectile, and gun tube. Project D276 Improved Conventional Ammunition will support continued development of the artillery delivered multipurpose submunitions (ARDEMS) to provide a more effective submunition for use in artillery delivered ICM projectiles, and initiation of SADARM advanced development to provide a fire and forget anti-tank capability to the 8-inch field artillery systems.

F. RELATED ACTIVITIES: The development items in this program are directly related to exploratory research being done in Program Element 6.26.03.A, Large Caliber & Nuclear Technology. Follow-on engineering development is conducted in: Program Elements 6.46.27.A, Field Artillery Weapons and Ammunition, 8-inch; 6.46.14.A, Field Artillery Weapons and Ammunition, 155mm; and 6.46.28.A, Indirect Fire Training Munitions. Developments in this program element are compatible with US Marine Corps requirements and are coordinated through joint meetings to preclude duplication of effort. Prior to FY 1979, work now done under project D008, in Program Element 6.36.29.A Field Artillery Weapons was conducted in this program element.

G. WORK PERFORMED BY: US Army Armament Research & Development Command (ARRADCOM), Dover, NJ; Watervliet, NY; and Aberdeen, MD; Army Materiel Systems Analysis Agency, Aberdeen, MD. Contractors performing work in this area are the Chamberlain Corporation, Waterloo, IA; Space Research Corporation, Troy, VT.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The qualification of alternate explosive fill in artillery shells was completed. Surveillance testing of climatically conditioned munitions to establish storage characteristics was initiated and will continue through FY 1978. The XM711, 8-inch high explosive (HE) projectile developed in-house and the XM762, 8-inch HE projectile developed by the Space Research Corporation were initiated in competitive advanced development. The XM762 was subsequently terminated as a result of Congressional action. A test fixture to demonstrate the soft recoil concept to large caliber artillery was fabricated. In FY 1977 work was initiated on an inert 155mm artillery training projectile and a concrete filled plastic 81mm

mortar training projectile. Fuze and spotting signatures were evaluated, low cost packaging design was conducted, and 81mm concrete rounds were fabricated and tested for cartridge integrity. The range extension program to demonstrate compatibility between the M109A1 self-propelled howitzer and the M203 maximum propelling charge continued in project D008.

2. FY 1978 Program: Development of 105mm howitzer and 60mm mortar low cost training projectiles will be initiated using the technology derived from the 155mm and 81mm programs in FY 1977. Advanced development will be initiated on the Artillery delivered multipurpose submunition (ARDEMS). The gun propulsion program will be initiated. Compatibility testing with the M109A1 howitzer/M203 propelling charge will continue.

3. FY 1979 Planned Program: Fracture mechanics, fragmentation tests, range match tests and gun tube wear tests of the XM711 8-inch projectile will be conducted. Advanced development of the training projectiles will be completed. The gun propulsion program will complete ignition train design for stick propellant and perform parametric analysis of tube wear and ballistic parameters. Initiate advanced development of sense and destroy armor munition (SADARM).

4. FY 1980 Planned Program: Complete advanced development of the XM711 8-inch projectile transition to engineering development in PE 6.46.27.A, Field Artillery Weapons and Ammunition, 8-inch continue development of the ARDEMS and SADARM submunitions.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D007 — Title: Field Artillery Ammunition Development
Program Element: #6.36.28.A — Title: Field Artillery Ammunition Development
DoD Mission Area: #413 - Fire Support — Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: This project comprises independent areas of effort to bridge the gap between exploratory research and engineering development of field artillery ammunition. End items currently under development are the 8-inch high explosive (HE) projectile, XM711, and low cost artillery and mortar training projectiles. In addition, a gun propulsion technology program will conduct research into the solution of current and anticipated gun propulsion problems to provide for the rational design and development of propelling charges and address the interface problems between the charge, projectile and gun tube. The XM711 will provide increased lethality over current standard HE projectiles and will be ballistically similar to the M509, 8-inch improved conventional munition (ICM) projectile which will improve speed and accuracy in delivering artillery fire support. Low cost training projectiles will provide realistic training for artillery and mortar crewmen and observers and provide significant annual savings in training munitions costs. One concept being evaluated is a plastic jacketed mortar projectile filled with concrete, which will provide the same exterior ballistics as the high explosive (HE) round and produce upon impact a signature similar to the HE round. The 155mm and 105mm artillery training projectiles will utilize thick walled, inert metal shells, which will be ballistically matched to the current high explosive projectile.

B. RELATED ACTIVITIES: The gun propulsion effort is a continuation of the exploratory research being conducted in program element 6.26.03.A, Large Caliber and Nuclear Technology. The 8-inch projectile is directly related to developments of other 8-inch munitions in program element 6.46.27.A, Field Artillery Weapons and Ammunitions, 8-inch, while the training items will continue engineering development in program element 6.46.28.A, Indirect Training Projectiles.

C. WORK PERFORMED BY: US Army Armament Research and Development Command, Dover, NJ; Rock Island, IL; Aberdeen, MD; US Army Materiel Systems Analysis Agency, Aberdeen, MD; Army Materiel and Mechanics Research Center, Watertown, MA.

Project: #D007 Title: Field Artillery Ammunition Development
Program Element: #6.36.28.A Title: Field Artillery Ammunition Development
DoD Mission Area: #413 - Fire Support Budget Activity: #4 - Tactical Programs

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The qualification of alternate explosive fills in artillery shells was completed. Surveillance testing of climatically conditioned munitions to establish storage characteristics was initiated and will continue through FY 1978. The XM711, 8-inch HE projectile developed in-house and the XM762, 8-inch HE projectile developed by the Space Research Corporation were initiated in competitive advanced development. The XM762 was subsequently terminated as a result of Congressional action. Development of the XM711 continued, and preliminary range match tests and flight stability tests were conducted in FY 1977. In FY 1977 work was initiated on an inert 155mm artillery training projectile, XM804, and a concrete filled plastic 81mm mortar training projectile, XM798. Fuze and spotting signatures were evaluated, low cost packaging design was conducted, and 81mm concrete cartridges were fabricated and tested for cartridge integrity.

2. FY 1978 Program: Development of 105mm howitzer and 60mm mortar training projectiles will be initiated using the technology derived from the 155mm and 81mm programs in FY 1977. Advanced development will be completed for the 155mm projectile with the ballistic firing of 500 rounds. Ballistic testing, fuze suitability testing and spotting charge signature characterization of the 81mm mortar round will be conducted.

3. FY 1979 Planned Program: The XM711 projectile will continue in advanced development with the conduct of required fracture mechanics analysis, fragmentation tests, range match tests and gun tube wear tests. Advanced development of the training projectiles will be completed. The gun propulsion program will complete ignition train design for stick propellant and perform parametric analysis of tube wear and ballistic parameters.

4. FY 1980 Planned Program: Complete advanced development of the XM711 projectile and transition to engineering development in program element 6.46.27.A; Field Artillery Weapons and Ammunition, 8-inch; and complete the gun propulsion program.

5. Program to Completion: This is a continuing program.

6. Major Milestones: Not Applicable.

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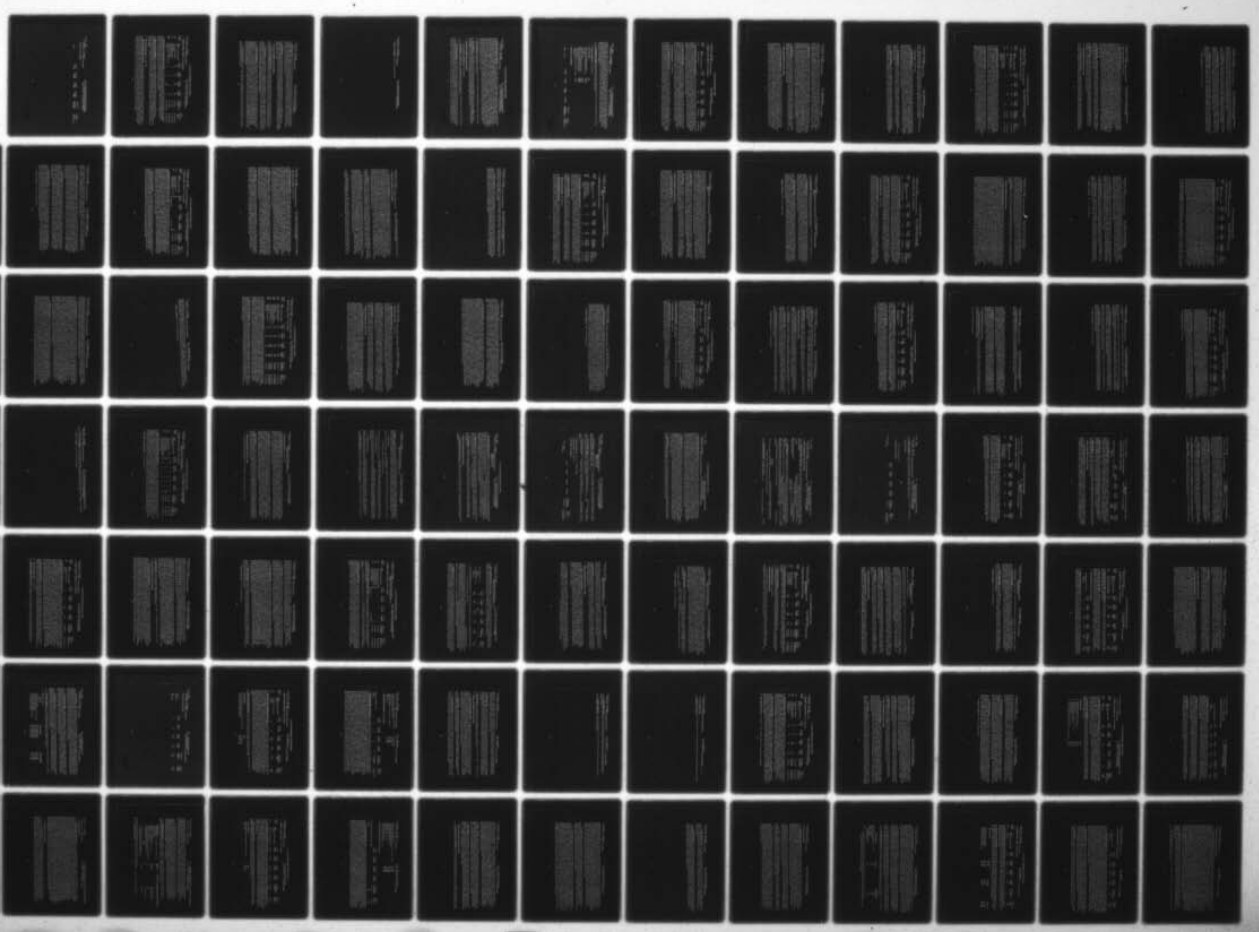

Project: #D007
Program Element: #6.36.28.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Ammunition Development
Title: Field Artillery Ammunition Development
Budget Activity: #4 - Tactical Programs

7. Resources ($ in thousands):

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Continuing	Total Estimated Cost
RDTE, A	1774	3589	5142	5546	Continuing	Not Applicable

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FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.36.29.A
Title: Field Artillery Cannon Systems
DoD Mission Area: #413 - Fire Support
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	310	1867	7835	8333	35458	47036
D008	Field Artillery Weapons Development	310	1867	2835	7000	Continuing	Not Applicable
D472	Light Division Direct Support System (LDDS)	0	0	0	933	Continuing	Not Applicable
D473	Artillery Fire Control	0	0	0	400	Continuing	Not Applicable
D285	Field Artillery Cannon Systems (NATO)	0	0	5000	0	Not Applicable	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the design and advanced development of cannon weapons and associated fire control subsystems. This program will be used to bring exploratory technology into advanced development prototype configuration. Once proven, these components or items will be merged with ammunition in an engineering development program. Although the program is not specifically system oriented it is needed to support transition of components from exploratory technology through advanced development into engineering development.

C. BASIS FOR FY 1979 RDTE REQUEST: This program was established from Program Element (PE) 6.36.28.A to allow for the development of weapons and fire control components or items at separate rates. In FY 1979 the compatibility of the M185 cannon and M203 propelling charge will be completed. Cooperative NATO development of the Self-Propelled Howitzer for 1970's (SP70) will be initiated. The Light Division Direct Support program is awaiting design concepts which are estimated to be available for development in FY 1980. In the fire control area efforts will continue to update support of the field artillery fire direction computer (FADAC).

D. OTHER APPROPRIATION FUNDS: Not applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The program consists of four projects which include work in field artillery weapons and fire control development. Field artillery weapon development will focus on a medium to large caliber, armored, self-propelled howitzer to replace current systems. A replacement for the light division direct support artillery weapons (LDDS) is under study. A requirement for development of LDDS is anticipated in FY 1979 with developmental work beginning in FY 1980. The field artillery Cannon systems (NATO) provides the resources to procure prototype SP70 for testing and evaluation. This effort will be coupled with D008 to definitize the new follow-on self-propelled howitzer and assure that it is interoperable in NATO.

Program Element: #6.36.29.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Cannon Systems
Budget Activity: #4 - Tactical Programs

F. RELATED ACTIVITIES: The projects in this program are related to Program Element (PE) 6.26.03.A, Large Caliber & Nuclear Technology (AH18), where exploratory work is performed; PE 6.46.27.A, Field Artillery Weapons and Ammunition, 8-inch; and PE 6.46.14.A, Field Artillery Weapons and Ammunition, 155mm, where engineering development is conducted. Advanced Development of the XM711 8-inch high explosive projectile is related to the XM650 rocket assisted projectile (RAP) and the XM753 nuclear projectile. Developments in this program are compatible with US Marine Corps requirements and are closely coordinated through joint meetings to preclude duplication of effort.

G. WORK PERFORMED BY: US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; ARRADCOM, Edgewood, MD; Army Materiel Systems Analysis Agency, Aberdeen, MD; ARRADCOM, Aberdeen, MD; ARRADCOM, Watervliet, NY; Defense Advanced Research Projects Agency, Arlington, VA; US Army Test and Evaluation Command (TECOM), Aberdeen, MD; US Army Operational Test and Evaluation Agency (OTEA), Falls Church, VA; US Army Field Artillery Board (USAFAB), Fort Sill, OK; and US Army Training and Doctrine Command (TRADOC), Fort Monroe, VA.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The range extension program to demonstrate compatibility between the M109A1 self-propelled howitzer and M203E2, zone 8 propelling charge was initiated and is on schedule. A special study group to evaluate the best technical and tactical considerations of future medium and large caliber armored, self-propelled howitzers was initiated.

2. FY 1978 Program: Technical feasibility of the M185/M203 compatibility is continuing. Concurrently, the compatibility of the XM712 Cannon Launched Guided Projectile (COPPERHEAD) and the M109 recoil mechanism at higher charges is being investigated. Limited studies of the alternative for a future self-propelled howitzer are being conducted. Development of a large caliber soft recoil test fixture is continuing. Adminstrative and protocol actions have been initiated to gain an opportunity for the US Army to participate in the NATO Self-Propelled 155mm Howitzer (SP70) development.

3. FY 1979 Planned Program: Range extension, M185 cannon and M203 propelling charge compatibility will continue. Initial US participation in the SP70 program is planned. This effort will provide the US 155mm howitzers (M109 & M198) with identified capabilities, i.e., 30 km range development of the soft recoil fixture will be continued. Both will assist in defining US requirements for follow-on self-propelled howitzers. The light division direct support system (LDDS) program will develop design concepts. In the fire control area work will be done to update the field artillery fire direction computer (FADAC) supporting program and fire control components identified as a result of the testing of the Human Engineering Labs Test Bed. The FY 79 program reflects a significant increase in resources and effort in the follow-on self-propelled howitzer area while completing actions on the M109 series howitzer. These projects will allow the US to maintain a quality advantage over the Soviet forces in self-propelled howitzers.

4. FY 1980 Planned Program: Acquisition of SP70 prototype and evaluation upon receipt will increase the level of work in the future self-propelled howitzer area. LDDS design will be finalized and work will begin on initial prototypes. Update of FADAC-related programs will continue.

Program Element: #6.36.29.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Cannon Systems
Budget Activity: #4 - Tactical Programs

5. Program to Completion: *This is a continuing program.*

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D285 — Title: Field Artillery Cannon Systems (NATO)
Program Element: #6.36.29.A — Title: Field Artillery Cannon System
DoD Mission Area: #413 - Fire Support — Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: The FY 1979 funding will purchase Trilateral Federal Republic of Germany (FRG), United Kingdom (UK), and Italy (IT) developed self-propelled Howitzer for the 1970's (SP70) system and related support. Delivery is estimated in early FY 1981. Technical and operational testing and evaluation will be conducted by the material developer, US Army Armament Research and Development Command (ARRADCOM) supported by US Army Test and Evaluation Command (TECOM) and the user, US Army Training and Doctrine Command (TRADOC) supported by US Army Operational Test and Evaluation Agency (OTEA) and US Army Field Artillery Board (USAFAB) to objectively define the performance of the SP70. Reliability, availability and maintainability (RAM) data will be an objective of all testing. Technical performance and human factors data will be compiled as will operational characteristics such as range, rate of fire, survivability and doctrinal compatability. This data will then be used to compare the SP70 to the fielded M109 series and prototypes and their components being developed in Project D008. This approach will ensure that the best of the Trilateral and US weapons components are in the US Army's follow-on self-propelled howitzer when it enters engineering development in the mid 1980's. The resulting system will have NATO commonality of some components and consumable items and may be a version of the SP70. This prototypes testing will also provide the hardware for demonstrations of US ammunition compatiability testing in the SP70.

B. RELATED ACTIVITIES: This project is related to Project D008, Field Artillery Weapons Development and D473, Artillery Fire Control of the parent Program Element; PE 6.36.29.A.

C. WORK PERFORMED BY: US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; Project Manager - Cannon Artillery Weapons Systems (PM-CAWS), Dover, NJ; US Army Test and Evaluation Command (TECOM), Aberdeen, MD; ARRADCOM, Aberdeen-MD; ARRADCOM, Watervliet, NY; US Army Operational Test and Evaluation Agency (OTEA), Falls Church, VA; US Army Field Artillery Board (USAFAB), Fort Sill, OK; and US Army Training and Doctrine Command (TRADOC), Fort Monroe, VA.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Not Applicable.

2. FY 1978 Program: Not Applicable. (Administrative and protocol actions were initiated to gain an opportunity for the US Army to participate in the NATO Self-propelled 155mm Howitzer (SP70) development.)

3. FY 1979 Planned Program: This project was included in the newly established Program Element (PE) 6.36.29.A to identify the funds and the items that were clearly related to the US Army and NATO. This project is structured to maintain the identity of the work which will be coordinated with other tasks, D008 and D473, in P.E. 6.36.29.A. The FY 1979 funds will allow the US Army to join the Trilateral nations in a cooperative development plan. The Army is currently negotiating the terms of its participation. Depending on the outcome of these actions specific details to include the costs of SP70 prototypes will be

finalized in March 1978. The FY 1979 funding represents the cost of one to two systems and necessary support. Once delivered, estimated by early 1981, the self-propelled Howitzer for the 1970's (SP70) system will undergo technical testing and evaluation by US Army Armament Research and Development Command (ARRADCOM) supported by US Army Test and Evaluation Command (TECOM) and operational evaluation by US Army Training and Doctrine Command (TRADOC) supported by US Army Operational Test and Evaluation Agency (OTEA) and US Army Field Artillery Board (USAFAB). The results of these tests coupled with project D008 will be the basis for US requirement and design of the US Army's follow-on self-propelled howitzer which should enter Engineering Development in the mid 1980's.

4. FY 1980 Planned Program: All known and necessary funding for the acquisition of the SP70 system will be completed. Testing to be initiated in early 1981 will be funded under Project D008.

5. Program to Completion: Not Applicable.

6. Major Milestones

	Date
Reply from Joint Management Board	2QFY78
Draft Memorandum of Understanding (MOU) on SP70	3QFY78
Sign MOU on SP70	1QFY79
Contract for Prototype SP70 Systems	1QFY79
Delivery of Prototype SP70 Systems	2QFY81
Begin Developmental and Operational type testing	2QFY81
Development Acquisition In-Process Review (DEVA-IPR)	2QFY82

7. Resources ($ in thousands):

	FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Cost
RDTE, A: Funds	0	0	5000	0	Not Applicable	Not Applicable

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FY 1979 RDTE CONGRESSIONAL SUMMARY

Program Element: #6.37.05.A
DoD Mission Area: #447 - Physical Security

Title: Physical Security
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	0	3500	3500	Continuing	Not Applicable
DK82	Physical Security	0	0	3500	3500	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Objective is to conduct advanced development of a Tri-Service family of interior physical security sensors, exterior lighting, barriers, and ancillary equipment that will operate worldwide, enabling military commanders to tailor physical security systems to protect assets, installations, bases, facilities, personnel and the rear area of deployed forces. Physical security equipment is required to better protect weapon systems and critical areas including arms rooms and storage facilities. Significant manpower savings are practical when adequate detection systems are installed. The Department of Defense uses more than 16,000 personnel daily just to guard nuclear facilities. Development is directed toward satisfying requirements for a Facility Intrusion Detection System (FIDS) and for a Fixed Installation Exterior Perimeter Sensor System (FIEPSS). All developments are aimed for satisfying Tri-Service requirements.

C. BASIS FOR FY 1979 RDTE REQUEST: Accomplish advanced development of components to provide additional capabilities for the Facility Intrusion Detection System (FIDS) in full scale development under Program Element #6.47.18.A, Physical Security, and initiate exterior lighting and barrier subsystem advanced development. Components will be procured and evaluated in-house to demonstrate concept feasibility. Items to be procured include a response/deterrent subsystem, cargo security and locking devices, a radio frequency (RF) data link, and a duress sensor. A Validation In-Process Review will be conducted in 2nd quarter, 1979 on the following items entering full scale development: Surveillance devices, Personnel Identification Elements, Remote Display Capabilities, Control, Communication and Display Subsystems, and high security locks, safes, and containers.

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: Objective is to conduct all design, development, test, and evaluation required to provide the technological base and establish the concept feasibility necessary to proceed into engineering development of complete, integrated physical security systems to protect materiel, bases, facilities, installations, and personnel against theft, sabotage, or espionage. Developments will be directed towards satisfying the Navy, Air Force and Army's Materiel Need (MN) for an interior security system (Facility Intrusion Detection System (FIDS)). Approach is to provide overall system overview via a "Systems Analysis and Control" task and to develop, under a number of other tasks, (1) sensors, including penetration, motion, item

removal, duress, and contraband; (2) electronic data links, data link security supervisory components, and centralized data processing components; (3) alarm display, monitoring, and readout components; (4) physical or psychological deterrent devices; (5) devices to protect cargo in depots or in transit by truck, rail, or ship; (6) standardized high security weapons containers; and exterior lighting and barrier subsystems; and (7) interfaces necessary to integrate exterior sensors developed by the Air Force and potentially shipboard security equipment components adopted by the Navy. In addition, there will be a continuing evaluation of commercial physical security equipment as well as those items that might be developed by other government agencies.

F. RELATED ACTIVITIES: This program leads into Engineering Development Program Element 6.47.18.A, Physical Security. The Interim Facility Intrusion Detection System is being developed under that program element to provide interior intrusion detection systems to all Department of Defense (DOD) elements. Related are the Army's Remotely Monitored Battlefield Sensor System (REMBASS) tactical sensor program, and the Air Force's Base and Installation Security System (BISS) exterior physical security program. Also related is the Army's Required Operational Capability for a Fixed Installation Exterior Perimeter Sensor System (FIEPSS). It is planned to satisfy the Army exterior requirement with the BISS program. Close coordination with REMBASS and BISS is being accomplished to assure utilization of related technologies and developments and to prevent duplication of effort. Coordination is accomplished by memberships of joint working groups and by attendance at other service and department meetings. The DOD Physical Security Equipment Action Group monitors and coordinates the development and acquisition of physical security equipment by all services. The Department of Army single point of contact is the Project Officer for Physical Security Equipment (POPSE) who monitors and coordinates the development, acquisition, integrated logistic support and installation of physical security systems.

G. WORK PERFORMED BY: The US Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA is assigned responsibility for Physical Security Research, Development, Test and Evaluation (RDTE). Other Government agencies currently involved are the US Army Test and Evaluation Command, Aberdeen, MD, and the US Army Natick Research and Development Command (NARADCOM), Natick, MA for development of secure containers. Major contractors are LaBarge Electronics Division, Tulsa, OK; GTE Sylvania, Mountainview, CA, and Aritech, Inc., Boston, MA.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Advanced development in pursuance of the approved Materiel Need for the Facility Intrusion Detection System (FIDS) was initiated during FY 1974 under PE 6.37.19.A, Special Purpose Detectors. A development plan was completed, concept formulation was demonstrated, and a Concept Feasibility In-Process Review was conducted in June 1974. The In-Process Review authorized full scale development of a Basic FIDS and continuing Advanced Development of an Advanced FIDS. During FY 1976 an analysis of physical security requirements was conducted including attack and threat scenarios, site functional requirements, and site parameters to insure development of physical security systems meeting both materiel and user requirements. The Engineering Development models of the FIDS sensors, power supply, and control, communication, and display subsystem (CC&DS) were tested and evaluated. Based upon this, the CC&DS was completed, reconfigured and rebuilt. The CC&DS can interface with both military and commercial seasors. Contracts were prepared and awarded for the Development Test II/ Operational Test II (DT II/OT II) models. In the cargo protection area, package alarms, vehicle trackers, electronic and

optical tagging techniques and remotely activated vehicle alarms were surveyed to determine suitability for use in a Facility Intrusion Detection System. In the equipment evaluation area, the major effort was in the evaluation of commercial and military equipment for use in FIDS. Countermeasure techniques were investigated and the threat reassessed.

2. FY 1978 Program: Not Applicable.

3. FY 1979 Planned Program: A Validation In-Process Review (VAL IPR) will be conducted for advanced FIDS capabilities prior to initiating Engineering Development of: surveillance devices, personal identification elements, and remote display capabilities. An Advance Development (AD) program will be initiated for the FIDS radio frequency (RF) data communication capabilities, response/deterrent capability, cargo security protection and highly secure locks and containers. In addition an Advanced Development effort will be started in the area of lighting and barrier systems. The purpose of this effort is to identify items which can meet military physical security requirements in the near range time frame and to identify improved lighting and barrier concepts which require additional development before they can be implemented. A VAL IPR will be conducted for selected components of the lighting and barrier subsystems. The ibcrease in funds is required to align this program with the Department of Defense effort to field a single effective physical security system in the 1981 timeframe.

4. FY 1980 Planned Program: The AD Program for RF data communication capability, response capability, cargo security protection and advanced locks and safes will be continued. Those lighting and barrier concepts identified as requiring additional development effort will undergo a detailed study to determine appropriate means of incorporating these concepts into demonstratable hardware.

5. Program to Completion: This is a continuing program. In FY81 and the outyears there will be a continuing effort to develop physical security hardware which is capable of countering the ever increasing sophistication of the threat to military personnel and property. Coordinated efforts with the other services will be directed towards integrating components/subsystems/systems developed under this Program Element into a completely integrated interior/exterior physical security system for DOD.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.06.A
Title: Identification Friend or Foe (IFF) Developments
DoD Mission Area: #444 - Tactical Combat Integration
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1064	544	3463	7185	Continuing	Not Applicable
D-243	Identification Friend or Foe (IFF) Developments	1064	544	1463	3685	Continuing	Not Applicable
D-297	NATO	0	0	2000	0	Continuing	Not Applicable
D-288	Common Reconnaissance, Survivability, Target Acquisition, Data Link (CRSTADL)	0	0	0	3500	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This advanced development (AD) effort is being performed to establish the feasibility of Identification of Friend or Foe (IFF) techniques and equipments that can be used to satisfy the need of the Army to identify ground targets in the Forward Combat Zone and aerial targets at both short and long ranges. The increasing ranges, accuracy, and capability to detect targets through smoke and haze has increased the need for early identification and engagement of foes. An identification capability is also required to increase the survivability of friendly forces in the turbulence of the modern battlefield. The potential applications include ground-by-ground (tank-by-tank), air-by-ground (air defense), and ground-by-air (tank-by-aircraft). Common Reconnaissance, Survivability, Target Acquisition, Data Link (CRSTADL) is required to provide a data link capable of operating in a high electronic countermeasures (ECM) environment in the 1985-1995 time frame.

C. BASIS FOR FY 1979 RDTE REQUEST: Work will be completed on a Tri-Service Study, for which the Army is the lead service, to gain approval of a NATO cooperatively developed signal format, which will be used in the direct component of the NATO Future Identification System. Development and acceptance of a standard signal format will ensure that the future identification systems of NATO allies are interoperable. As part of a cooperative effort with the Federal Republic of Germany (FRG), the German developed Battlefield Identification Friend or Foe (BIFF) equipment, Combat Active Passive Radar Identification System (CAPRIS), will be evaluated. A separate contract will be awarded for a study effort to define the configurations of BIFF equipment for various weapon systems. In the area of noncooperative identification of aircraft, a previously awarded computer simulation will be completed, and approvals will be sought for procurement in FY-80 of an advanced development model for testing with the improved HAWK Air Defense System.

Program Element: #6.37.06.A
DoD Mission Area: #444 - Tactical Combat Integration

Title: Identification Friend or Foe (IFF) Developments
Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to establish the technical and operational feasibility of equipments that can be used by weapon systems to positively identify as friend or foe targets they acquire and might attack. In order to ensure that the battlefield identification systems that are developed by NATO allies in the future are interoperable, e.g., a West German tank can identify American as well as other West German tanks as friends, a standard signal format is being jointly developed by NATO allies in fiscal year 1978. The Army was designated as the lead Service to develop this standard format, and in fiscal year 1979 is expected to test and obtain approval, e.g., frequency allocation, of the signal. A Memorandum of Understanding is currently being processed by the Federal Republic of Germany (FRG) and the United States that will result in the exchange of the specifications of the FRG developed Combat Active Passive Radar Identification System (CAPRIS) for American development specifications. If operational and technical evaluation of CAPRIS is favorable, advanced development (AD) models of CAPRIS will be procured for integration into US weapon systems. Air defense radars are currently equipped with the cooperative MARK XII Identification System. In fiscal year 1979, the Army plans to procure a development model of a noncooperative interrogator that will not require a response from an aircraft to identify it as a friend. This system makes use of developments made by the Navy, and will be configured so that it can be integrated into the existing MARK XII and augment information provided by it. Development of the Common Reconnaissance, Surveillance, Target Acquisition Data Link (CRSTADL), a common modular data link system which can be configured to meet specific system requirements for the post 1985 electronic countermeasure (ECM) threat, will begin in FY 1980.

F. RELATED ACTIVITIES: A Memorandum of Understanding is being negotiated by the Office of the Under Secretary of Defense for Research and Engineering with the United Kingdom for cooperative development of an improved version of the MARK XII, and with the Federal Republic of Germany for receipt of the CAPRIS specifications. Services coordinate identification activities through a coordinating group led by the Air Force.

G. WORK PERFORMED BY: In-house work is being performed by the US Army Electronics Research and Development Command, Fort Monmouth, NJ. Contractors that are expected to actively participate in the battlefield Identification Friend or Foe (IFF) development are SCOPE Inc, Reston, VA; Hazeltine Corporation, Greenlawn, NY; Teledyne Electronics, San Diego, CA; American Electronics Laboratory, Bluebell, PA; and Texas Instruments, Dallas, TX.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: In conjunction with the Memorandum of Understanding with the United Kingdom on the improvement of the MARK XII, a Tri-Service plan to measure the electronic countermeasure (ECM) vulnerabilities of the MARK XII was prepared. Demonstration of a Navy noncooperative signal processor with the MARK XII system of the improved HAWK showed that

the overall weapon reaction time could be improved by more than 35%. Two battlefield identification systems were fabricated for conceptual evaluation. One system interrogates with a laser and responds using the vehicle radio, the other used microwave interrogation and response. In FY 1977 the Army coordinated attendance of US representatives at the field demonstration of Combat Active Passive Radar Identification System (CAPRIS) in the Federal Republic of Germany.

2. FY 1978 Program: Serve as lead Service for development of the United States candidate for signal format of the direct component of the NATO future identification system. Measure electronic countermeasure vulnerabilities of MARK XII systems, and determine corrective action. Perform design simulation of incorporation of noncooperative device into MARK XII.

3. FY 1979 Planned Program: Complete coordination necessary to arrive at acceptance of the NATO standard signal format. Procure the developmental model of a noncooperative signal processor that is compatible with the MARK XII. In conjunction with cooperative development of Combat Active Radar Identification System (CAPRIS) with the Federal Republic of Germany if initial evaluations are favorable. The approximately $2.8 million increase in FY 1979 over FY 1978 is required to obtain models of the CAPRIS for test and evaluation, and begin configuration studies for battlefield identification.

4. FY 1980 Planned Program: Continue cooperative development of CAPRIS if operational and technical evaluation is favorable. Conduct Development Test/Operational Test I (DT/OT I) of noncooperative Identification Friend or Foe (IFF) system with improved HAWK air defense system. Initiate contract for models of the initial family of Common Reconnaissance, Survivability, Target Acquisition, Data Link (CRSTADL) common modules to meet advanced data link requirements and provide an evolutionary data link growth concept.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.07.A
Title: Communications Development
DoD Mission Area: #443 - Tactical Communications
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2917	2527	9754	13379	Continuing	Not Applicable
	Quantities						*
D137	Joint Tactical Information Distribution System Development	850	0	3700	3700	Continuing	Not Applicable
D245	Strategic Communications Development	1694	1655	3373	4075	Continuing	Not Applicable
D246	Tactical Communications Development	99	0	442	2330	Continuing	Not Applicable
D437	Tactical Radio Communications System	274	872	2239	3274	Continuing	Not Applicable

* Quantity of diversified items.

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Advanced Development of communications equipment and systems is conducted in this program to meet the strategic and tactical requirements of the Defense and Army communications systems. Emphasis is placed on the conversion of strategic communications systems from an analog to a digital capability. The program provides the technology to ensure that the next generation of communications equipment provides for the user a more effective and reliable data, voice, and record copy capability. Specific problems being addressed which limit current equipment capabilities include; lack of mobility, excessive setup/tear down time, system vulnerability to jamming and Electromagnetic Pulse, cost, electromagnetic spectrum congestion, and message handling time.

C. BASIS FOR FY 1979 RDTE REQUEST: Continue Joint Tactical Information Distribution System development and initiate Advanced Development contracts for Class 3 (manpack) terminals. Complete Advanced Development of a High Power Amplifier Tube required for the digital tropospheric scatter program in support of the Defense Communications System. Continue contracts for development of the Modular, Transportable, Recoverable Defense Communications System communication-electronics assets. Initiate Advanced Development contract for a Fiber Optic Local Distribution system. Continue tactical antenna, vehicular intercom, and audio transducer projects and initiate contract for development of a high power/low noise radio frequency amplifier for tactical radios. These single channel tactical net radio ancillery equipment efforts will improve the performance of current equipment and provide technical information and/or ancillery equipment for the Single Channel Ground and Airborne Radio System - Very High Frequency (SINCGARS-V).

Program Element: #6.37.07.A
DoD Mission Area: #443 - Tactical Communications

Title: Communications Development
Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The Joint Tactical Information Distribution System is a joint Service program to develop and acquire an integrated Communication, Navigation, Identification System which is secure and jam resistant. This system is a candidate for the Army's requirement for a short response time Communications, Navigation, and Identification System to support tactical command and control systems. In Strategic Communications Development, the primary emphasis is on conversion of the Defense Communications System to an all digital network and to interface Army communications systems with this network. Specific tasks include developing equipment in the areas of Digital Transmission, Data Terminals, Systems Control, and Digital Access Area Switch System. In Tactical Communications Development, the primary tasks are for Advanced Development of Subscriber Equipment, and Trunk and Loop Transmission Devices. The main thrusts are the development of the Tactical Automatic Message Entry Equipment which will automate the tactical communications center and thereby decrease the writer to reader time of narrative message handling; and the development of Fiber Optic Cables to eliminate the present vulnerable, costly, and unwieldy wire and cable communications systems. Advantages of millimeter wave transmission (low probability of interception, low power, wideband capability) will be used in a new line of lightweight tactical radios with signal hiding capability. Additionally single channel net radios, less Single Channel Ground and Airborne Radio System - Very High Frequency (SINCGARS-V), and their ancillery equipment are developed to improve the current capability and to provide ancillery equipment development information to Program Element 6.37.46.A, SINCGARS-V.

F. RELATED ACTIVITIES: Exploratory Development for this program is conducted in Program Element 6.27.01.A (Communications Electronics). As developments in this program proceed into Engineering Development, Program Element 6.47.01.A (Communications Engineering Development) applies. All efforts are closely coordinated with the efforts in Program Element 2.80.10.A (Joint Tactical Communications Program) and 6.37.46.A (SINCGARS-V). Coordination is accomplished by Department of Army reviews, through exchange of technical reports, and attendance at scientific meetings.

G. WORK PERFORMED BY: Contractors include: Varian Associates, Palo Alto, CA; Collins Radio, Dallas, TX; Hazelfine Corporation, Greenlawn, NY; Harris Corporation, Melbourne, FL; Corning Glass Works, Corning, NY; Cincinnati Electronics, Cincinnati, OH; and Signatron, Lexington, MA. In-house developing agencies are US Army Communications Research and Development Command and the US Army Communications System Agency, both of Fort Monmouth, NJ.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Participated in studies related to Army application of Joint Tactical Information Distribution System. Awarded concept development contracts for the Class 3 Joint Tactical Information Distribution System terminal for manpack and missile applications. Advanced Developmental models of the Tactical Automatic Message Entry Device were successfully tested in an European Field exercise and showed that the device can replace nine teletypewriters and operators, and reduce message processing time by 70 percent. A Letter of Agreement for Optical Cable Transmission Systems was approved by the combat developer in order to initiate Advanced Development. Field tests for a 38 gigahertz millimeter wave radio were initiated. Advanced Development of an efficient, reliable High Power Amplifier Tube and Adaptive Antenna Control System, both

for digital tropospheric scatter application, was completed. Prepared for award of contract on the Access Area Digital Switch System. Continued efforts on a low profile vehicular antenna for armor vehicle application, a transceiver multicoupler to reduce the number of radiating antennas, a noise cancelling microphone for use in tanks, capacitive tuning element for greater antenna efficiency and initiated development of a vehicular intercom system.

2. FY 1978 Program: Congress deleted FY 1978 funds for Joint Tactical Information Distribution System, pending completion of Air Force development which has been accomplished. Army plans, with Congressional approval, to utilize unobligated FY 1977 funds to sustain the program office in FY 1978 while reprograming for FY 1978 funds to permit continuation of concept development contracts to completion, determination of a solution to the need for a Tactical Information Distribution System, and to achieve joint Service interoperability. Complete testing of Adaptive Antenna Control System and Amplifier Tube. Initiate contracts for a design plan for the Access Area Digital Switch System and Amplifier Tube. Initiate contracts for development of modularized transportable Defense Communications System Facilities designed for rapid deployment and recoverability. Continue prior efforts and monitor established contracts for Single Channel Radio ancillery devices. In particular, the intercom effort is essential for Single Channel Ground and Airborne Radio System - Very High Frequency (SINCGARS-V) and has to be available for SINCGARS-V test and evaluation.

3. FY 1979 Planned Program: Initiate Advanced Development in the Tactical Information Distribution System arena for the Class 3 (manpack) terminal. Complete Advanced Development of the Amplifier Tube. Integrate results of the Adaptive Antenna Control System and Amplifier Tube and prepare specifications for future Engineering Development. Continue contracts for modularized transportable, recoverable equipment. Complete contracts for competitive development of designs for Access Area Digital Switch System. Initiate Advanced Development contract for Fiber Optic Local Distribution System. Complete Outline Development plan and initiate contract for a Long Haul Fiber Optic Cable System. Prepare a Letter of Agreement for millimeter wave radio. Continue developments started in prior years and test two prototype vehicular intercom systems and select one intercom system for advancement into Engineering Development. Increase in FY 1979 funds over FY 1978 is due to increased contractual efforts.

4. FY 1980 Planned Program: Continue effort on Tactical Information Distribution System Class 3 (manpack) terminal development and Army applications effort. Initiate contracts for digital tropospheric scatter upgrade using Adaptive Antenna Control System and Amplifier Tube. Complete contract for concept development for Data Terminal, test alternate power source systems, systems control devices, and modularized configurations for transportable, recoverable equipment. Develop test bed and test candidate systems for Access Area Digital Switch System. Contract models of the Fiber Optic Local Distribution system will be field tested with the AN/TTC-39 Joint Tactical Communications Program Switch. Contract development will start on the Long Haul Fiber Optic Cable System. Prepare specifications for the millimeter wave radio. Continue with vehicular intercom, and audio transducers, and other ancillery equipment from previous year effort.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.11.A
Title: Aircraft Electronic Warfare (EW) Self-Protection Equipment
DoD Mission Area: #445 - Electronic Warfare/Counter C^3
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT					Continuing	Not Applicable
DB52	Aircraft Survivability Equipment (ASE)					Continuing	Not Applicable
D653	Aircraft EW Self-Protection (AEWSP) Equipment					Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element (PE) develops the technology and supports the systems engineering/effectiveness efforts which will provide US and allied aircraft with the needed protection or staying power to counter the known and changing threat air defenses. The technical feasibility/military potential is established for passive and active countermeasures (in prior years, active and passive were separate PEs 6.32.08.A/DB52 and 6.37.11.A/D653) against infrared, optical, laser and/or radar-directed threats. The program is the continuation of an urgent, deliberate, proven approach directed to achieve the survivability required to accomplish the attack, assault, and special electronic mission aircraft (SEMA) mission requirements. The program was structured to eliminate Service duplication and to reflect the Army's responsibility of the Tri-Service Memorandum of Agreement reached in 1977. This program responds to the Required Operational Capability (ROC) for Aircraft Survivability Equipment (ASE). ASE is needed for both current and developmental Army aircraft in order to accomplish combat missions. ASE increases combat effectiveness by reducing or eliminating the ability of threat air defense systems to detect, hit, damage or destroy Army aircraft.

C. BASIS FOR FY 1979 RDTE REQUEST: The principle component efforts are directed at Development Test (DT)/Operational Test (OT) I for optical warning, location and detection (OWL/D) equipment; initiating advanced development of an advanced surface-to-air missile (SAM) countermeasure jammer for special electronic mission aircraft (SEMA); and completion of light shade of (desert/arctic) laser countermeasures investigations. Threat exploitation and infrared measurements and effectiveness evaluations for required infrared suppressor and jammers will continue. The increase funding reflects Under Secretary of Defense for Research and Engineering (USDRE) and Army interest in providing countermeasures for SEMA.

Program Element: #6.37.11.A
DoD Mission Area: #445 - Electronic Warfare/Counter C^3

Title: Aircraft Electronic Warfare (EW) Self-Protection Equipment
Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: Not applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: This program element (PE) combines two advanced development (AD) projects managed by the Army Project Manager for Aircraft Survivability Equipment (PM-ASE) in FY 1979: PE #6.32.08.A/DB52, Aircraft Survivability Equipment (ASE); and PE #6.37.11.A/D653, Aircraft Electronic Warfare Self-Protection (AEWSP) Equipment. Both projects were initiated after the Soviets introduced the SA-7 shoulder fired surface-to-air missile (SAM) in the Mideast. The objectives of DB52 ASE concentrated on systems engineering, signature reduction, infrared (IR) suppression, effectiveness measurements and evaluations, and ballistics hardening, or vulnerability reduction. Project D653 AEWSP developed warning devices and active IR, optical and radar countermeasures. In 1972 the SA-7 was used against Army helicopters in Vietnam which were quickly equipped (within 4 months) with IR suppressors and low reflectance paint developed under DB52 ASE. The success of the suppressors provided credible evidence of tactical helicopters operating against surface-to-air missiles. This success, coupled with demonstrations of the ability to jam almost any known IR threat missile (IR jammer) and to defeat any known tactical air defense radar (radar warning receiver), formed the basis for expanding the ASE program in all technological areas as well as balancing the funding in advanced development, engineering development and production. The objectives are maintained in the combined PE and address the technology to counter threat systems which include all radar, infrared and optical/laser-directed weapons. The resultant program established in 1974-75 is on schedule.

F. RELATED ACTIVITIES: This program is conducted in conjunction with PE 6.47.11.A, Aircraft Electronic Warfare (EW) Self-Protection Systems, also managed by PM-ASE, and PE 6.32.15.A, Joint Survivability Investigations, of which PM-ASE is the Senior Army Representative. In 1977, the Services signed a Memorandum of Agreement outlining the following responsibilities for Tri-Service development and production of the following aircraft EW self-protection (AEWSP) systems for helicopters and selected fixed-wing aircraft: (1) Army: Radar warning receivers, radar jammers, infrared (IR) jammers for small helicopters, pulse doppler missile warning detectors and laser warning receivers; (2) Navy: IR jammers for large helicopters, continuous wave (CW) radar jammers and ultraviolet (UV) missile warning detectors; and (3) Air Force: IR missile warning detectors for fixed-wing and selected large helicopters. International coordination is achieved through North Atlantic Treaty Organization (NATO), NATO Army Armaments Group (NAAG) and Quadripartite Working Groups.

G. WORK PERFORMED BY: US Army Aviation Research and Development Command (AVRADCOM), St. Louis, Missouri; US Army Electronics Research and Development Command (ERADCOM), Electronic Warfare Laboratory (EWL), Fort Monmouth, New Jersey; US Army Armament Research and Development Command (ARRADCOM), Dover, New Jersey. Contractors: Sanders Associates, Inc., Nashua, New Hampshire; ITT Corporation, Nutley, New Jersey; TRACOR, Inc., Austin, Texas; Hughes Helicopter, Culver City, California; Aerojet Electrosystems Company, Cincinnati, Ohio; Riverside Research Institute, New York, New York; Calspan Corporation, Buffalo, New York, Perkin Elmer, Norwalk, Connecticut; Applied Technology, Inc., Mountain View, California.

Program Element: #6.37.11.A
DoD Mission Area: #445 - Electronic Warfare/Counter C^3

Title: Aircraft Electronic Warfare (EW) Self-Protection Equipment
Budget Activity: #4 - Tactical Programs

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: In response to the Soviet SA-7 surface-to-air missile introduced into Vietnam in 1972, infrared (IR) suppressors and paint were produced from advanced development (AD) models and applied to attack, observation and utility helicopters. These were successful in reducing the effectiveness of the SA-7 virtually to zero and convincingly proved that Army aircraft could survive against sophisticated infrared (IR) missiles. In 1976, improved versions of these IR suppressors were fielded to front line US tactical aircraft in Germany, Korea and the United States. Advanced development (AD) was completed and engineering development (ED) was initiated for IR suppressors for growth threats for the following aircraft: OH-58 (FY 1975), OV-1 MOHAWK (FY 1975), AH-1 COBRA (FY 1977), RU-21 GUARDRAIL (FY 1977). IR jammers applicable to attack, observation and utility helicopter including AH-64 and UH-60 BLACK HAWK completed AD FY 1975; and doppler missile detector, FY 1977. An advanced radar warning receiver, AN/APR-39(V)2, for special electronic mission aircraft (SEMA), completed AD in FY 1976 as did a dual purpose chaff and flare dispenser and tactical aircraft radar jammer. An optically designed flat plate canopy, which reduced sun glint, was completed and entered ED in 1975 for the AH-1 and OH-58 aircraft. An improved light shade of IR paint modeled after an Air Force development, was initiated for ED in 1977 for SEMA. AD of the optical warning, location and detection (OWL/D) system and laser warning receiver started in 1976. In summary, Aircraft Survivability Equipment (ASE) in each technological area is proceeding through AD as scheduled through FY 1977.

2. FY 1978 Program: The ASE AD program for FY 1978 will continue ballistic hardening of the AH-1S transmission. The OWL/D system is scheduled for delivery for development and operational tests. The laser warning receiver (LWR) will complete AD testing and enter competitive ED. The LWR is compatible with and interfaces with the basic radar warning receiver (RWR), the AN/APR-39(V)1. In addition, IR field measurements and evaluations for ongoing IR suppressor and IR jammer programs will continue.

3. FY 1979 Planned Program: In FY 1979 test measurements and infrared (IR) effectiveness evaluations will be conducted for required ongoing IR development programs. Residual test and analysis for the optical warning, location and detection (OWL/D) system will be conducted and the supporting development of the ultraviolet missile warning detector will be continued. Exploitation of threat systems will be pursued for changes/improvements required primarily of radar aircraft survivability equipment and investigations will continue on laser countermeasures posed by threat weapons. Advanced development (AD) of light colored low reflectance IR paint for desert and arctic operations will be continued. Development of a countermeasure for advanced surface-to-air-missiles (SAM) such as the SA-4 will be initiated for special electronic mission aircraft (SEMA). This development has Under Secretary of Defense for Research and Engineering (USDRE) interest.

4. FY 1980 Planned Program: In FY 1980, signature measurements and effectiveness evaluations and systems analysis to support present fleet and BLACK HAWK, AH-64, Advanced Scout Helicopter and their survivability hardware developments will be continued. Initiate developments of advanced chaff expendable for special electronic mission aircraft (SEMA). Continue

radar exploitation and advanced surface-to-air-missile (SAM) jammer development program. Countermeasures developments for antitank guided missiles and optical jammers to complement optical warning, location and detection (OWL/D) systems will be initiated. Investigate systems to counter beamrider missiles.

5. Program to Completion: This is a continuing program. The aircraft survivability equipment and electronic warfare self-protection countermeasures advanced development programs respond to stated user requirements and threat documentation. The requirements and threats are reviewed on a continuing basis by the Aircraft Survivability Equipment (ASE) Permanent Steering Group (PSG) with broad representation from the US Army Training and Doctrine Command (TRADOC) and US Army Materiel Development and Readiness Command (DARCOM). Interservice review is accomplished in accordance with the Tri-Service Memorandum of Agreement by the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS).

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FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.12.A Title: Mapping and Geodesy
DoD Mission Area: #446 - Navigation, Positioning and Related Systems Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	929	143	4282	4631	Continuing	Not Applicable
	Quantities						Not Applicable
D580	Field Army Mapping	3	26	798	831	Continuing	Not Applicable
D673	Field Army Surveying	536	117	1774	2000	Continuing	Not Applicable
D862	Terrain Data Developments	390	0	210	300	Continuing	Not Applicable
DT44	Army Terrain Information System	0	0	1500	1500	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objectives of this advanced development program are to develop techniques, software, and equipment for Army mapping, surveying, and military geographic intelligence activities in direct support of Field Army tactical deployment of forces and weapon system operation. Major elements of the program include the development of an Army Terrain Information System, an Analytical Photogrammetric Positioning System, a Miniaturized Gyrocompass, Forward Area Survey Equipment, and advanced components to upgrade the Topographic Support System. This program addresses present deficiencies in the Army's capability to provide topographic data and field artillery fire control positioning in a timely manner, consistent with rapid and effective combat operations.

C. BASIS FOR FY 1979 RDTE REQUEST: FY 1979 funds are required to: complete fabrication and testing of the prototype Analytical Photogrammetric Positioning System; continue advanced development of special map products displaying geographic information pertinent to combat operations; begin contract fabrication of the prototype Quick Response Multicolor Copier; initiate advanced development of the Miniaturized Gyrocompass; and begin contractual development of the Army Terrain Information System (ARTINS).

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The objectives of this program are the development of techniques, materiel, and equipment to support rapid acquisition, processing and dissemination of position location, mapping, and other terrain data. These objectives are in direct support of the tactical deployment of forces and the operation of weapons systems. This program element includes work on the following systems: (1) development of a prototype Advanced Analytical Photogrammetric Positioning System (AAPPS) which will rapidly provide accurate position coordinates of friendly units and target locations; (2) development of an Army Terrain

Information System (ARTINS), which will support and be an integral part of the Automated Tactical Data System for the Army in the field and satisfy field commander requirements for terrain and topographic information; (3) development of a Quick Response Multi-color Copier which will permit rapid reproduction of relatively small quantities of topographic products; (4) development of a Factor Map Synthesizer which will speed up and simplify preparation of special topographic products in the field; (5) development of an Advanced Map Update Capability to speed up and simplify map revisions in the field; (6) development and validation of experimental specialized "topical" map products which will provide improved legibility and better understanding of terrain effects on operations; (7) development of a Miniaturized Gyrocompass which will permit forward observers to obtain more accurate azimuths and thereby locate targets more accurately; and (8) development of vehicle-mounted forward area survey equipment which will be capable of meeting the essential requirements of the Position and Azimuth Determining System.

F. RELATED ACTIVITIES: The Army works directly with Air Force, Navy, and Marine Corps, and under the coordination of the Defense Mapping Agency (DMA) and the Under Secretary for Defense Research and Engineering in the functional area of Mapping and Geodesy. Specific related program elements are as follows: DMA Program Element 6.37.01.B, Mapping, Charting, and Geodesy Investigations and Prototype Development; DMA Program Element 6.47.01.B, Mapping, Charting, and Geodesy Engineering Development and Test; Army Program Element 6.27.07.A, Mapping and Geodesy; and Army Program 6.47.16.A, Mapping and Geodesy.

G. WORK PERFORMED BY: This program is the responsibility of the US Army Engineer Topographic Laboratories (USAETL) at Fort Belvoir, VA. The major contractors are: Litton Systems, Incorporated, Woodland Hills, CA; IDEAS, Incorporated, Beltsville, MD; Bausch and Lomb, Rochester, NY; DBA Incorporated, Melbourne, FL; and Dell Foster, San Antonio, TX. Support for ARTINS software development and mobility modeling are provided by the US Army Computer Systems Command, Fort Belvoir, VA, and the Army Engineer Waterways Experimental Station, Vicksburg, MS, respectively.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Initiated development of prototype special map products especially designed to support infantry and airmobile operations in hostile areas. Designed, developed and tested prototype Position and Azimuth Determining System (PADS). Completed fabrication and testing of specialized map products which support battlefield sensor operations. Completed testing, evaluation and trade-off analysis for jeep-mounted PADS, completed studies establishing feasibility of helicopter-mounted PADS. Initiated advanced development of an in-house digital image correlation facility to support PERSHING II target reference scene generation experiments. Completed fabrication and testing of initial set of experimental map products for operations in built-up areas. Initiated contractual work for design and fabrication of experimental Advanced Analytical Photogrammetric Positioning System (AAPPS). Completed component studies for development of a Forward Observer Vehicle (FOV) kit. Initiated systems study and data elements dictionary compilation for Army Terrain Information System.

Program Element: #6.37.12.A Title: Mapping and Geodesy
DoD Mission Area: #446 - Navigation, Positioning and Related Systems Budget Activity: #4 - Tactical Programs

2. FY 1978 Program: Advanced development of Quick Response Multicolor Copier will be initiated. Contractual work for fabrication of AAPPS will be completed, and equipment testing will commence.

3. FY 1979 Planned Program: Initiate contractual development of applications programs and supporting software required for validation of ARTINS advanced development model. Complete update of ARTINS data elements dictionary and finalize Outline Development Plan. Complete documentation to support ARTINS engineering development, to include the Best Technical Approach (BTA) and a Cost and Operational Effectiveness Analysis (COEA). Complete design and fabrication of additional selected "topical" graphics and initiate field testing. Initiate operational testing of cathode-ray tube-type map display to determine applicability to ARTINS. Complete development testing of the Advanced Analytical Photogrammetric Positioning System (AAPPS). Contract for design and fabrication of a prototype Quick Response Multicolor Copier. An increase over the FY 1978 funding level is needed to start the new tasks and fund contract development of the copier.

4. FY 1980 Planned Program: Procure hardware and software for Army Terrain Information System (ARTINS) advanced development model. Complete software integration on ARTINS needed for Development Test/Operational Test (DT/OT) I. Publish Final ARTINS data elements dictionary. Complete operational testing of CRT-type map displays and prepare documentation needed for initiation of engineering development. Transfer development of the Advanced Analytical Photogrammetric Positioning System into engineering development. Continue contract development of the Quick Response Multicolor Copier. Begin advanced development of a Factor Map Synthesizer, a Forward Area Survey Equipment and a Miniaturized Gyrocompass for forward observers, and contract for development of prototype models of each. Increase in funds for FY 1980 is needed to fund a full year on contract development of the Multicolor Copier and to initiate the new tasks.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.22.A
Title: Tactical Operations System (TOS)
DoD Mission Area: #444 - Tactical Combat Integration
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4240	6777	100	100	Continuing	Not Applicable
	Quantities						Not Applicable
D494	Tactical Operations System	4240	6777	100	100	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Tactical Operations System (TOS) is a computer assisted command and control system which increases significantly, the capability of ground combat commanders and their staffs to manage the employment of Army combat power. Highly sophisticated automated intelligence and combat systems are being fielded to obtain information needed by Corps and Division Commanders and Staffs to see the battlefield more clearly to greater depth. The volume of required information generated by these systems is such that current manual procedures cannot meet existing requirements. TOS provides the automated assistance required to collect, process, store, display, retrieve, and disseminate this volume of data quickly to provide commanders accurate, up-to-date information on status, deployment and capabilities of friendly and enemy forces.

C. BASIS FOR FY 1979 RDTE REQUEST: Division level TOS is expected to transition to Engineering Development in January 1978. Development of TOS at Corps level is expected to evolve from experience at division level. Requirements for Corps TOS are being studied now by the US Army Combined Arms Command Development Agency. The 1979 funds allow the Project Manager, US Army Tactical Data Systems to scope the Corps TOS plan for advanced development. Major milestones for Corps TOS will be determined in the Army Systems Acquisition Review Council/Defense Systems Acquisition Review Council processing in early 1978.

D. OTHER APPROPRIATION FUNDS: Not applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: Advanced development for TOS at division level will be performed in this program element (PE) through FY 1978. Division level TOS is planned to enter full scale engineering development in January 1978 and a complete description of that effort is shown in PE #6.47.49.A, Project D197, Tactical Operations System. Development of TOS for Corps will draw heavily on experience and data gained from the development of TOS at Division level. Requirements for Corps TOS are currently being defined by the US Army Combined Arms Center, Fort Leavenworth, KS. Preliminary Corps TOS advanced development functional requirements will be available in 1978 with requirement definition continuing.

Program Element: #6.37.22.A Title: Tactical Operations System (TOS)
DoD Mission Area: #444 - Tactical Combat Integration Budget Activity: #4 - Tactical Programs

F. RELATED ACTIVITIES: Engineering development (ED) for division level TOS is funded in Program Element (PE) #6.47.49.A, Project D197, Tactical Operations System. Corps TOS is expected to interface with Division TOS; the Air Defense Command and Control System, AN/TSQ-73; worldwide communications systems; and intelligence producing systems. Equipment being developed for use in Division TOS and related activities to Division TOS will be related to Corps TOS. The Project Manager, Army Tactical Data Systems (PM ARTADS), will manage this program to preclude duplication of effort. PM ARTADS provides liaison with other Services to ensure a continuous dialogue between system developers.

G. WORK PERFORMED BY: Overall coordination will be provided by Project Manager, Army Tactical Data Systems (PM ARTADS), US Army Communication Research and Development Command (CORADCOM), Fort Monmouth, NJ. Contractors have not been selected for the Corps TOS system.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: During the period 1964-1969, the Army developed an experimental TOS in Europe under the direction of US Army Europe (USAREUR/7th Army) using commercial equipment and contractual personnel to evaluate the feasibility and desirability of the TOS concept at Field Army and Corps levels. These experiments became known as EUROTOS. Based on results from these tests, the Army directed its efforts toward the development of a system for the division and its subordinate units. In 1970, hardware and software packages were moved from Europe to Fort Hood, Texas, and the experimental system was renamed the Development TOS (DEVTOS). In February 1972, DA approved the TOS Systems Engineering Study (SES) which defined the hardware and software specifications for the TOS Operable Segment (TOS^2) test bed and authorized the procurement of tactical fire direction system (TACFIRE) hardware to satisfy the test bed hardware requirements. It was also determined that although TACFIRE hardware purchased for TOS^2 could be considered ED equipment, the software was not developed and the program was more accurately described as advanced development (AD). At the time of the SES approval, the Army further decided that the TOS^2 software would be developed in-house by the US Army Computer Systems Command (USACSC). The software effort began in February 1972, and the TOS^2 hardware contract was awarded to Litton Industries in June 1972. The TOS Development Concept Paper (DCP) was approved by the Office of the Secretary of Defense in September 1972. The FY 1973 effort was devoted to the TOS^2 hardware fabrication and software development. In June 1973, the first increment of the TOS^2 hardware for Software Support System (SSS) was delivered on schedule. In FY 1974, the major effort continued to be the area of software development and completion of the hardware development contract. In August 1973, Director of Defense Research and Engineering was notified of an anticipated 9 month slippage of the software acceptance milestone and a potential 3 month breach of the DCP schedule thresholds. A program review resulted in a revised milestone schedule which slipped the program 9 months and a revised funding profile, which increased Phase I costs but kept the total RDTE cost estimate constant. A revised DCP was approved in June 1974. In October 1974, the TOS Operable Segment (TOS^2) hardware delivery was completed and accepted by PM ARTADS at Fort Hood, TX. Also in October 1974, the Army reevaluated the USACSC capability to complete the design and production of the TOS^2 software. This resulted in a 3 year contract for software development assistance to Auerbach Associates, Incorporated Philadelphia, PA. Software development continued throughout FY 1975.

Program Element: #6.37.22.A
DoD Mission Area: #444 - Tactical Combat Integration

Title: Tactical Operations System (TOS)
Budget Activity: #4 - Tactical Programs

The major thrust of FY 1976 was to continue TOS Operable Segment (TOS^2) development and hardware integration. In February 1976, Force Development Test and Evaluation, FM 120 was initiated; however, it was suspended in April 1976 due to software problems. Following the suspension, the major emphasis during the July-September 1976 time frame was to improve the TOS^2 software package in preparation for software/hardware integration testing to conduct development test/operational test (DT/OT) during FY 1977. OT I was conducted April-July 1977. Data was gathered for validation of the TOS concept. Test data is being analyzed, cost estimates are being completed, and other analyses are being finalized for presentation to Defense System Acquisition Review Council (DSARC) II, scheduled for January 1978.

2. FY 1978 Program: The DSARC will be conducted in January 1978 to review the program. Funds are programmed to implement decision for engineering development (ED) for Division TOS. All experimental work will be performed and the system will be ready for full scale development. Equipment will be purchased for the software support center to upgrade software based on OT I results. Contracts for purchasing prototype hardware and software will be completed. Work willbegin on training and logistics packages along with training publications leading to OT II in 1980. The study of requirements and their definition for Corps TOS will continue to be performed by the US Army Training and Doctrine Command.

3. FY 1979 Planned Program: The decrease in funds is due to Division TOS being continued in program element 6.47.49.A, Tactical Operations Systems. The funds in FY 1979 allow the Project Manager, Army Tactical Data Systems (PM ARTADS), to plan for Corps TOS development and begin scoping size of the development program and necessary resources.

4. FY 1980 Planned Program: Funding provides for PM ARTADS to continue planning for Corps TOS development and conduct of technical feasibility analysis. Additional funds will be programmed if necessary based on requirements defined by US Army Combined Arms Center, Fort Leavenworth, KS., during 1978. The cost and operational effectiveness analysis required operational capability should be complete.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.23.A Title: Command and Control
DoD Mission Area: #444 - Tactical Combat Integration Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	10386	8257	10984	19759	Continuing	Not Applicable
D101	Integration of Army Tactical Data Systems	10386	8257	10984	19759	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The full combat effectiveness of the various automated tactical data systems currently being developed and fielded can only be realized by insuring interoperability between those data systems. To provide the tactical commander with an accurate, up to date portrayal of the battle situation, data from many systems must be combined, correlated and displayed quickly and accurately. These processes can only be accomplished if the standards, methodologies, procedures, and equipment required to establish data system interoperability are developed and implemented. This is required to permit data generated by one system to be transmitted to and correctly interpreted by other systems which further process and correlate that data. In addition, the ever increasing costs being incurred in developing and maintaining the software for emerging tactical data systems must be halted if those systems are to be cost, as well as operationally, effective. This program pursues the goal of interoperability through the provision of a disciplined engineering approach, integrating the development of Army tactical system interoperability efforts in a coherent total program directed towards enhancing the capability of the ground commander in the execution of his command, control and coordination functions. This approach will ensure the attainment of interoperability with a minimum of extraneous translation devices and special purpose software. This program pursues the goals of reduced software costs and obtaining the latest low cost technology through adaption of existing commercial equipment and development of common standardized automated data processing equipments, and higher order programing languages for use by the Army's application system developers and project managers for major system programs, including TSQ-73 Missile Minder and Tactical Operations System. The program content is coordinated under the joint Service Research and Development Technology Panel to the Office of the Secretary of Defense (OSD) Management Steering Committee, and as such is integrated, interlocking and responsive to DoD-wide deficiencies. New technology initiatives with Army-wide payoff will be demonstrated; commercial technology will be extended to satisfy requirements in military environments; and tactical computer-based components, including memories, interactive displays and processing hardware will be improved. Efforts are specifically focused to provide tools and equipments to enhance the capabilities and efficiency of programers and program managers, establish standardization whenever viable, and to explore advanced architectures.

C. BASIS FOR FY 1979 RDTE REQUEST: Continue development of a computer emulation system. An emulation system is needed to test interface designs, interoperability, and software efficiency of Tactical Data Systems. The testing of concepts using this emulation test bed will reduce considerably resources presently required by operational system tests. Emulation further reduces cost and

time required in evaluating commercial technology for tactical applications. A primary effort will be the continuation of the joint Service Military Computer Family (MCF) effort to standardize hardware and software capabilities among the Services. A major FY 1979 thrust will be acceleration of new proven software advances utilization by program managers and defense contractors. Quality enhancing tools for the standard tactical higher order language (TACPOL) will be developed for use by the Tactical Fire Direction System (TACFIRE), TSQ-73 (Missile Minder), and Tactical Operations System Project Managers in the development of more responsive application programs. Requirements and costs for interoperability and interface design for battlefield computer systems and tactical information distribution systems will be identified and refined.

D. OTHER APPROPRIATION FUNDS: Not applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: Recent studies by the Army in coordination with the Department of Defense have established that a major portion of the problems experienced in weapon system development is directly attributable to development and timely delivery of software. This program, in support of a new defense program initiative underway to define and implement new software policies and procedures, refines, evaluates, and applies new advanced software tools and techniques; instilling an engineering discipline with vigor similar to that characteristic of hardware development programs. Further, it ensures integration of Army tactical data systems through a systems approach to develop and enhance components and subsystems (both hardware and software) for integration into Army data systems. The installation and expansion of the Center for Tactical Computer Sciences Teleprocessing Design Center for multiple system interoperability demonstrations through emulation is included in this program, as well as the development, testing, and technology insertion of system elements having application to the family of tactical data systems supporting the ground commander within the context of command and control. Technology equipment advancements accomplished under this program are infused into ongoing automated system developments being performed by Army developers, including the Tactical Operations System (TOS), TACFIRE, and PATRIOT Air Defense Missile Project Managers. Development of a standardized software compatible family of military computers and a single set of standardized higher order languages, as well as other technology initiatives in support of the objectives of the Department of Defense (DoD) Management Steering Committee for Embedded Computer Resources, are also funded under this program.

F. RELATED ACTIVITIES: This program is related to the Tactical Operations System (6.37.23.A), the Tactical Operations System (6.47.49.A), Communications-Electronics (6.27.01.A), Computer Information Sciences (6.27.25.A), and Automatic Data Processing Equipment Developments (6.37.03.A). With the establishment of the US Army Communications Research and Development Command, the US Army Center for Tactical Computer Sciences is now responsible for Program Elements (PEs) 6.37.23.A and 6.37.03.A. These programs have been combined under PE 6.37.23.A effective FY 1979. This PE, together with PEs 6.27.25.A (Computers and Information Sciences) and 6.27.01.A (Communications-Electronics), and the other Service-related PEs - 6.27.21.N (Command and Control Technology), 6.35.21.N (Surface Electronic Warfare), 6.27.02.F (Command, Control, Communications), 6.22.04.F (Aerospace Avionics), and 6.37.28.F (Advanced Computer Technology) - constitute the DoD Software Science and Technology Program.

G. WORK PERFORMED BY: Activities are the responsibility of the Center for Tactical Computer Systems, US Army Communications Research and Development Command (CORADCOM), Fort Monmouth, NJ. Contractors performing work under this project include: Systems Development Corporation, West Long Branch, NJ; Singer Librascope, Glendale, CA; Litton Industries, Van Nuys, CA; Magnavox, Fort Wayne, IN; and Control Data Corporation, Minneapolis, MN.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: This project was initiated in FY 1972. Since that time, it has been used to: create, enhance, and operate the Teleprocessing Design Center, a facility for systems interoperability investigation and demonstration based on actual emulation of tactical systems on a microprogramable multiprocessor system; develop a Digital Message Device, a microprocessor-based fully militarized source data entry instrument for use by a variety of tactical data systems, furthering the Department of Defense (DoD) goal of standardization and common integrated logistics support; initiate development of a Tactical Computer System for use as a stand-alone militarized processor or powerful computer-based tactical terminal for generalized application; and initiate development on an all electronic Interactive Tactical Display System to meet group display requirements. The Digital Message Device was developed competitively with two contractors participating in the advanced development (AD) phase. The Tactical Display System (TDS), a project jointly funded and administered by the German Ministry of Defence and the US Army, is currently progressing through the AD phase, with Litton Industries and Control Data Corporation as developers competing with divergent but promising display technologies. The TDS will utilize symbology being developed by the North Atlantic Treaty Organization (NATO) panel on automatic data processing (ADP) systems for command and control at echelons under national responsibility, (AC 225/Panel XIII), ensuring the correct interpretation of graphic representations by all NATO members. This program also affords the Center for Tactical Computer Sciences the ability to continue systems engineering support for developers in specialized computer-related areas, maintenance and support of the Telecommunications Design Facility, and specialized efforts in system security.

2. FY 1978 Program: The Military Computer Family (MCF) FY 1978 effort is focused on development of a militarized emulator system for processing Tactical Fire Direction System (TACFIRE) software, system producibility and integration plans for multiple module suppliers for selected Army and other Service tactical data systems, and instruction set planning and control for the selected MCF standard architecture. Effort will continue on the joint German/US development of the interactive large area display which, when completed, will permit the accurate transfer of graphic information from one point to another; a battlefield interoperability terminal design based on the Digital Message Device; test and evaluation of an intelligence analyst console; extension of the Digital Message Device into a miniterminal configuration, and the specification of a flexible Interface Message Device. The integration of common support software and establishment of a support software control facility is included with this program as well as the maintenance and technical services required to keep the Teleprocessing Design Center (TDC) emulation system in operation. The TDC will also be interfaced with the Advanced Research Projects Agency (ARPA) network for the purpose of testing new concepts in information distribution and exchange. A militarized version of a commercial disk system will be installed with the TDC to examine its potential for use with tactical data systems requiring increased storage capacity.

Interoperability testing of the Tactical Display System, Tactical Fire Direction System and other tactical data systems will be continued, and the Teleprocessing Design Center system expanded as required. Through the systems engineering contract, support in the specific areas of interoperability planning and system acquisition guidelines will be furnished to developers. Development of a test bed will be initiated for evaluating the feasibility of retaining and transmitting technical, doctrinal, and instructional material, normally furnished in hard copy form, through electronic media.

3. FY 1979 Planned Program: The goal of the Military Computer Family (MCF) program is to develop a hardware architecture that permits the transfer of software from one technology generation to another in order to permit upgrading without sacrificing software programs already written, and still provide for vendor competition and broad application. Efforts in FY 1979 will be directed towards defining the degree of standardization and examining the MCF's feasibility, concentrating on system producibility and integration plans for additional standard Army prior generation systems and validation of form, fit, and function specifications for the standard Army architecture. The contract for instruction set architecture planning and control will continue and contracts for built-in test and security features will be initiated. Advanced development (AD) effort on the Intelligent Family of Terminals, to include the Battlefield Interoperability Terminal and Intelligent Analyst Console, will be continued with special emphasis on achieving standard interfaces for incorporation into the MCF of processors for specified equipment. Design of the Interface Message Device will be finalized. The Teleprocessing Design Center (TDC) maintenance and services contract, support software integration control, and enhancement effort, Advanced Research Projects Agency (ARPA) network test bed for information distribution system analysis, and existing fire control/operations/intelligence systems interoperability assessments, requirements and demonstrations will be carried out in concert with this program. Computer resource management standards and formal training to be conducted within Army training schools will be partially funded by D101 (Integration of ARTADS). Examinations of potential methods and media for preparing, presenting, and distributing technical, doctrinal, and instructional data will be carried out using the TDC emulator as a test bed. Increased funding level in FY 1979 is due to increased resources being provided to support the Army's MCF program and the consolidation of Program Element 6.37.03.A (Automatic Data Processing Equipment Developments) into this program.

4. FY 1980 Planned Program: The MCF programs for an updated tri-Service market survey of computers and terminals to determine areas and quantities involved in the MCF standardization effort, system producibility and engineering studies for additional members, architecture planning and standardization, instruction set planning and standardization, and built-in test and security systems planning will continue. The intelligent terminal family, ranging from handheld devices to large screen displays will be continued, as well as examination of smart microprocessor-driven peripheral devices, such as disk storage and tactical computer terminals for incorporation into tactical systems. Special emphasis will be placed on microprocessor and buss structure standards and controls to reduce proliferation and insure compatibility with the MCF program. The Interface Message Device (IMD) development will be initiated. The IMD will permit the conversion of data from one system into the form required by another system and the converse, thus providing a truly automated interface between two systems. Multiple sources will be qualified for procurement of the more mature terminal equipment, such as the Battlefield Interoperability Terminal. TDC maintenance and technical services contract, support software integration, enhancement, and control, tactical systems software validation and interoperability efforts, and Army tactical information distribution system planning and analysis will be continued.

Special emphasis will be placed on the security aspects of new information distribution systems. Efforts to provide policy, procedures, and standards documents for system developers will continue. As the number of interfacing systems grow, more complex and sophisticated interoperability exercises will be carried out. Experiments will continue, using the Tactical Display System (TDS) emulator, to examine new electronic methods and media for distributing training and doctrinal materials to the field.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.26.A Title: Combat Support Equipment
DoD Mission Area: #442 - Logistics/General Combat Support Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3568	3464	8486	16806	Continuing	Not Applicable
DG01	Combat Engineer Equipment	1032	1394	4050	6000	Continuing	Not Applicable
DG14	Container Distribution Equipment	505	354	490	900	Continuing	Not Applicable
DK39	General Support Equipment	339	364	916	1400	Continuing	Not Applicable
DK41	Petroleum, Oil, and Lubricants Distribution Systems	240	290	1208	3106	Continuing	Not Applicable
D428	Tactical Rigid-Wall Shelters	0	0	250	400	Continuing	Not Applicable
D471	Camouflage	1357	878	1022	3800	Continuing	Not Applicable
D526	Marine Oriented Logistics Equipment	95	184	550	1200	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Army requires new and advanced logistical support equipment to meet the requirements of ship-to-shore and over-the-beach resupply operations, as well as the requirements of deployed forces in support of various military contingencies. In the event that port facilities are unavailable, commercial container ships must be assisted by military equipment capable of off-loading and transporting containerized supplies. This program also provides the Army with materiel that will increase the Army's tactical mobility and reduce the burden of logistic resupply through: a new family of tactical bridging to provide improved capabilities for crossing rivers and other natural barriers, new water purification equipment that can provide potable water more efficiently than can existing equipment, new equipment for handling fuel more efficiently from the tanker to the ultimate user in the forward area, new and more efficient environmental control equipment (heating/air-conditioning), and enhanced survivability via new camouflage techniques to defeat enemy surveillance threat.

C. BASIS FOR FY 1979 RDTE REQUEST: Complete AD of a container transporter for over-the-beach operations, a low-temperature helicopter and vehicle fueling system and Total Environmental Control System (18,000/30,000 British Thermal Unit per Hour (BTU/H)). Continue AD of: new components for tactical bridging and related equipment for rapid access to and egress from such bridges; container handling items, electric heaters and air conditioners to meet requirements for controlled environments; water purification equipment; fuel storage and distribution items; camouflage hardware and techniques; tactical rigid wall shelters; and logistics-over-the-shore equipment.

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: This program element supports the advanced development (AD) of various items which are essential to enable the Army to provide the logistic and combat support functions during combat and contingency operations to include: The capabilities for rapid combat engineer construction; resupply of increasingly greater amounts of containerized cargo; mobile salt water purification units; environmental control for shelters and vehicles housing critical electronic equipment and personnel in all climates; resupply of fuels and lubricants (POL), techniques and equipment to counter the surveillance threats; tactical shelters to replace vans; and marine-oriented logistics support items.

F. RELATED ACTIVITIES: Coordination to avoid duplication and provide program guidance is accomplished through trilateral (United States, United Kingdom, and Federal Republic of Germany) agreement and Steering Committee for Bridging for 1985 and Beyond; Department of Defense Joint Container Steering Group; Joint Committee on Tactical Shelters; and Project Manager for Army Container-Oriented Distribution System. Related exploratory development programs are in Program Element (PE) 6.27.23.A, Clothing, Equipment and Packaging Technology; and PE 6.27.33.A, Mobility Equipment Technology. Items in this PE progress to engineering development in PE 6.47.17.A, General Combat Support.

G. WORK PERFORMED BY: In-house efforts are performed by the US Army Mobility Equipment Research and Development Command, Fort Belvoir, VA; the US Army Engineer Waterways Experiment Station, Vicksburg, MS; and the US Army Natick Research and Development Command, Natick, MA. Contractors include Pacific Car and Foundry, Renton, WA; Brunswick Corporation, Marion, VA; ROVAC Corporation, Maitland, FL; Varo Corporation, Garland, TX; and ten additional planned contracts totaling $2,900,000.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Established trilateral (United Kingdom, Federal Republic of Germany and United States) Bridging for 1985 and Beyond Program, identified design concepts, narrowed candidates to most promising three and initiated advanced development. Conducted evaluations of various items for handling containerized cargo to include flatracks, spreader bars, container inserts, structural ammunition restraint, container identification means, electronic inventory label, container insulation, and air cushion cargo moving device. Established design parameters for an advanced type ammunition loading and restraint system. Completed advanced development (AD) of 250,000 British Thermal Unit/Hour (BTU/H) heater, and 600 and 1500 gallons per hour (GPH) Reverse Osmosis Water Purification Units (ROWPU). Completed fuel pipeline transport study, tested a scale model seamless nylon fabric fuel storage tank and identified components suitable for a low temperature fueling system. Proved feasibility of smoke screen camouflage. Completed pattern painting criteria, design of disrupter, and analysis of NATO missile site camouflage test. Conducted evaluation of prototype decoys, thermal attenuators, foam obscuration, artillery unit signatures, and means to reduce missile signatures. Initiated analysis of alternatives for a rapidly deployable sectionalized barge. Participated in a DoD-sponsored joint Army/Navy logistics-over-the-shore (LOTS) test.

Program Element: #6.37.26.A Title: Combat Support Equipment
DoD Mission Area: #442 - Logistics/General Combat Support Budget Activity: #4 - Tactical Programs

2. FY 1978 Program: Complete fabrication of 52 meters of prototype bridge and associated bridge ancillary items including reinforcing system, wheeled vehicle launcher and launching mechanism. Finalize concept formulation for Total Environmental Control System (18,000/30,000 British Thermal Unit per Hour (BTU/H)). Complete advanced development (AD) of cargo container insert, flatrack container, and container identification system. Fabricate test model prestaged ammunition loading system. Continue evaluation of container insulation. Buy pumps, filters, and feeders for 3000/2000 gallons per hour (GPH) Reverse Osmosis Water Purification Units (ROWPU) to conduct reliability tests. Procure scale model Kevlar fabric fuel storage tank and components for low temperature fueling system. Develop foam smoke, instant smoke, thermal and radar suppressors, and identify camouflage design goals. Provide camouflage assistance to users and developers. Complete analysis of alternatives for sectionalized cargo barge. Initiate study of alternatives for 60-ton high speed amphibian. Analyze results of joint logistics-over-the-shore (LOTS) test.

3. FY 1979 Planned Program: Complete tests, evaluations and assessments of three competing design concepts for a standardized military family of bridges used for assault crossings, dry gaps and wet gaps. Incorporate advanced composite materials into fabrication of bridge girder bottom chord member, launching nose member and reinforcing kit. Evaluate new approaches and materials for rapid construction of access to/egress from tactical bridges. Begin test of prestaged ammunition loading system, and continue test of container insulation. Initiate deferred joint Army-Navy effort on a beach cargo transporter. Develop design of a high mobility beach container crane. Initiate AD of a material handling load stability device. Complete AD of Total Environmental Control System (TECS-18). Develop clarifiers, carbon absorption columns, and oxidizers for waste water treatment. Start AD of family of electric heaters and air cycle environmental control units. Test scale model Kevlar fabric fuel storage tank and procure full scale test model. Complete AD of low temperature fueling system. Initiate AD of fuel filter/separator, fuel distribution system, and large fuel tanker mooring sytem. Buy prototype 50 foot accordion type shelter. Continue AD of camouflage hardware and techniques with emphasis on smoke, foam, disrupters, infrared and radar suppressors, camouflage design goals, and inflatable missile decoy systems. Provide camouflage assistance to users and developers. Complete systems definition for 60-ton logistics amphibian. Begin AD on candidate items identified in joint LOTS test. Increase in funding for FY 1979 compared to FY 1978 is necessary to insure timely development of equipment required for containerized cargo and fuel resupply in support of combat vehicle operations in a LOTS mission. Emphasis on bridging is necessary to meet Army needs and trilateral commitments, and on camouflage to counter enemy surveillance capabilities.

4. FY 1980 Planned Program: The bridging design selected from the three competing concepts will move into engineering development; advanced composite material bridging members will be tested and modified as necessary for integration into the bridge family. A high speed soil excavator for rapid construction of protective structures will be designed and tested. AD of beach container crane, load stability safety device, family of electric heaters, air cycle environment control unit, field generated waste water treatment components, obscurants (foam and smoke), infrared attenuators for concealing the thermal signature of turbine generators, field artillery flash/sound simulators, and 50 foot accordian type shelter will be continued. AD of beach cargo transporter, 9000 BTU/H and 36,000 BTU/H Total Environmental Control System for heating and air conditioning (TECS 9, TECS 36), and camouflage design goals for camouflage critical items will be completed. Assist developers and users in camouflage. Evaluation of container insulation and testing of components for large tanker mooring system and fuel distribution system will be completed and total system design will be initiated. Testing of Kevlar fabric fuel tank will start. Advanced development (AD) on closed circuit refueling for armored vehicles, marine terminal filter-separator, diesel fuel decontaminator, prototype 60-ton amphibian, and rapidly deployable port modules for containership discharge will be initiated.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.30.A Title: Tactical Surveillance System
DoD Mission Area: #444 - Tactical Combat Integration Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT					Continuing	Not Applicable
D560	Tactical Surveillance System					Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element (PE) supports the Army's Tactical Exploitation of National Capabilities (TENCAP) program (Part A) which is directed toward developing a tactical support system to collect, process, and disseminate intelligence/information which locates enemy units, activity and targets representing a general tactical threat. Such intelligence/information is essential to the tactical commander to enable him to fight and win while outnumbered in a highly intensive but short duration conflict. The tactical commander must have the capability to locate, identify, engage and attrite superior enemy forces at maximum range to insure that a manageable combat power ratio exists in the main battle area. The tactical commander must also have the capability to seize the initiative from the enemy by blunting his strength and exploiting his weaknesses. Since the enemy has the advantages of great numerical superiority and the choice of time, location and nature of an attack, friendly forces must rely heavily on superior intelligence systems to counter these advantages. In the TENCAP Program, advanced techniques are applied to exploit information collected from a variety of sensors, which, in general, is not otherwise obtainable, and provide that information to the tactical command and control environment in a sufficiently timely and useful form to greatly assist the commander in defeating the enemy.

C. BASIS FOR FY 1979 RDTE REQUEST: Continue AD work on hardware/software interfaces between existing and future sensor systems and Army tactical exploitation systems.

D. OTHER APPROPRIATION FUNDS: Not applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: Data originating from a variety of and tactical surveillance sensors must be transmitted to central collection points where the data can be processed and analyzed. The resulting tactical intelligence must then be rapidly disseminated and fuzed into the command and control environment in such a timely and useful form as to materially influence the land battle. Techniques and equipment which provide for this rapid collection, transmission and manipulation of intelligence data is being developed under this program.

Program Element: #6.37.30.A Title: Tactical Surveillance System
DoD Mission Area: #444 - Tactical Combat Integration Budget Activity: #4 - Tactical Programs

F. RELATED Activities: Technological developments designed to shorten the time required to collect and disseminate information are related to this development. These areas include automated search procedures, data link technologies, and tactical identification and positioning. The use of satellite communications is being considered. This work is coordinated with the appropriate offices at the level. Program Element (PE) 6.47.40 covers engineering development (ED) work which is related to this PE.

G. WORK PERFORMED BY: RCA Corp., Camden, NJ; TRW, Los Angeles, CA; Aerospace Corp., El Segundo, CA; US Army Electronic Research and Development Command (ERADCOM), Adelphi, MD; Electromagnetic Systems Laboratories, Sunnyvale, CA; Aeronutronic Ford Corp., Palo Alto, CA; Systems Planning Corp., Arlington, VA; Mechanics Research, Inc., McLean, VA.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Studies were completed which provide the technical base for the equipment and techniques for design and development of a major collection/exploitation system. In FY 1977, studies continued to provide the technical base for equipment and techniques for design and development of interfaces with other collection and exploitation systems. System interface specifications definition were initiated for an advanced exploitation system.

2. FY 1978 Program: Four subsystem design studies are scheduled to be completed. Development and installation of interfaces with two subsystems will be initiated. One subsystems interface specification definition will be completed.

3. FY 1979 Planned Program: The systems interface elements for a major system will be developed and tested. All necessary experimental work will be completed and the first system will be ready for engineering development. System development for interface with a second collection system will be continued. Advanced development (AD) of three subsystems for an advanced exploitation system will be completed. Increase in funds in FY79 is required to complete the AD work for systems interface with a major collection system and to test the associated hardware/software.

4. FY 1980 Planned Program: Advanced system development for interface with a second collection system will be completed and operational testing (OT) and developmental testing (DT) completed by program executive agent. Development of interface with other collection systems will continue.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.37.A
Title: Anti-Radiation Missile Countermeasures (ARM-CM)
DoD Mission Area: #411 - Battlefield Surveillance
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2387	3401	4292	5345	Continuing	Not Applicable
D181	Anti-Radiation Missile Countermeasures	2387	3401	4292	5345	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Technology for reducing vulnerability of ground-based emitters to attack by enemy anti-radiation missiles will be developed. Approach is to perform analysis, develop hardware prototypes, and perform system testing to demonstrate effectiveness of a variety of countermeasure techniques. Effort addresses five areas of activity: threat evaluation and projection, countermeasure development, laboratory simulation and countermeasures testing, establishment of field test capability, and support for Tri-Service Joint Working Group on Anti-Radiation Missile Countermeasures (ARM-CM).

C. BASIS FOR FY 1979 RDTE REQUEST: Funds requested will provide for continuation of laboratory simulation of generic ARM seekers (seekers which can be modified electronically to appear as any of several threat seekers) to determine effectiveness of CM techniques; utilize generic seeker hardware to support PATRIOT air defense missile system field test/measurements; support of Tri-Service Joint Working Group on ARM-CM, provide field- test instrumentation, and support for future HAWK air defense missile system and FIREFINDER countermortar/counter battery radar system field tests; start analysis to establish CM techniques for postulated "main beam" seeker and dual-mode (Radio Frequency and Infra-red) threats; investigate techniques to destroy enemy seekers in-flight; investigate air defense and communications netting techniques to enhance survivability.

D. OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #6.37.37.A
DoD Mission Area: #411 - Battlefield Surveillance

Title: Anti-Radiation Missile Countermeasures (ARM-CM)
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: The Army has under development the Counter Battery Radar, AN/TPQ-37, and the Mortar Locating Radar, AN/TPQ-36, to provide a hostile weapons location capability, and the Surface-to-Air Missile Systems (PATRIOT, HAWK, ROLAND) to provide the air defense surveillance, detection, and target tracking capability.

F. RELATED ACTIVITIES: Development of anti-radiation missile countermeasures techniques will be conducted with the Army as the lead service. Countermeasures techniques developed in this Program Element will be utilized by anti-radiation missile countermeasures work done in Program Elements 6.43.07.A, SAM-D (PATRIOT), 2.37.31.A (SAM, HAWK, HAWK IMPROVEMENT), 6.43.09.A (ROLAND), and 6.37.29.A (Counter Battery Radar). The Navy has conducted work in Program Element 6.35.16.A (Radar Surveillance Equipment), and the Air Force in Program Elements 6.37.18.F (Electronic Warfare Technology) and 6.37.50.F (Counter-Countermeasures Advanced Development. Information will be transferred between Services through the Tri-Service Joint Working Group on Anti-Radiation Missile Countermeasures and coordinated among the Services.

G. WORK PERFORMED BY: The Army in-house developing organizations for this program are: Harry Diamond Laboratories, Adelphi, MD; US Army Electronics Research and Development Command (EPADCOM), Adelphi, MD; and US Army Missile Research and Development Command (MIRADCOM), Huntsville, AL. The Navy in-house developing organization for this program is Commander, Naval Sea Systems Command, Alexandria, VA, and Naval Weapons Center, China Lake, CA. The Air Force in-house developing organization for this program is Rome Air Development Center, Griffiss Air Force Base, NY. Contractors are Analytics Incorporated, Willow Grove, PA; Computer Science Corporation, Huntsville, AL; General Dynamics, Pomona, CA; Systems Planning Corporation, Arlington, VA; HRB Singer, State College, PA.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The generic foreign threat seeker simulation was started and technical specifications for the generic seeker hardware were completed. A study describing the impact of the ARM threat to present Army systems and Army systems under development was completed.

Support of the Tri-Service Working Group continued.

2. FY 1978 Program: The generic foreign threat anti-radiation missile seeker hardware and the generic threat simulation will be completed.

Studies will be initiated to determine field testing methods for anti-radiation missile countermeasure techniques proposed for PATRIOT and HAWK. A more detailed threat definition and exploitation will be pursued. Support of the Tri-Service Working Group will continue. Investigations of the susceptibility of continuous wave emitters including communications terminals to anti-radiation missile and appropriate countermeasures will be initiated.

3. FY 1979 Planned Program: Increase in funds will accelerate the utilization of the generic foreign threat simulation to determine the effectiveness of anti-radiation countermeasure techniques and the sensitivity of these techniques relative to specific seeker characteristics. A flyable model of the generic seeker will be developed as field-test instrumentation. This model will be used in anticipated tests for the HAWK and PATRIOT systems.

Countermeasures techniques for these types of seekers will be explored. Methods to destroy enemy seekers in-flight will be studied. Support of the Tri-Service Working Group will continue.

4. FY 1980 Planned Program: Further investigations of countermeasure techniques for the more sophisticated type of anti-radiation missile seekers will continue; field-test instrumentation will be maintained and improved for field test support and to support site signature measurements on various systems; current countermeasure techniques will be improved; and Tri-Service Working Group support will be continued.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.40.A
DoD Mission Area: #414 - Field Army Air Defense

Title: Divisional Air Defense Command and Control System
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	65	0	500	500	Continuing	Not Applicable
D593	Divisional Air Defense Command and Control Systems	65	0	500	500	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Objective is to design, procure, and test developmental models of a command, control and communications system for divisional air defense target acquisition, gun, and missile systems. An operational deficiency exists on the battlefield in that there are no means available at present to efficiently coordinate and control organic division air defense weapons. Existing manual procedures are incapable of reacting to the hostile high performance aircraft threat which will exist across the battle front. An automated system must be provided which will give to the Division Commander a responsive command, control, and communications capability to influence the immediate air defense threat by integrating the forward area air defense weapons and sensors proliferated throughout the division area into a cohesive air defense weapons system. The system will provide the force multiplier effects in the attrition of hostile air assets while minimizing electronic radiation and permitting minimum expenditure of friendly air defense resources, at the same time providing greater satety to the friendly air and ground forces through interoperability with TOS and the AN/TSQ-73 systems.

C. BASIS FOR FY 1979 RDTE REQUEST: A test bed will be developed and experimentation conducted to validate the operational effectiveness of divisional air defense operational and organizational concepts. System specifications will be generated in preparation for entering into engineering development of a system to satisfy United States Army Air Defense divisional area requirements. The test bed/experimentation facility activities will be conducted in full coordination with continuing concept definitions and operational studies allowing for a meaningful cross fertilization of user and developer ideas and providing immediate feed back on operational and technical parmeters.

D. OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #6.37.40.A
DoD Mission Area: #414 - Field Army Air Defense

Title: Divisional Air Defense Command and Control Systems
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: The program is the continuation of a new start initiated in FY 1977. The proliferation and the growing sophistication of divisional air defense weapons and airspace users - both friendly and hostile - in the dynamic air battle environment of measures and countermeasures compounds an aready serious air defense command, control and communications condition. The Army has recognized that a division command, control, and communications (C3) system must be developed which will provide the optimum defense to the division's critical assets without incurring unacceptable risks to the friendly airspace users. It is essential that such a C^3 system be capable of timely and accurate detection and identification of air threat. The growing inadequacy of the current manual Divisional Air Defense Command, Control, and Communications (DIVAD-C^3) system results in the inefficient use of modern weapons, less than adequate weapon design capability to defeat the air threat, and increasing risk to friendly Army and Air Force aircraft. The DIVAD-C^3 system must integrate and coordinate the activities of division air defense weapons and interoperate with TOS. The divisional air defense command and control (DIVAD-C^2) system must provide the means to amplify the weapon crews' performance and provide commanders the means to rapidly plan and manage his operations. The system must be as survivable as the maneuver units that it supports. The Army Air Defense Command and Control (AAD-C^2) studies, conducted by U.S. Army Air Defense School, have demonstrated that a semi-automated command, control and communication system will enhance modern air defense weapons effectiveness from 2 to 4 times. This effectiveness is the force multiplier that provides greater efficiency for less cost at the same time receiving a higher return on investment for the weapons systems. The value of one enemy fighter aircraft annihilated or one USAF aircraft saved through command, control and communications far exceeds the projected cost for developing and procuring such a system. Tradeoff is not necessarily based on the linear dollar cost comparison (i.e., one USAF aircraft is at 11M dollars = one DIVAD is at 8M dollars). The value that is realized must be calculated in view of the potential damage that could result from one enemy aircraft getting through to its target or the negation of damage of one of our USAF aircraft could cost, if it were lost due to friendly air defense fire.

F. RELATED ACTIVITIES: Development of the AN/TSQ-73 Group and Battalion level Command and Control System (P.E.6.43.02.A) and the Tactical Air Control Systems/Tactical Air Defense System (TACS/TADS) (program P.E.6.47.12.A) have been designed to insure interoperability of the air defense systems of all services. The Tactical Computer System (TCS) (P.E.,6.37.23.A) being used in TOS and the Digital Message Device (DMD) (P.E.6.37.26.A) used in TACFIRE, will be examined as potential candidates in the divisional air defense command, control and communications system. Communications developments and technologies (SINCGARS, Packet Radio, and other Tactical Information Distribution Systems) will be examined as the integral communications media. Compatibility and Interoperability requirements for on-going air defense weapons (STINGER, ROLAND, and the new Divisional Air Defense Gun) will also be defined. Efforts in this area will result in minimum perturbations in dollars and retrofit modifications to these programs at a later date.

G. WORK PERFORMED BY: Overall coordination of the developmental effort is provided by the US Army Communications Research and Development Command (CORADCOM) Center for Systems Engineering and Integration located at Fort Monmouth, New Jersey in coordination US Army Training and Doctrine Command (USATRADOC), US Army Combined Arms Command (USACAC) and the US Army Air Defense School. A list of contractor support will be selected at a later date.

Program Element: #6.37.40.A
DoD Mission Area: #414 - Field Army Air Defense

Title: Divisional Air Defense Command and Control Systems
Budget Activity: #4 - Tactical Programs

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: A study titled "Division Air Defense Command and Control Analysis" was conducted under this program element. This study examined the various aspects including the following items: Reaction time vs weapon system effectiveness under different levels of command and control. Measures of effectiveness of command and control to enhance the air defense mission and costs of a command and control system vs cost of the air defense weapons vs friendly/foe aircraft saved/ annhilated. The results of the overall study were that operational effectiveness, reaction time, kill ratio, and better identification can be accomplished with the institution of automated command and control. The communications needs of the divisional air defense system were also examined as a part of the Army's effort to develop a tactical information distribution system. TRADOC and DARCOM have jointly developed a Letter of Agreement for the development of a test facility to support the development of a divisional air defense system. Another study, the restructured division study of candidate Air Defense Command and Control System - 1985, also supports the requirement. The study established a analytical framework which relates the architecture of a command and control (C^2) data network to a gunners effectiveness. This has resulted in the generation and evaluation of a C^2 data net structure that is made up of sub-structures which could stand alone or be integrated, and which satisfy critical functions. These functions are air defense warning, queuing, aircraft identification, target coordination, emission control, and radar coverage integration. These results show that an automated C^2 system could increase the probability of an air defense gunner participating in an engagement from 0.22 to 0.91. A 1976 USMC test compared the effectiveness of manportable air defense weapons when (1) queued by voice radio from a HAWK radar and (2) queued by a state-of-the-art display device with an automated data link from the same radar. The results showed a 1.8 increase in the number of detections by the gunner with automatic device and a 2.9 increase in the number of forward hemisphere launches by the same gunner. This test was conducted in a low density environment where the voice system was not saturated. Other tests have shown that a voice queuing system will saturate with six to eight tracks. The expected track density in the area of interest of a manportable air defense weapons gunner in a SCORES 3A scenario D+1 air attack, is on the order of [redacted] tracks including both hostile and friendly aircraft.

2. FY 1978 Program: Not Applicable.

3. FY 1979 Planned Program: A functional test facility will be established to validate and demonstrate the technical feasibility of providing a command and control capability to the division air defense units. Existing air defense and data system components along with limited breadboard models of specifically tailored devices will be employed as the basis for synthesizing viable equipment, configuration, operational employment relationships and interoperability for effective DIVAD-C^2. Compatability and interoperability requirements will be established for other on-going air defense weapon and sensor systems. Communications equipments and technologies will be evaluated and incorporated into the definitions of the DIVAD-C^2 system. System specifications for the DIVAD command, control and communications system will be generated, preparatory to commencement of an engineering development effort. Interoperability with NATO will be assured through the Joint Standardization Group and NATO standardization panels.

Program Element: #6.37.40.A
DoD Mission Area: #414 - Field Army Air Defense

Title: Divisional Air Defense Command and Control Systems
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: Complete Advanced Development and the preparations for Engineering Development of a DIVAD-C^2 system. Initiate the development of training and support requirements for the DIVAD-C^2 system.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.45.A
Title: Tactical Electronic Warfare Equipment
DoD Mission Area: #445 - Electronic Warfare Counter Command, Control, and Communications (C^3)
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT					Continuing	Not Applicable
	Quantities						Not Applicable
D905	Tactical Electronic Support Measure Systems					Continuing	Not Applicable
D907	Tactical Electronic Surveillance Systems					Continuing	Not Applicable
D925	Tactical Electronic Warfare and Intelligence Command and Control Systems					Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: In order to survive on the modern battlefield, any Army must depend on timely information, rapid decisions and swift communications for success due to the greatly accelerated pace and violence of ground warfare. These functions therefore become important points of vulnerability and are targets of high value for destruction, disruption, exploitation and deception. The US Army is currently ill-equipped to destroy, disrupt, exploit or deceive an opposing commander's command and control means. It's tactical electronic warfare equipment, where it exists at all, is antiquated, unreliable and unsupportable on the battlefield in the large majority of cases. The long range goal of the Army is to overcome this major deficiency in the balance of its combat forces by providing the means to rapidly exploit vulnerabilities inherent in an enemy's electronic-dependent systems, to negate his command and control, and to provide tactical systems which, by exploiting technical superiority, will serve as force multipliers to assist in offsetting enemy numerical and firepower superiority.

C. BASIS FOR FY 1979 RDTE REQUEST: Initiate development

Program Element: #6.37.45.A Title: Tactical Electronic Warfare Equipment
DoD Mission Area: #445 - Electronic Warfare Counter Command, Control, and Communications (C^3) Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: Not applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to establish the technical feasibility and military potential of tactical electronic support measures (ESM) equipment, tactical electronic surveillance systems and tactical electronic warfare intelligence (EWI) command and control systems. This program includes the development of equipment and systems to detect, collect, and locate enemy emitters, infrared and optical battlefield surveillance devices and provide electronic order of battle information. Equipment developed includes ground vehicular and airborne mounted systems. All items in this program are Non-Signal Intelligence (SIGINT)/Intelligence-Related (IRA) activities. Non-IRA systems (jammers) were transferred to Program Element (PE) 6.37.55.A, Tactical Electronic Countermeasures Systems, and SIGINT items were transferred to National Security Agency (NSA) PE 3.10.11.G, Cryptologic Activities, in FY 1979.

F. RELATED ACTIVITIES: Related developments are conducted by the Air Force, Navy, and NSA. Coordination is effected between the Services to maximize the interchange of technical data and minimize duplication of effort. Coordination is effected by the exchange of technical reports, attendance at scientific meetings and conferences, joint participation on subgroups and working panels of the Technical Cooperation Program, and by the Joint Tri-Service Electronic Warfare Panel. In addition, formal requirements documents of each Service are exchanged, reviewed, and commented upon by the other Services. Coordination is also accomplished as part of the program reviews conducted by the Office of the Secretary of Defense (Under Secretary for Research and Engineering). Following Air Force/Navy/NSA PEs apply: 2.56.74.N, Electronic Countermeasures Response; 6.42.55.N, Electronic Support Measures Equipment; 6.37.97.N, Surface Electro-Optic Systems; 6.47.10.F, Reconnaissance Electronic Warfare Equipment; 6.37.43.F, Electro-Optic Warfare, and 3.10.11.G, Cryptologic Activities.

G. WORK PERFORMED BY: US Army Electronic Warfare Laboratory, Fort Monmouth, NJ; the Program Manager for Aircraft Survivability Equipment, St. Louis, MO; the US Army Signals Warfare Laboratory, Arlington Hall Station, VA; US Army Materiel Development and Readiness Command, Alexandria, VA. The major contractors are: ESL Incorporated, Sunnyvale, CA; GTE Sylvania, Mountain View, CA; Cincinnati Electronics, Cincinnati, OH; RCA Corporation, Camden, NJ; Texas Instruments, Dallas, TX; ITT Corporation, Nutley, NJ; and IIT Research Institute, Chicago, IL.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Advance development of prototype equipment was initiated

Program Element: #6.37.45.A Title: Tactical Electronic Warfare Equipment

DoD Mission Area: #445 - Electronic Warfare Counter Command, Control, and Communications (C^3) Budget Activity: #4 - Tactical Programs

Details on tactical electronic surveillance systems are found in Congressional Descriptive Summary for Project D907, Program Element (PE) 6.37.45.A, Electronic Warfare Counter Command, Control, and Communications. In addition, programs to militarize and incorporate a direction finding capability to QUICK FIX airborne communications jamming system, to investigate the effective radiating power of existing and developmental communications jammers, and to investigate the use of chaff in an area defense role were initiated. A helicopter air defense suppression system study was initiated.

2. FY 1978 Program:

The communications jamming modulation analysis investigation will be completed and results applied to existing and future communications jammers.

Two competitive design contracts will be awarded

Development will continue on control and processing systems. Effort will continue on Tactical Electronic Surveillance Systems. Details are found in Congressional Descriptive Summary for Project D907, PE 6.37.45.A.

3. FY 1979 Planned Program:

Advanced development (AD) of control and processing systems is continued. Details on Tactical Electronic Surveillance Systems developments are found in Congressional Descriptive Summary for Project D907, PE 6.37.45.A. Increase in funds from FY 1978 to FY 1979 is to provide for an orderly development of Tactical Electronic Surveillance Systems.

4. FY 1980 Planned Program:

Procurement of Government equipment to be furnished to the prime contractor will be initiated. Complete AD of control and processing systems and conduct development and operational testing. Planned effort on Tactical Electronic Surveillance Systems are found in Congressional Descriptive Summary for Project D907, PE 6.37.45.A.

5. Program to Completion: This is a continuing program. Programs under development will be evaluated for continuance into engineering development, PE 6.47.45.A, Tactical Electronic Warfare Systems.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D907
Program Element: #6.37.45.A
DoD Mission Area: #445 - Electronic Warfare/Counter Command, Control and Communications (C^3)

Title: Tactical Electronic Surveillance System
Title: Tactical Electronic Warfare Equipment
Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: This program supports the Army's Tactical Exploitation of National Capabilities (TENCAP) program advanced development (AD) work which is directed toward developing a tactical support system to collect, process, and disseminate electronic intelligence/information which locates and identifies enemy units, activity, and targets representing a general tactical threat. Data originating from a variety of and tactical electronic surveillance sensors must be transmitted to central collection points where the data can be processed and analyzed. The resulting tactical intelligence must then be rapidly disseminated and fuzed into the command and control environment in such a timely and useful form so as to materially influence the land battle. Techniques and equipment which provide for this rapid collection, transmission, and manipulation of intelligence data is being developed under this program.

B. RELATED ACTIVITIES: Technological developments designed to shorten the time required to collect and disseminate information are related to this development. These areas include automated search procedures, data link technologies, and tactical identification and positioning. The potential use of satellite communications is being considered. This work is coordinated with the appropriate offices at the level to avoid duplication of effort.

C. WORK PERFORMED BY: Aerospace Corporation, El Segundo, CA; Electromagnetic Systems Laboratories, Sunnyvale, CA; US Army Electronics Research and Development Command (ERADCOM), Adelphi, MD; US Army Communications Research and Development Command, Fort Monmouth, NJ.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Studies were conducted to provide the technical basis for the equipment and techniques for system development and interface definitions with a variety of collection systems. A brassboard model of one system was completed.

Project: #D907 — Title: Tactical Electronic Surveillance System
Program Element: #6.37.45.A — Title: Tactical Electronic Warfare Equipment
DoD Mission Area: #445 - Electronic Warfare/Counter Command, Control and Communications (C^3) — Budget Activity: #4 - Tactical Programs

2. FY 1978 Program: Studies will be completed to provide the technical basis for the equipment and techniques for systems development and interface definition with three collection systems. Other studies initiated in FY 1977 will continue. Advanced development will be initiated for a new system.

3. FY 1979 Planned Program: Complete system design for interface with two major collection systems. Initiate installation of interface equipments. Initiate advanced development (AD) for interfaces with a new collection program, which is the reason for the increase in funds over FY 1978.

4. FY 1980 Planned Program: Complete installation of interface equipments with one collection system. Initiate AD for interfaces with a new collection system. Increase in funds is to support AD interface with additional collection systems.

5. Program to Completion: This is a continuing program.

6. Major Milestones: Not applicable

7. Resources ($ in thousands):

		FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Cost
RDTE:	Funds					Continuing	Not Applicable
	Quantities						Not Applicable

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D925 Title: Tactical Electronic Warfare and Intelligence Command and Control Systems

Program Element: #6.37.45.A Title: Tactical Electronic Warfare

DoD Mission Area: #445 - Electronic Warfare/Counter C^3 Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to provide for advanced development of tactical electronic warfare and intelligence command and control systems for use by Division, and Corps commanders. Army commanders, at all echelons, depend upon tactical intelligence, combat information and effective electronic countermeasures to win the land battle. The enemy may be expected to have weapons generally as effective as our own, and it may be anticipated that he will have them in greater numbers, at least in the opening stages of conflict. Detection and positive identification of the enemy's main thrust must be made early, while its leading elements are still in the covering force area, so that it can be met with massed armor and anti-tank weapons. Processing of intelligence from electronic sensors and the control of electronic countermeasures systems in near real time is therefore required. The single task within this project provides for command and control of Army tactical signals intelligence and electronic warfare systems. This project contains only Intelligence-Related activities (IRA); in FY 1979, all Non-IRA items were transferred to Program Element 6.37.55.A, Tactical Electronic Countermeasures (ECM) Systems, and all Signals Intelligence (SIGINT) items were transferred to the National Security Agency (NSA).

B. RELATED ACTIVITIES: Related developments are conducted by the Air Force, Navy, Marine Corps and NSA. Coordination is effected between the Services and NSA to minimize duplication of effort and insure the interchange of technical data. Coordination is accomplished by reviews conducted by the Office of the Under Secretary of Defense for Research and Engineering, through the exchange of RDTE resume cards and technical reports, attendance at scientific meetings and conferences, and joint participation on subgroups and working panels of The Technical Cooperation Program and by the Joint Tri-Service Electronic Warfare Panel. In addition, each Service's formal requirements documents are reviewed and commented upon by the other Services. Following Program Elements apply: 2.56.74.N, Electronic Countermeasures Response; 6.42.55.N, Electronic Support Measures Equipment; 6.37.97.N, Surface Electro-Optic Systems; 6.47.10.F, Reconnaissance Electronic Warfare Equipment; 6.37.43.F, Electro-Optic Warfare; and 3.10.11.G, Cryptologic Activities.

C. WORK PERFORMED BY: Major contractors are: GTE Sylvania, Mountain View, CA; TRW Inc., Redondo Beach, CA; RCA Corporation, Burlington, MA. In-house development and contract monitoring is conducted by the Army's Electronic Warfare Laboratory, Fort Monmouth, NJ, and the US Army Signal's Warfare Laboratory, Arlington Hall Station, Arlington, VA.

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Project: #D925 Title: Tactical Electronic Warfare and Intelligence Command and Control Systems

Program Element: #6.37.45.A Title: Tactical Electronic Warfare Systems

DoD Mission Area: #445 - Electronic Warfare Counter C^3 Budget Activity: #4 - Tactical Programs

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Prior to FY 1978, efforts currently in this project were found in Program Element (PE) 6.37.11.A, D905, General Support Electronic Warfare Systems. Developments included Technical Electronic Support Measures System (TECH ESM). Single Channel Collection System - Rear (SCCS-R), Automatic Ground Transportable Emitter Location and Identification System (AGTELIS); Tactical Control and Analysis Center (CAC), Tactical Automatic Communications Emitter Location and Identification System (TACELIS), Tactical Army Communications Jamming System (TACJAM), Multiple Target Electronic Warfare System (MULTEWS), and other systems.

2. FY 1978 Program: Program Element (PE) 6.37.11.A was changed to PE 6.37.45.A, Projects D905 (Division Tactical Electronic Warfare (EW) Systems), and D925 (Corps Tactical EW Systems) for FY 1978. The AGTELIS system and associated funding were transferred as an Intelligence Related Activity (IRA). Development of control and processing systems was funded in Program Element 6.47.45.A, Tactical Electronic Warfare Systems, in FY 1978. Development is now scheduled to continue through 1980 because of the necessity to restructure the control and processing systems programs to support the evolution of the Battlefield Exploitation and Target Acquisition (BETA) program and the All Source Analysis Center (ASAC).

3. FY 1979 Planned Program: An All Source Analysis Center (ASAC) prototype will be developed. The ASAC is providing information to the tactical commander. Development of control and processing systems was funded in Program Element 6.47.45.A, Tactical Electronic Warfare Systems, in FY 1978. Increase in FY 1979 funding results from continuing development

4. FY 1980 Planned Program: Development of ASAC hardware and software will be completed. Developmental/Operational Test will be conducted through mid-FY 1980.

Project: #D925 Title: Tactical Electronic Warfare and Intelligence Command and Control Systems

Program Element: #6.37.45.A Title: Tactical Electronic Warfare Systems

DoD Mission Area: #445 - Electronic Warfare Counter C^3 Budget Activity: #4 - Tactical Programs

5. Program to Completion: This is a continuing program. Developments under this project will normally be transferred to engineering development, Program Element 6.47.45.A, Tactical Electronic Warfare Systems.

6. Major Milestones:

	Date
All Source Analysis Center	

7. Resources ($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
RDTE,A: Funds					Continuing	Not Applicable
Quantities						Not Applicable

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FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.46.A

Title: Single Channel Ground and Airborne Radio Subsystem (SINCGARS-V)

DoD Mission Area: #443 - Tactical Communications

Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3950	8151	12721	22280	36819	87098
	Quantities						86
D555	Single Channel Ground and Airborne Radio Subsystem (SINCGARS-V)	3950	8151	12721	22280	36819	87098

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this project is to develop a family of single channel Very High Frequency/Frequency Modulation (VHF/FM) combat net radios for the Combat Arms. The new family will replace the current standard VHF/FM radios. These radios will provide improved availability through increased reliability and an optimized integrated logistics support concept. The modular construction of the radios will provide securability, as well as anti-jamming and anti-position-fixing capabilities, to the field with a high degree of flexibility of employment and operational readiness. They will also provide approximately twice as many communication channels as the present radios operating over the same portion of the frequency spectrum. The radios are being designed to be interoperable with current and future NATO combat net radios.

C. BASIS FOR FY 1979 RDTE REQUEST: Funds requested will provide for: monitoring two advanced development contracts to be awarded in FY 1978; second increment of payments for these advanced development contracts; and monitoring of foreign candidate radio developments. Work on development of Memorandums of Understanding with NATO countries for Single Channel Radio Communications will be continued.

Program Element: #6.37.46.A Title: Single Channel Ground and Airborne Radio Subsystem (SINCGARS-V)

DoD Mission Area: #443 - Tactical Communications Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Other Procurement, Army: To be initiated in FY 1984.						
Funds:					946000	946000
Quantities:					192000	192000

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to perform development of a family of single channel Very High Frequency/Frequency Modulation (VHF/FM) combat net radios to be organic to and operated by the Combat Arms. The family will consist of three configurations, a manpack, a vehicular, and an aircraft radio. These radios will be modularized, securable, and possess anti-jamming and anti-position-fixing features. The new radios will replace the currently standard vehicular, manpack, and aircraft radios -- the AN/VRC-12 family, the AN/PRC-77 family and the AN/ARC-114, respectively.

F. RELATED ACTIVITIES: Program Element 6.27.01.A, Communications Electronics, Program Element 6.37.07.A, Communications Development, and Program Element 6.47.01.A, Communications Engineering Development, provide exploratory, advanced and engineering developments of related and supporting single channel net radio equipment. Other service requirements are contained in an approved joint operational requirement document. Army is lead-service for acquisition.

G. WORKED PERFORMED BY: The in-house developing organizations are the US Army Communications Research and Development Command (CORADCOM), Fort Monmouth, New Jersey, and US Army Test and Evaluation Command, Fort Huachuca, Arizona. Contractual efforts will be accomplished by contractors to be selected in FY 1978.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Results of the ultra reliability radio development program, the AN/URC-78, contracts and other prior developments were analyzed by the SINCGARS-V Special Task Force, US Army Communications Research and Development Command (CDRADCOM), and the SINCGARS Project Management Office in preparation of the procurement packages for the two SINCGARS-V solicitations. Office of the Project Manager, SINCGARS was established in April 1975. A Test Integration Working Group (TIWG) was established and the SINCGARS-V Coordinated Test Program was formulated. Secretary of Defense approved the advanced

development (validation) program. An Electromagnetic Compatibility/Vulnerability (EMC/EMV) Analysis of the SINCGARS-V system in support of the Advanced Development effort was started and solicitations for the SINCGARS-V radios were prepared. The FY 1977 SINCGARS-V effort was conducted in Program Element 6.37.07.A., Communications Development. Contractual advanced development was initiated by soliciting two competitive prototype contracts, each for design and fabrication of 43 slow frequency hopping and 43 fast frequency hopping radios. Completed an electromagnetic interference/vulnerability analysis for frequency hopping radios and applied the results to the contractual efforts. Expanded the scope of the previously established Test Integration Working Group. Began effort to establish Memorandum of Understanding with appropriate foreign governments for procurement and evaluation of foreign candidate radios.

2. FY 1978 Program: The FY 1978 SINCGARS-V program will be transferred from Program Element 6.37.07.A., Communications Development to this Program Element. Award and monitor the performance of a slow frequency hopping contract and a fast frequency hopping contract established in FY 1978. Coordinate the radio design with the National Security Agency in connection with the VANDAL communication security (COMSEC) system development to insure that anti-jam module and COMSEC are compatible. Monitor the development and evaluation of foreign candidate radios. Continue work on Memorandum of Understanding with appropriate foreign governments started in FY 1977.

3. FY 1979 Planned Program: Continue coordination and monitoring of the two existing Advanced Development (AD) contracts that are producing competitive AD models for development and operational testing. Plan for the procurement of foreign candidates radios that will be tested along side US and US/UK produced models. Plan the developmental and operational testing of all candidates radios. Increase in funds in FY 1979 over FY 1978 is due to larger contractural effort.

4. FY 1980 Planned Program: Continue coordination and monitoring of existing contracts. Finalize plans for developmental testing and continue plans for operational testing of all candidates radios. Complete Developmental Testing I (DTI).

5. Program to Completion: Complete advanced development, select a candidate system, proceed into engineering development, and then production. Initial Operational Capability (IOC) is currently projected for

Program Element: #6.37.46.A
DoD Mission Area: #443 - Tactical Communications

Title: Single Channel Ground and Airborne Radio Subsystem (SINCGARS-V)
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation:

a. Contractors have not been selected for this program at this time.

b. All testing for this program is in the planning stage. A Coordinated Test Plan (CTP) for the first phase of testing has been prepared. The CTP displays the test schedule through April 1981. Development Testing (DT) will begin with DT I in December 1980 and the critical issues will be addressed in all testing. Two contractors will participate through DT II to keep costs of development and procurement as low as possible. DT II is scheduled to begin June 1983 and DT III in December 1984. Reliability, availability, and maintainability (RAM) data will be collected throughout development testing.

2. Operational Test and Evaluation: No testing has been accomplished to date. Operational Testing (OT) planned and executed by the US Army Operational Test Evaluation Agency (OTEA) will begin with OT I in Jan 1981. Testing will concentrate on obtaining data for subsequent evaluations of the functional performance of each of the SINCGARS-V configurations and overall effectiveness of the SINCGARS-V concepts. Typical soldiers will operate the equipment and other agencies will determine the reliability. The selected contractors will perform the maintenance. Concepts and interoperability with other tactical communication systems will be assessed. OT II is scheduled to be conducted 1st Qtr 1983. Test sites have not been determined, but tests will be conducted where an operational division and maneuver area are available.

3. System Characteristics:

Operational Characteristics	Objective	Demonstrated Performance 1/
Advanced Radio Systems Developments		
Optimum Very High Frequency-Frequency Modulation digital transmission at 16 Kilobits/ per second between 30-88 Mega Hertz	25 Kilo Hertz	
Available channels	2400	

Program Element: #6.37.46.A
DoD Mission Area: #443 - Tactical Communications

Title: Single Channel Ground and Airborne Radio Subsystem (SINCGARS-V)
Budget Activity: #4 - Tactical Programs

Operational Characteristics	Objective	Demonstrated Performance 1/
Manpack Configuration		
Size (cu in) complete system	250	
Weight (lbs) including security device and Electronic Counter Counter Measures (ECCM) modules	20	
Weight (lbs) without Communications Security (COMSEC) device	17	
System Reliability (MTBF-hours) 2/		

1/ No testing performed to date.

2/ Mean Time Between Failure (MTBF) criteria not yet finalized; to be provided not later than 60 days after advanced development contract award.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.49.A
DoD Mission Area: #610 - Technical Integration

Title: Technical Vulnerability Reduction
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	0	2000	2000	Continuing	Not Applicable
D462	Technical Vulnerability Reduction	0	0	2000	2000	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is to perform as the US Army Materiel Development and Readiness Command (DARCOM) Countermeasure/Counter-Countermeasure (CM/CCM) focal point to insure that CCM are properly addressed during the development cycle of Army systems. Systems hardening (CCM's) must be continuously reviewed during their development cycle and compared against the most recent/projected enemy CM threats. This program will provide the interface and the capability to coordinate, integrate and assist in studies, analyses, and evaluations of CCM concepts and principles as related to the research and development of effective combat materiel. The most recent Mid-East conflict demonstrated significant technological improvements in threat CM equipment. This sophisticated CM equipment poses a real threat to effective combat functioning of US systems. It is imperative that in order for US systems to function effectively, an intensified program of CM awareness and CM technical vulnerability reduction for US equipment be pursued. The goal of the CCM program will be to provide the survivable level required for the complete weapon system to perform its mission in the projected threat environment. This goal will be met by the establishment of a center of excellence to provide advice, data assistance, and total system vulnerability assessment on the CM threat and CCM development activity, thus insuring that CCM capabilities are considered early in the development cycle. U.S. Army requirements documents (Letters of Agreement, Required Operational Capability and Development Plans) will be thoroughly evaluated relative to the approved/validated threat to assure that the overall program objective is met.

C. BASIS FOR FY 1979 RDTE REQUEST: Continue to review and address where required the CCM annexes to new Letters of Agreement, Required Operation Capabilities, and Development Plans. Continue expansion of technical data base to provide access to managerial and technical information covering threat CM and Army-wide CCM developments, capabilities and testing facilities. Continue efforts on the two priority programs, PATRIOT air defense missile system vulnerability reduction and smoke/electro-optics.

D. OTHER APPROPRIATION FUNDS: Not Applicable

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to perform as the DARCOM countermeasure/counter-countermeasure (CM/CCM) focal point for ensuring that tactical and technical CM/CCM are properly considered throughout the

development cycle and materiel acquisition processes. The systems to be addressed are those involved in or relying upon the transmission, emission, reception, or reflection of signals by electromagnetic, sonic, seismic, olfactory or optical means. This objective will be met by serving as a focal point for advice, data, assistance on countermeasure (CM) threat, and counter-countermeasures (CCM) development activities. The technical aspects of CM/CCM will be directly handled by a continuing review of programs and, where necessary, conducting studies of selected systems/developmental items, with the goal being an independent assessment of the CM/CCM aspects of systems under review at US Army Materiel Development and Readiness Command (DARCOM) and within the Department of the Army (DA).

F. RELATED ACTIVITIES: This project is concerned primarily with the technical aspects of US counter-countermeasures. The tactical aspects of CCM will be indirectly handled by maintaining a continuous interaction with the US Army Training and Doctrine Command (TRADOC) counterpart office, the US Army Combined Arms Center (CAC), located at Fort Leavenworth, Kansas. Interaction will assure that the newest technologies are combined with optimized tactics to provide a fully integrated, balanced and updated countermeasure threat scenario for use in the concept, design and evaluation of the Army's combat ready materiel. This program element is the continuation of the PATRIOT (SAM-D) Vulnerability Studies Office which was limited to the vulnerability reduction of the PATRIOT air defense missile system only. This previous effort was funded through FY 1978 under Program Element 6.57.02.A, Project D671, PATRIOT (formerly called SAM-D) Tactical Vulnerability. This office as Army's overall counter-countermeasures (CCM) manager, will closely interface with and support the vulnerability assessment activities, research and development laboratories, and product/project managers to preclude duplication of effort and make maximum use of existing capabilities through normal channels of operation.

G. WORK PERFORMED BY: The organization having responsibility for this program is the DARCOM CM/CCM Office located at the US Army Electronics Research and Development Command, Adelphi, Maryland.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: This project is a continuation of the PATRIOT (SAM-D) Vulnerability Studies Office (VSO) which investigated vulnerability reduction to the PATRIOT System only. Conversion of two computer software programs (SAMJAM and MIDAS) to the Harry Diamond Laboratory computer was completed. Plotting routines for SAMJAM were developed. SAMJAM was used to re-analyze behavior of low altitude targets with realistic employments of standoff jammers. Two computer programs for triangulation simulations were developed. An analysis was made of false targets (ghosts) on the fire platoon's data handling capacity and the Intra-fire platoon (short base line) accuracies. The results of the analysis will assist in vulnerability reduction and were published in a November 1977 report. During FY 1977, with the expansion in the direction of this program, smoke/electro-optics was added as a second priority program. Primary efforts have been to provide specific assistance and coordination to the Smoke Project Manager. This support consisted of surveying Army resources for testing the effectiveness of electro-optic (EO) systems in battlefield aerosols, and production of a plan to manage and apply these resources. Two working groups were chaired. The intelligence and integrated CM/CCM for on-board armored vehicle protection systems working group had responsibility for producing an assessment of the threat to armored vehicles and the integration of

smoke generation with other counter-countermeasure techniques. A working group studies near-millimeter wave propagation in smoke (both military and environmental particulates) and chaff. Documentation was drafted for a countermeasure/counter-countermeasure (CM/CCM) managerial data base contract and a technology base review was initiated. The FIREFINDER, a counter mortar/counter battery radar, operational security risk assessment was completed in January 1977. A joint service study group was chaired to develop more cost effective approaches to thermal signature reduction within the Services.

2. FY 1978 Program: The PATRIOT air defense missile system up-down communication links, track-via-missile (TVM) operation and inter-station data transfer loading as well as accuracies will be analyzed. An analysis will be made of those areas found to be vulnerable during the development model tests. Support will continue in the smoke/electro-optics (EO) programs and committees, and an assessment of EO system effectiveness will be initiated. The XM1 tank signature analysis will be completed and an input provided to the Project Manager. Selected ad hoc addressments will consist of CCM evaluations on the HELLFIRE Anti-Tank Missile, Advanced Attack Helicopter, Advanced Heavy Anti-Tank Missile System, Ground Support Rocket System and other assessments as directed. The CCM technology base review started in FY 1978 will continue.

3. FY 1979 Planned Program: An in-depth analysis will be made of the PATRIOT Developmental Test/Operational Test (DT/OT) scheduled for second and third quarters FY 1979. Actual results will be compared with previously predicted computer simulations to uncover any remaining system vulnerabilities before the Army Systems Acquisition Review Council (ASARC III) meeting scheduled for third quarter FY 1979. Efforts in smoke/electro-optics will be concentrated on programs selected for study in FY 1978. Second generation vehicle protection smoke systems will provide an integrated CM screen for armored vehicles through an automatically triggered smoke distributing system. The technical data base will be completed and the CCM technology base review will continue to be updated as shortfalls in critical areas are uncovered and resources are directed to fill any gaps. To assess system vulnerabilities, ad hoc studies of systems selected in FY 1978 for review this year will include Division Air Defense Gun (DIVAD), Single Channel Ground and Airborne Radio System (SINCGARS) and ROLAND Air Defense Missile System. The following additional systems are to be included for study: STINGER Air Defense Missile System, COPPERHEAD Artillery Guided Projectile, DRAGON Anti-Tank Missile System, VIPER Anti-Tank Weapon System, Satellite Communications System (SATCOM), Tactical Operations System (TOS), Position Locating and Reporting System (PLRS), Tactical Surveillance System, Advanced Multipurpose Missile, Air Defense Suppression Missile, Remotely Piloted Vehicle, and the Division Air Defense Command and Control System. Product Improvement Programs will be monitored for ECCM applications and new systems as directed by US Army Materiel Development and Readiness Command (DARCOM) will be included.

4. FY 1980 Planned Program: Specific tasks will be undertaken where required to insure an adequate up-to-date CM threat package is used in development and testing of Army systems. New systems will be evaluated to determine their effectiveness against these projected threats. Army priority lists will be used to select high priority programs with critical areas/features for counter-countermeasure addressments.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.37.55.A
Title: Tactical Electronic Countermeasures Systems
DoD Mission Area: #445 - Electronic Warfare/Counter Command, Control, and Communications (C^3)
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT					Continuing	Not Applicable
DK12	Division Tactical Electronic Countermeasures Systems					Continuing	Not Applicable
DK13	Corps Tactical Electronic Countermeasures Systems					Continuing	Not Applicable
D251	Protective Electronic Warfare Equipment					Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is to provide for validation/advanced development of electronic countermeasures (ECM) equipment and systems to deny or degrade the enemy's use of his electromagnetic, communications and radar devices.

New ECM systems are urgently needed to support Army tactical commanders. By exploiting technical superiority, they can serve as force multipliers to offset hostile numerical and firepower superiority.

C. BASIS FOR FY 1979 RDTE REQUEST: FY 1979 funds are required to support: development of applications software for the Tactical Ground-based Communications Jammer, TACJAM (AN/MLQ-34), and the heliborne very high frequency jammer and directive finding system, QUICK FIX (AN/ALQ-151), to allow for intermediate maintenance to be performed at common automatic test system facilities; system validation leading toward the development of a family of very rugged and rapidly deployable antenna systems for use with communications and non-communications jammers; completion of a program to optimize communications jamming modulations (stipulate a minimum effective jamming to signal ratio for each type of enemy receiver), and application of the results to deployed and developmental communications jammers; continuation of advanced development of an expendable very high frequency communications jammer.

Program Element: #6.37.55.A
DoD Mission Area: #445 - Electronic Warfare Counter Command, Control, and Communications (C^3)

Title: Tactical Electronic Countermeasures Systems
Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS ($ in thousands): This program element is advanced development and procurement funds are not normally provided until validation and initiation of engineering development; however, a few systems within this program are prototype systems and are to be followed with procurement funds. Those are summarized below. See Program Element 6.47.50.A, Tactical Electronic Countermeasures Systems, for procurement data on systems in engineering development.

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Other Procurement, Army						
Funds	0	0				
Quantities	0	0				
Aircraft Procurement, Army						
Funds	19598	11800	13924	25900	118122	156034
Quantities	14	5	5		34	58

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to provide for validation/advanced development of

This program includes the development of

Equipment developed includes ground vehicular mounted and airborne ECM systems. Developments include both airborne and ground mounted versions of the Multiple Target Electronic Warfare System (MULTEWS) radar jammer; Close Air Support Communications Jammer; Heliborne Communications Intercept and Jamming System (QUICK FIX); Tactical Army Communications Jammer (TACJAM); quick erectable antenna mast assemblies; automated test equipment software development for all systems; expendable jammers, both artillery launched and for installation in remotely piloted vehicles (RPV); warning devices as self-protection measures for tactical vehicles and installations; and

Systems developed in this program element normally proceed to Program Element 6.47.50.A, Tactical Electronic Countermeasures Systems, for full scale development.

F. RELATED ACTIVITIES: Related electronic warfare developments are conducted by the Air Force and Navy. Air Force developments are conducted in Program Elements 6.37.18.F, Electronic Warfare Technology, and 6.37.43.F, Electro-Optic Warfare. Navy developments are found in Program Elements 2.57.64.N, Electronic Warfare Countermeasures Response; 6.35.21.N, Surface Electronic Warfare; and 6.37.97.N, Surface Electromagnetic and Optical Systems. Coordination is maintained between the Services to maximize the interchange of technical data and minimize duplication of effort. Coordination is accomplished by the exchange of technical

reports, attendance at scientific meetings and conferences, joint participation on subgroups and working panels of the Technical Cooperation Program, and by the Joint Tri-Service Electronic Warfare Panel. In addition, formal requirements documents of each Service are exchanged and reviewed by the other Services. Coordination is also accomplished as part of the program reviews conducted by the Office of the Secretary of Defense (Under Secretary for Defense Research and Engineering).

G. WORK PERFORMED BY: US Army Electronic Warfare Laboratory, Fort Monmouth, NJ; the Project Manager for Aircraft Survivability Equipment, St. Louis, MO; the US Army Signal Warfare Laboratory, Arlington Hall Station, VA; US Army Materiel Development and Readiness Command, Alexandria, VA. The major contractors are: ESL Incorporated, Sunnyvale, CA; GTE Sylvania, Mountain View, CA; Cincinnati Electronics, Cincinnati, OH; RCA Corporation, Camden, NJ; Texas Instruments, Dallas TX; ITT Corporation, Nutley, NJ; ITT Research Institute, Chicago, IL.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Studied techniques for degrading the guidance levels of enemy anti-tank guided missile (ATGM). Conducted technical evaluation of counterbattery radar expendable jammers. Two competing anti-tank guided missile (ATGM) electronic countermeasures (ECM) were field tested. Advanced development was completed and military potential demonstrated for the following systems: Multiple Target Electronic Warfare System (MULTEWS) radar jammer, Close Air Support Communications Jammer (AN/MLQ-33), and the Heliborne Communications Intercept and Jamming System (QUICK FIX). All these systems are currently in full scale development in Program Element 6.47.50.A, Tactical Electronic Countermeasures Systems. Advance development or prototype development has been initiated on the following: Tactical Army Communications Jammer (TACJAM), and a family of rugged and rapidly deployable antenna systems for use with communications and non-communications jammers. In addition, a program to

2. FY 1978 Program: Operational and developmental testing of AN/MLQ-33, TACJAM, will be completed and the system type classified. Procurement of applications software for the AN/MLQ-33 and AN/ALQ-151, QUICK FIX with direction finding, to allow for intermediate maintenance to be performed at common automatic test system facilities will continue. System validation leading toward the development of a family of very rugged and rapidly deployable antenna systems for use with communications and non-communications jammers will continue. The program to develop optimized communications jamming modulations will continue. System validation for a series of expendable

Program Element: #6.37.55.A Title: Tactical Electronic Countermeasures Systems
DoD Mission Area: #445 - Electronic Warfare/Counter Command, Control, and Communications (C^3) Budget Activity: #4 - Tactical Programs

3. FY 1979 Planned Program: Efforts initiated in prior years will continue. Development of Automatic Test Equipment (ATE) software for the AN/MLQ-34, Tactical Ground Based Communications Jammer (TACJAM) and the Heliborne Very High Frequency Jammer and Direction Finding System, QUICK FIX (AN/ALQ-151) to allow for intermediate maintenance to be performed at common automatic test system facilities will continue. System validation leading toward the development of a family of very rugged and rapidly deployable antenna systems (Tactical Antenna Masts and Assemblies) for use with communications and non-communications jammers will continue. A program to optimize communications jamming modulations which will provide a minimum jamming to signal ratio effective for enemy receivers will be completed and the results applied to deployed and developmental communications jammers. Advanced development of an expendable very high frequency communications jammer will continue. The increase in funds is due to the creation of this PE (Program Element) in FY 1979, caused by realignment of the Army's electronic warfare advanced development program from one Program Element 6.37.45.A (Tactical Electronic Warfare Equipment) to two Program Elements 6.37.45.A (Tactical Electronic Support Measures Systems) and 6.37.55.A (Tactical Electronic Countermeasures Systems). This realignment was done in order to separate funds associated with Intelligence Related Activities (IRA) from those associated with jammers. There are no IRA items in this Program Element.

4. FY 1980 Planned Program: Efforts initiated in prior years will continue. Automatic Test Equipment applications software for the AN/MLQ-34 and AN/ALQ-151 will be completed. Development of the Tactical Antenna Masts and Assemblies will continue. Development of the will be completed and development testing initiated. Development of a will be initiated. Development of a will be initiated. Increase in funds is to provide for expedited development of Tactical Antenna Masts and Assemblies and the

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.42.01.A
DoD Mission Area: #446 - Navigation, Positioning and Related Systems

Title: Aircraft Avionics
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3760	2775	6359	5669	Continuing	Not Applicable
	Quantities					Continuing	Not Applicable
DC95	Airborne Data Links	0	0	4110	610	Continuing	Not Applicable
DC96	Aircraft Navigation & Control Systems	1526	0	1384	2725	Continuing	Not Applicable
DC97	Avionics Systems	2234	2775	865	2334	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides for engineering development leading to production of data link, avionics and air traffic control equipment. The goal is to provide subsystems which improve mission performance of tactical helicopters and special mission aircraft operating in the anticipated enemy air defense and electronic warfare environment.

C. BASIS FOR FY 1979 RDTE REQUEST: The FY79 request supports engineering development start of _ improvement of the OV-1D MOHAWK surveillance radar data link, engineering development start of the AN/ASN-132 integrated inertial/TACAN navigation system, and completion of the Integrated Avionics Control System (IACS) engineering development.

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION:

1. Project DC95 (Airborne Data Links) is responsive to the tactical environment of the OV-1D MOHAWK airborne radar surveillance system. Information received by this radar system is converted to a digital data format and transmitted to the ground station in near real time. Currently the OV-1D uses a data link The

purpose of project DC95 is to design and test, Anti-jam circuit techniques will be incorporated to allow the AN/ARC-164 radio to cope with the threat potential for jamming. Techniques developed will have application to other airborne systems

2. Project DC96 (Aircraft Navigation and Control Systems) is directed at the development of tactical navigation, approach and landing, and air traffic control systems to enhance combat and combat support aviation operations. The AN/ASN-132 integrated inertial/Tactical Air Navigation (TACAN) navigation system development will capitalize on Air Force inertial and TACAN developments. The standard inertial navigation system and the AN/ARN-118 TACAN will be integrated to provide automatic TACAN updating and navigation data inputs to mission equipment in Army special mission aircraft. Significant cost savings are anticipated as a result of using standard Air Force hardware in the AN/ASN-132.

3. Project DC97 (Avionics Systems) includes the Integrated Avionics Control System (IACS) which will use integrated control panel, microprocessor and data bus multiplexing techniques to achieve significant saving of cockpit space. It is planned to apply IACS to the AH-64 Advanced Attack Helicopter (AAH), and other applications are being investigated. Other efforts in this project include system installation and engineering support, and developments in communications accessories and antennas, including audio processing and ECCM improvements.

F. RELATED ACTIVITIES: In order to avoid unnecessary duplication of effort, related programs of the Air Force, Navy, Federal Aviation Agency, and other organizations are monitored by the Army through committees and working groups. Cost reduction is pursued through joint developments and hardware standardization. This program element is related to program elements 6.22.02.A (Aircraft Avionics Technology) and 6.32.07.A (Aircraft Avionics Equipment).

G. WORK PERFORMED BY: Combat Surveillance and Target Acquisition Laboratory (Project DC95), Project Manager, Navigation and Control (Project DC96), and US Army Avionics Research and Development Activity (Project DC97), Fort Monmouth, NJ. Contractors include: Grumman Aerospace Corporation Bethpage, NY; and Collins Avionics Division of Rockwell International Corporation, Cedar Rapids, IA.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Completed engineering developments include: the AN/TRN-30 low frequency beacons, the AN/TSQ-97 man portable control facility, the AN/TSW-7A transportable control tower (adaptation of Air Force item), the Tactical Landing System (TLS), the AN/ARN-114 Long Range Navigation (LORAN) receiver, the AN/ASN-128 Doppler navigation system, and the AN/ARC-98 high frequency radio. The AN/TRN-30, AN/TSQ-97, AN/TSW-7A and AN/ASN-128 items mentioned above are in production.

Program Element: #6.42.01.A Title: Aircraft Avionics
DoD Mission Area; #446 - Navigation, Positioning and Related Systems Budget Activity: #4 - Tactical Programs

2. FY 1978 Program: Government tests of initial production articles of the AN/TSW-7A and the AN/ASN-128 will be conducted.

3. FY 1979 Planned Program: The improvement of the OV-1D MOHAWK surveillance radar data link will enter engineering development. Engineering development of the AN/ASN-132 integrated inertial/Tactical Air Navigation (TACAN) navigation system will be initiated, using Air Force inertial and TACAN hardware, and building on the Army interface hardware and software advanced development. IACS prototypes will be delivered and undergo competitive development and operational testing to complete engineering development. System installation and engineering effort in support of flight testing will continue. Before engineering development is initiated, all necessary experimental work will have been performed and the proposed system will be ready for full scale development. The principal reason for the increase in FY 79 over FY 78 is the initiation of airborne data link effort.

4. FY 1980 Planned Program: The OV-1D MOHAWK data link improvement will continue in engineering development. The AN/ASN-132 will complete engineering development. System installation and engineering effort in support of flight testing will continue. Before engineering development is initiated, all necessary experimental work will be performed and the proposed system will be ready for full scale development.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.42.02.A
Title: Aircraft Weapons
DoD Mission Area: #413 - Fire Support
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3893	15751	10460	5302	3753	43727
	Quantities	61	169	153	1	1	386
DL62	Aircraft Rocket Subsystems	930	5129	6808	4202	3753	25390
D133	Aircraft Gun Type Weapons	2963	10622	3652	1100	0	18337

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the development and test of new aircraft weapon subsystems, excluding missiles. These efforts support the requirement for low cost, reliable, easily maintainable, light weight armament subsystems of Advanced Design.

C. BASIS FOR FY 1979 RDTE REQUEST: The high explosive dual purpose (HEDP) 30mm Round, XM789, will be type classified. The 2.75 inch Rocket Lightweight Launcher and its boresight retention rack will be type classified and low rate initial production initiated. The remote set fuze screening smoke warhead and improved 2.75 inch Rocket Motor will continue development. Engineering Development of the remote set fuze submunition warhead for the 2.75 inch rocket will begin. These weapons provide the attack helicopter with supressive fire at the standoff ranges necessary to accomplish its mission.

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Aircraft Procurement, Army						
Funds	0	0	2300	3400	54478	60178
Quantities	0	0	3	4	122	129

E. DETAILED BACKGROUND AND DESCRIPTION: This program supports the development of new gun and rocket weapons subsystems for Army Aircraft. The requirement is for reliable, low cost, easily maintainable, minimum drag, lightweight armament subsystems of advanced design that provide sufficient standoff range and effectiveness. Guns (turret and pod mounted) and rockets proven feasible, continue development. Fire control and other associated equipment for total subsystem operation will be developed.

Program Element: #6.42.02.A
DoD Mission Area: #413 - Fire Support

Title: Aircraft Weapons
Budget Activity: #4 - Tactical Programs

F. RELATED ACTIVITIES: Close liaison is maintained with the other military services and industry to avoid duplication of effort. The Army participates in the Tri-Service Joint Technical Coordinating Group for Air-Launched Non-Nuclear Ordnance, an organization chartered at the major field command level. This group provides a medium for exchange of technical information and determination of joint use implications. An Army representative serves on the Air Munitions Requirements and Development Committee, an organization within the Office of the Secretary of Defense. One of the functions of this committee is the establishment of joint service requirements and development of air munitions. Related Program Elements are 6.42.07.A, Advanced Attack Helicopter; 6.42.12.A, COBRA/TOW; 6.32.06.A, Aircraft Weapons; and 6.22.01.A, Aircraft Weapons Technology.

G. WORK PERFORMED BY: Contractors: Hughes Aircraft Company, Canoga Park, CA; Norris Industries, Los Angeles, CA; Hercules Incorporated, Radford, VA; Hi-Line Plastics, Incorporated, Olathe, KS; Cosin Industries, Sheboygan, WI; Hughes Helicopters, Culver City, CA; Honeywell Incorporated, Minneapolis, MN; and five other contractors or prospective bidders accounting for ($629,000) of the effort. In-house organizations: US Army Aviation Research and Development Command, St. Louis, MO; US Army Armament Research and Development Command, Dover, NJ; US Army Missile Research and Development Command, Huntsville, AL; Naval Ordnance Station, Indian Head, MD; Project Manager Fighting Vehicles Systems, Warren, MI; Lake City Ammunition Plant, Lake City, MD.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Developed and standardized: 7.62mm suppressive fire subsystems for the OH-13, OH-23, UH-1B, UH-1C, UH-1D and CH-47 Helicopters; 2.75 inch rocket systems for the UH-1B, UH-1C and AH-1G Helicopters; a first generation hard point target missile system for the UH-1B (M-22); a 40mm grenade launcher system for the UH-1B and UH-1C; a new improved 7.62mm machine gun for all systems; and a super-quick fuze for the 2.75 inch rocket. Developed an improved 7.62mm machine gun and a 40mm grenade suppressive system for the OH-6A Helicopter; an illuminating flare and dispenser system for helicopters; and a 20mm automatic gun system for the AH-1G. Completed development of the proximity fuze for the 40mm grenade and 2.75 inch rocket. Developed an integrated fire control system utilizing moving target indicator radar for long-range target detection and forward looking infrared for target identification and engagement and 19-tube and 7-tube, repairable, reusable 2.75 inch aerial rocket launchers. Development of 30mm ammunition with aluminum case cartridge, XM-140 30mm automatic gun turret, and XM-129 40mm grenade launcher was completed. Initiated development of: the Aerial Scout sighting system (including day/night vision); and added navigation capability and laser rangefinder/designator; and improved survivability aspects for installation on the Light Observation Helicopter. Completed the TOW missile system installation on the AH-1G. A Data Acquisition Test (DAT) to acquire data on the performance characteristics and operational parameters of the XM188 and XM230, the two candidate 30mm cannons for the Advanced Attack Helicopter (AAH), was completed. Efforts for weight reduction and icing qualification for the AH-1G were completed. The Fixed Range Screening Smoke Warhead for the 2.75 inch rocket was type classified. 30mm Ammunition, common to NATO, for attack helicopters began development in FY 1977.

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2. FY 1978 Program: The Training Practice (XM788) and High Explosive (XM799) 30mm rounds with aluminum case cartridge will complete development and Low Rate Initial Production (LRIP) will begin. The High Explosive Dual Purpose (HEDP) warhead for the 30mm ammunition will begin development. The 2.75 inch Lightweight Launcher and the boresight retention rack will continue development. The remote set fuze (R/S) screening smoke warhead and the improved rocket motor for the 2.75 inch rocket will begin development.

3. FY 1979 Planned Program: The HEDP 30mm round (XM789) will complete development and low rate initial production (LRIP) will begin. The 2.75 inch lightweight launcher and the boresight retention racks will also enter LRIP. Development will continue for the R/S screening smoke warhead and improved motor for the 2.75 inch rocket. The R/S submunition warhead for the 2.75 inch rocket will begin development.

4. FY 1980 Planned Program: The R/S screening smoke warhead and improved motor for the 2.75 inch rocket will complete development. The R/S submunition warhead will continue development. The R/S illumination warhead will begin engineering development.

5. Program to Completion: The R/S submunition and R/S illumination warheads for the 2.75 inch rocket are scheduled to complete development in FY 1981 and FY 1982, respectively.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #DL62 — Title: Aircraft Rocket Subsystems
Program Element: #6.42.02.A — Title: Aircraft Weapons
DoD Mission Area: #413 - Fire Support — Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: This project began in FY 1976 as a combination of three related projects: the former Advanced Development project, DK62, Selective Effects Armament Subsystems (SEAS); the former Engineering Development project, D134, Aircraft Missiles and Rockets; and the Engineering Development project, D124 that supported fire control development. Combining the rocket development with the fire control efforts was a concerted attempt to produce a complete system for the AH-1G/S attack helicopter. The fire control program was transferred to Program Element (PE) 6.42.12.A, COBRA/TOW, in FY 1977 to provide better management of these programs. This project will be devoted to the 2.75 inch Rockets and associated subsystem development.

B. RELATED ACTIVITIES: Close liaison is maintained with other military services, NATO organizations, and industry to avoid duplication of effort. The Army participates in the Tri-Service Joint Technical Coordinating Group for Munitions Development, which provides a medium for exchange of technical information and determination of joint use implications. To enhance International Standardization, the Army participates in the North Atlantic Treaty Organization, Air Armament Working Party, and the Air Standardization Coordinating Committee. An Army representative serves on the Department of Defense Air Munitions Requirements and Development Committee which has as one of its functions the establishment of joint service requirements and development of air munitions. Related programs are 6.32.06.A, Aircraft Weapons; 6.42.07.A Advanced Attack Helicopter; 6.42.12.A, COBRA/TOW; and 6.22.01.A, Aircraft Weapons Technology.

C. WORK PERFORMED BY: Contractors: Hughes Aircraft Company, Canoga Park, CA; Norris Industries, Los Angeles, CA; Hercules Inc, Radford, VA; Hi-Line Plastics, Inc., Olathe, KS; Cosin Industries, Sheboygan, WI; Five other contractors or prospective bidders ($629,000). In-house organizations: US Army Aviation Research and Development Command, St. Louis, MO; US Army Armament Research and Development Command, Dover, NJ; US Army Missile Research and Development Command, Huntsville, AL; Naval Ordnance Station, Indian Head, MD.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: A product improvement program for a turret capable of accepting a 7.62mm, 20mm, or 30mm gun for integration on the AH-1S COBRA/TOW Helicopter began in FY 1976 and was subsequently transferred to Program Element 6.42.12.A, COBRA/TOW, in FY 1977. Development of a lightweight rocket launcher for the AH-64 Advanced Attack Helicopter (AAH) and the COBRA/TOW Helicopter was initiated in FY 1976.

Project: #DL62 Title: Aircraft Rocket Subsystems
Program Element: #6.42.02.A Title: Aircraft Weapons
DoD Mission Area: #413 - Fire Support Budget Activity: #4 - Tactical Programs

2. FY 1978 Program: Design configuration for the Remote Set Fuze (R/S) smoke screen warhead will be completed, verification tests will be conducted, and the first operational test will be initiated. Prototype lightweight launchers will be delivered and development and operational tests will be conducted. A contract will be awarded for the design and fabrication of prototype boresight retention and rapid rearm racks. Development and operational tests of this rack will be combined with those tests being conducted for the lightweight launcher. Work on the improved rocket motor task utilizing the Navy MARK 66 motor technology will begin with the procurement of long lead items. Prototype testing will be conducted to select one of the several fin and nozzle design approaches upon which further development will be accomplished.

3. FY 1979 Planned Program: Engineering Development of the Remote Set Fuze (R/S) multipurpose submunition warhead will begin with the procurement of long lead hardware and initial ground launch testing. Development testing will be completed on the R/S smoke screen warhead and operational testing will be initiated. The lightweight launcher and boresight retention rack program are scheduled to complete development and low rate initial production initiated. The work on rocket motor improvements will continue with the procurement of the selected improved fin and nozzle on the 2.75 inch rocket for interface with the MK66 motor. Static, ground launch, and airborne firing test will be conducted.

4. FY 1980 Planned Program: Ground launch testing of the R/S multipurpose submunition warhead will continue. Additionally, air launch testing and aircraft safety tests will be initiated. The development and operational testing plan will be updated and hardware for those tests will be procured and assembled. The R/S smoke screen warhead development will be completed. Engineering development of the R/S illumination warhead will begin. The rocket motor improvement development and operational testing will be completed, followed by type classification.

5. Program to Completion: The R/S multipurpose submunition warhead development and operational testing will be completed in FY 1981. Type classification of the illumination warhead is scheduled for FY 1982.

6. Major Milestones:

TASK NAME	MAJOR MILESTONE	DATE BY QUARTER
Lightweight Launcher	Type Classification	2d Q, FY79
Boresight Retention and Rapid Rearm Rack	Type Classification	2d Q, FY79
R/S Smoke Screen Warhead	Type Classification	2d Q, FY80
Rocket Motor Improvements	Type Classification	4th Q, FY80
R/S Multipurpose Submunition Warhead	Type Classification	3rd Q, FY81
R/S Illumination Warhead	Type Classification	2d Q, FY82

Project: #DL62 Title: Aircraft Rocket Subsystems

Program Element: #6.42.02.A Title: Aircraft Weapons

DoD Mission Area: #413 - Fire Support Budget Activity: #4 - Tactical Programs

7. Resources ($ in thousands):

	FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Cost
RDTE,A	930	5129	6808	4202	3753	25390
Quantities						10
APA	0	0	2300	3400	54478	60178
Quantities	0	0	3	4	122	129

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.42.03.A
Title: Aerial Scout
DoD Mission Area: #411 - Battlefield Surveillance
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	0	5487	41408	598405	645300
	Quantities					1438	1438
D281	Advanced Scout Helicopter (ASH)	0	0	2987	41408	598405	642800
D304	ASH NATO	0	0	2500	0	0	2500

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Ground commanders require a light, dedicated, highly survivable Advanced Scout Helicopter (ASH) for the conduct of reconnaissance, security, and target acquisition functions in all intensities of warfare. In performing these roles, the ASH will operate in cavalry, attack helicopter and field artillery units. The objective of this program is to develop and acquire a small, agile, and highly maneuverable ASH with Target Acquisition and Laser Designation (TADS), and Pilot Night Vision Systems (PNVS) equipment. The ASH will give the Army a new capability by providing the front line tactical units with an aerial scout capable of day and night operation under adverse weather conditions. As an integral part of the Army's combined arms team, the ASH will be the focal point for effectively finding enemy and directing a coordinated attack against these forces. In the anti-armor role, the ASH and the AH-64A, Advanced Attack Helicopter (AAH) will operate in close harmony as a hunter/killer team. The performance designed into the ASH will provide the power margin, agility and maneuverability required for nap-of-the-earth (NOE) tactics. The stand-off range capability provided by the TADS, night operation capability of the visionics, ability to operate NOE, and vulnerability reduction features will make the ASH a highly effective and survivable intelligence and target acquisition/designation system.

C. BASIS FOR FY 1979 RDTE REQUEST: Establish a program office; complete fiscal inputs, analyses, and trade studies for specification development; and develop a request for proposal for release to industry in FY 1980.

Major Milestones	Date
Cost Operational Effectiveness Analysis (COEA) Complete	November 1979
Concept Formulation Package Complete	November 1979
Draft Request for Proposal Complete	November 1979

Program Element: #6.42.03.A
DoD Mission Area: #411 - Battlefield Surveillance

Title: Aerial Scout
Budget Activity: #4 - Tactical Programs

Defense System Acquisition Review Council (DSARC) IB	December 1979
Request For Proposal (RFP) Released	December 1979
Source Selection	May 1980
Army System Acquisition Review Council (ASARC) II	May 1980
DSARC II	June 1980
Contract Award	July 1980

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Aircraft Procurement, Army						
Funds	0	0	0	0	To be Determined	To be Determined
Quantity	0	0	0	0	1438	1438

E. DETAILED BACKGROUND AND DESCRIPTION: In January 1974, Headquarters, Department of the Army, approved a Required Operational Capability (ROC) for the ASH and established a Task Force to investigate the means for acquiring the capability. During FY 1975 the Task Force conducted a review of the need for an aerial scout, and conducted concept formulation and trade-off efforts. The program was reviewed by the Army Systems Acquisition Review Council (ASARC) in June 1975, which approved the need for the ASH and initiation of development. In September 1975, the Department of Defense Systems Acquisition Review Council (DSARC) approved the need for the ASH and initiation of a development program. The Army also concluded that a certain amount of commonality for other aircraft applications in the ASH weight class could be accommodated if this consideration was incorporated early in the design stage. In March 1976, the DSARC reviewed the Army's assessment and reaffirmed support for a helicopter in the weight class of ASH for multiple applications. The DSARC also directed that the options for twin engine and other airframe applications should be maintained during development, approved development of a Target Acquisition Designation System (TADS) and Pilot Night Vision System (PNVS) to be common to the ASH and AAH, and approved delaying the initiation of ASH airframe development. Congressional action resulted in an increase of $18.7 million of FY 1977 funds for the AAH program for consolidation of TADS and PNVS development, deletion of ASH FY 1977 funds, and guidance to disestablish the ASH Project Office. Congress indicated, however, that the ASH program would be considered later if proposed by the Army. This submission reflects continuation of the Army requirement. The ASH will be a small, agile, highly maneuverable, aircraft. The primary mission of the ASH will be to perform airborne reconnaissance and surveillance, scout for the AAH as part of the hunter/killer team, and laser designate for the Cannon Launched Guided Projectile (CLGP). The ASH will be assigned to Air Cavalry, Attack Helicopter and Field Artillery units. By use of the TADS, it will be capable of locating targets day or night, at extended ranges and laser designating for precision guided

munitions such as the Hellfire missile on the AAH, CLGP in the Artillery, or the US Air Force delivered Maverick and laser guided bombs. The PNVS will provide a night capability to operate effectively in the nap-of-the-earth (NOE) environment. Incorporating the most recent aircraft technological advances, the ASH will have significantly improved reliability, maintainability, survivability, crashworthiness and performance.

F. RELATED ACTIVITIES: Previous aerial scout program concept and program formulation efforts were conducted under program element 6.32.05.A, Aerial Scout. The TADS and PNVS are being developed under program element 6.42.07.A, AAH. The ASH may use the GE T-700 engine which is being used on AAH and Utility Tactical Transport Aircraft System (UTTAS) and provide increased commonality. This engine was developed under program element 6.42.06.A, UTTAS. Weapons systems, being developed under program elements 6.46.21.A and 6.43.10.A, Heliborne Missile - Hellfire, will be capable of terminal homing guidance by the ASH.

G. WORK PERFORMED BY: Contractors will be determined when source selection has been completed in 1980. In-house developing organization: US Army Aviation Research and Development Command, St. Louis, MO.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: A program formulation effort was undertaken in FY 1973 which included defining the Required Operational Capability (ROC). With Department of the Army approval of the ROC during January 1974, a multi-command Task Force was established to formulate the ASH program. Program formulation efforts continued through FY 1975. During FY 1976, the program was reviewed and approved for development by the Office of the Secretary of Defense (OSD). During FY 197T, the Decision Coordinating Paper (DCP) and ROC document was updated and submitted for staffing at Department of the Army Headquarters in preparation for (DSARC) review to provide final program guidance in January 1977. In September 1976, Congressional action deleted all funds for the restructured FY 1977 program with the guidance that the Project Office should be disestablished. The office was disestablished on 30 September 1976.

2. FY 1978 Program: The Army will revalidate the ROC in FY 1978, coordinate with other Services, and NATO initiatives will be assessed. A Joint Services Operational Requirement will be developed and Memoranda of Understanding with interested NATO countries will be initiated if appropriate.

3. FY 1979 Planned Program: A program office will be organized and the concept formulation package completed. A request for Proposals (RFP) will be drafted in the second quarter, FY 1979. Industry comments will lead to a final RFP release in first quarter FY 1980. Responses from industry will be received in the second quarter, FY 1980. Studies will be initiated to adequately define trade-offs to current Army requirements which would be dictated by NATO involvement.

Program Element: #6.42.03.A Title: Aerial Scout
DoD Mission Area: #411 - Battlefield Surveillance Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: RFPs will be evaluated and contractor selection for prototype development made in the third quarter, FY 1980. Two competing contractors will initiate full-scale engineering development effort in fourth quarter, FY 1980.

5. Program to Completion: Full-Scale Development Phase efforts will continue toward completion in FY 1986. Maturity Phase Development efforts will be completed in FY 1988.

Program Element: #6.42.03.A
DoD Mission Area: #411 - Battlefield Surveillance

Title: Aerial Scout
Budget Activity: #2 - Tactical Programs

I. Test and Evaluation Data:

Development and operational test requirements are to be developed in accordance with the program alternative to be selected by the Department of the Army.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.42.04.A
DoD Mission Area: #441 - Airlift

Title: Air Mobility Support Equipment
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1151	829	1095	1595	Continuing	Not Applicable
	Quantities						Not Applicable
DC32	Ground Support Equipment (GSE)	50	60	52	0	Continuing	Not Applicable
DC33	Cargo Handling Equipment	175	272	200	245	Continuing	Not Applicable
DC45	Aircraft Subsystems and Components	0	0	198	400	Continuing	Not Applicable
D279	Air Drop Equipment Development	926	578	645	950	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops items of equipment, excluding aircraft, that support the Army air mobility concept. This program leads to the production of the items which are directly applicable to the aircraft or which support the aircraft fleet. Army aircraft must fly at low levels under conditions of reduced visibility to evade enemy air defense systems. These operating characteristics demand improved aircraft subsystems and components to enhance the efficiency, safety and survivability of air crew members operating in a hostile environment. New and improved ground support and cargo handling equipment is required to minimize aircraft turnaround times and to maximize efficient operations and maintenance, especially in forward battle areas. Airdrop Equipment Development: develops and fields airdrop systems, components, and techniques used for airborne assault, clandestine air entry, special operations, and airdrop resupply by all Services.

C. BASIS FOR FY 1979 RDTE REQUEST: Ground Support Equipment (GSE): Ground Support Equipment: Provide development support for acquisition of commercially available ground support equipment for Army aviation systems. Cargo Handling Equipment: Technical evaluation of the Air Force Advanced Medium Transport (AMST) aircraft to satisfy the user (Army) requirements. Aircraft Subsystems and Components: Initiate a consolidated effort to identify and develop common items of Aviation Life Support Equipment (ALSE). Airdrop Equipment Development: Operational Test (OT)/Development Test (DT) II will be initiated for the Type V Multipurpose Airdrop Platform Assembly. Staged Personnel Parachute Assembly for high speed airdrop of personnel at low altitudes will be procured for Engineering Design Test (EDT).

D. OTHER APPROPRIATION FUNDS: Not applicable. NOTE: Airdrop items are stock fund procured and managed.

Program Element: #6.42.04.A
DoD Mission Area: #441 - Airlift

Title: Air Mobility Support Equipment
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: The ongoing program combines the past efforts of ground support equipment, airdrop and cargo handling developments, to enhance the operational effectiveness of current and future aircraft systems and air mobility operations. The goals of this program are to improve existing hardware, develop and evaluate prototype equipment and type classify the acceptable items/systems. The ground support equipment project evaluates and develops equipment applicable to the servicing and maintenance of aircraft. The cargo handling project develops slings, nets, and devices to optimize helicopter transportation of supplies, equipment, and personnel in Army aircraft. The Airdrop Equipment Development project develops items/systems used in airdrop operations by the Army, Navy, Marine Corps, Air Force and as requested, Allied forces. Objectives are to increase mission capability of airdrop operations and improve the readiness posture of airborne/airlift forces. Improved reliability, reduction of operational costs and complexity are complementary goals.

F. RELATED ACTIVITIES: Program Elements 6.32.09, Air Mobility Support; 6.22.09, Aeronautical Technology; and 6.22.10.A, Airdrop Technology, in coordination with the Joint Technical Coordinating Group/Airdrop, Joint Air Movements Board and North Atlantic Treaty Organization Standardization Agreements. These panels and board maximize development progress, exchange research information and avoid duplication of effort.

G. WORK PERFORMED BY: Barnes & Reinecke, Chicago, IL; Brooks and Perkins, Inc., Livonia, MN; Pioneer Recovery Systems, Manchester, CT; Boeing-Vertol, Philadelphia, PA; Metric Systems Corp., Fort Walton Beach, FL; US Army Natick Research and Development Command, Natick, MA; US Army Aviation Research and Development Command, St. Louis, MO.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Completed development test and field evaluation of a self-propelled crane, cleaning and de-icing system and weapons handling vehicle in support of aircraft maintenance. Developed and type classified an aircraft maintenance trailer, heavy airdrop system, cargo parachute ground release, MC1-1B steerable parachute, aircraft aerial recovery kit, helicopter external cargo slings, platform extraction force transfer coupling, universal drive-off aid, improved parachute harness, and the G-11B parachute for low level airdrop of loads up to 15 thousand pounds. Awarded contract for quantity of Type V airdrop platforms to be operationally tested. Qualified 34 loads for Low Altitude Parachute Extraction System. Awarded contract for Interim High Level Container Airdrop System for operational test (OT)/developmental test (DT). Fabricated test items of the DRAGON Missile Jump Pack.

2. FY 1978 Program: Prototype aircraft cleaning and de-icing system will undergo design refinement in preparation for formal DT/OT. Initial operational capability (IOC) will be achieved for 10 thousand and 25 thousand pound capacity helicopter external cargo slings. Production engineering support for procurement of the 5 and 10 thousand pound capacity cargo nets will be initiated. Development will be initiated for helicopter external carrying devices designed for rapid transport of vehicles, such as the M880/

890 series, which have no integral lift attachments. Airdrop Equipment (ADE): Contract for design and fabrication of a quantity of Type V airdrop platforms for DT/OT II. A joint Army/Air Force test plan will be developed for the Type V joint Service airdrop platform project. Conduct of DT/OT II on the interim high altitude airdrop resupply system (IHLCADS) and type classification action for the 2 thousand pound system. Qualification of selected airdrop loads for air delivery using the Low Altitude Parachute Extraction System (LAPES) will continue. A joint Air Force/Army development test program for operational certification of the High Speed Low Level Airdrop System will be conducted. Rigging procedures for high priority selected munitions will be developed.

3. FY 1979 Planned Program: Test the cleaning and de-icing system and complete type classification. Technical evaluation of the Air Force Advanced Medium STOL Transport (AMST) to transport and airdrop Army personnel and equipment will be supported. Development will be initiated on common Aviation Life Support Equipment (ALSE) for helicopters, such as a crashworthy litter, standardized crew restraint and on-board oxygen generating systems. Commercially available equipment will be applied to selected aircraft to improve cockpit lighting for night operation, especially when using night vision goggles. Airdrop Equipment (ADE): The Type V multipurpose joint Service airdrop platforms obtained in FY 1978 will be operationally tested. This platform will replace three other airdrop platforms and physically reduce the quantity of field stock required. Prototypes of the staged personnel parachute assembly will undergo Engineering Design Test. Support type classification of IHLCADS.

4. FY 1980 Planned Program: Data collection by the Army on the AMST will continue. Engineering development (ED) is planned for a container lift adapter and a gondola system. The crashworthy litter system and crew restraint system are scheduled to enter developmental testing (DT). Development effort to provide new systems for internal and external Army aircraft lighting will be initiated. A family of skis for the aircraft fleet will be developed. ADE: DT II/Operational Test II and type classification of the Type V airdrop platform will be completed. Engineering design of the Staged Personnel Parachute Assembly will be completed. Development of the 500 pound capacity Interim High Level Container Airdrop System will be initiated and engineering design of the Airdrop Controlled Exit System (ACE), transitioned from Program Element 6.32.09.A, will be initiated.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.42.06.A

Title: BLACK HAWK, YUH-60A (Formerly Utility Tactical Transport Aircraft System, UTTAS)

DoD Mission Area: #441 - Airlift

Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	74778	37935	2972	0	0	467656
	Quantities						Not Applicable
D189	Engine	5000	3255	0	0	0	70115
D378	BLACK HAWK	69778	34680	2972	0	0	397541

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The BLACK HAWK is a new twin engine helicopter that will replace the UH-1 helicopter in the air assault, air cavalry and AEROMEDICAL evacuation mission. This new aircraft is designed to be the Army's first true squad assault helicopter. The BLACK HAWK supports the Army's airmobility doctrine for employment of land forces through the 1980s. Adaptable to all intensities of conflict, in worldwide geographical and environmental conditions, the BLACK HAWK provides the mobility necessary to rapidly mass, disperse and recycle forces, weapons and equipment. This significant combat multiplier enhances the capability and flexibility of land forces to successfully accomplish missions of the modern battlefield. *The BLACK HAWK reduces the cost per troop mile over 40 percent. Improved reliability and maintainability will* provide the Army with a low cost of ownership helicopter.

C. BASIS FOR FY 1979 RDTE REQUEST: The airframe contractor will finalize producibility engineering and planning (PEP) and provide support of government verification testing. The engine contractor, General Electric (GE), will continue to provide support for government verification testing and continue with the redesign and verification of changes in design resulting from the cost reduction program.

Major Milestones	Date
a. Engine Development Contract Award	Mar 72
b. Prototype Development Contracts Awarded	Aug 72
c. First Flight	Nov 74
d. Engine Military Qualification Test (150 hr)	Mar 76
e. Prototype Evaluation Completed	Dec 76
f. Production Award	Dec 76
g. Initial Aircraft Production Delivery	Aug 78
h. Force Development Test and Evaluation Completed (FDTE)	May 79

Program Element: #6.42.06.A

Title: BLACK HAWK, YUH-60A (Formerly Utility Tactical Transport Aircraft System, UTTAS)

DoD Mission Area: #441 - Airlift

Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

AIRCRAFT PROCUREMENT, ARMY	FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Cost
Funds	140600	235800	376900	426100	1967600	3147000
Quantities	15	56	129	168	739	1107

E. DETAILED BACKGROUND AND DESCRIPTION: The BLACK HAWK program started with the development objectives of both an airframe and engine in 1965. Concept formulation studies were conducted in 1967 to define the required performance parameters for primary and secondary missions. The primary mission is delivery of the combat infantry squad and supplies, with air cavalry and aeromedical evacuation as secondary. It provides a follow-on helicopter that has 1 1/2 to 11 times more troop lift capability than the UH-1 helicopter, with substantially improved performance, reliability, maintainability, survivability, and crashworthiness characteristics. The BLACK HAWK, with a crew of three, will be capable of transporting 11 combat equipped troops, or an equivalent payload.

F. RELATED ACTIVITIES: The US Navy awarded interim sustaining contracts to Sikorsky Aircraft and General Electric for the Light Airborne Multi-purpose System (LAMPS) mission which will utilize a slightly modified BLACK HAWK with a T700 engine derivative. A Memorandum of Understanding has been signed by the BLACK HAWK and LAMPS Project Managers on 17 November 1977. Close coordination is being maintained with the LAMPS project to help reduce costs through commonality of the two systems. The Air Force has expressed an interest in the BLACK HAWK for their air rescue mission. Constant dialogue is being maintained with both Services in this regard.

G. WORK PERFORMED BY: The T-700 engine development is being conducted by General Electric (GE), Lynn, Massachusetts. The BLACK HAWK airframe development, production and systems integration is being conducted by Sikorsky Aircraft Division of United Technologies, Stratford, Connecticut. Responsibility for the project is vested in the BLACK HAWK Project Manager, US Army Materiel Development and Readiness Command, St. Louis, Missouri.

Program Element: #6.42.06.A

Title: BLACK HAWK, YUH-60A (Formerly Utility Tactical Transport Aircraft System, (UTTAS)

DOD Mission Area: #441 - Airlift

Budget Activity: #4 - Tactical Programs

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Following early concept and definition studies (1965-1970) the Department of Defense, in Jun 1971, approved the initiation of a program to develop an aircraft to replace the UH-1 helicopter in certain missions. By August, 1972 the Army had selected General Electric as the engine contractor and Boeing and Sikorsky as the competing airframe contractors. Both airframe contractors completed fabrication of the ground test vehicles (GTV), Static Test Articles and three flying prototypes each in FY 74 and achieved first flight in November, 1974. The General Electric T-700 engine successfully completed a 50 hour preliminary flight rating test in September 1974 and deliveries of the flight rated engines continued into 4QFY75. In September 1975 the Army awarded both airframe contractors Producibility Engineering and Planning (PEP) contracts. They continued their Ground Test Vehicle (GTV) testing and achieved the 150 hour Military Qualification Test (MQT) rating August 1975. The GET-700 engine achieved its 150 hour (MQT) rating goal in March 1976, Government Competitive Tests ran from March to December 1976. During this time the 300 hour GTV test was completed. Following the Service Selection evaluation and the Army and Defense Systems Acquisition Review Council decisions, a contract was awarded to Sikorsky on 23 December 1976 for completion of full scale development and initial FY 77 production. During FY 77 General Electric updated their engines for the maturity phase and initiated and provided both in-house and vendor tool design effort to provide necessary production tooling.

In order to identify failure modes or design deficiencies and determine corrective action for the production vehicle, comprehensive reliability, availability and maintainability (RAM) programs were initiated to provide: engine reliability growth assessments; aircraft prototype RAM assessments; failed item analysis and corrective action; task verification; vendor audits and design reviews. By December 1977 General Electric will have completed the update of 20 engines for the maturity phase of the flight test program and will have finished with two 1000 hour endurance runs on separate engines. Additionally they initiated a separate 1500 hour accelerated mission test to detect failure modes associated with time in simulated aircraft environment. The test will lead the fleet by three to five years and will provide sufficient time to identify and correct any deficiency well in advance of the problem being discovered in the field. During FY 1977, GE continued to provide engineering and logistics support to Sikorsky Aircraft Company for the continued flight testing. System familiarization training and flight transition training for Army personnel were conducted and update of existing prototype publications continued.

Program Element: #6.42.06.A

Title: BLACK HAWK, YUH-60A (Formerly Utility Tactical Transport Aircraft System, UTTAS)

DoD Mission Area: #441 - Airlift

Budget Activity: #4 - Tactical Programs

2. FY 1978 Program: The maturity phase testing will focus on completion of the Ground Test Vehicle military qualification test (MQT); component vulnerability tests; peculiar support equipment qualifications; main and tail rotor component fatigue testing; full system and miscellaneous component qualification testing; and life support environmental and furnishing tests. In addition, operational, reliability and maintainability tests will be conducted and Producability Engineering and Planning efforts will be ongoing in preparation for the follow-on production decision scheduled for August 1979. Publications continue to be improved and verified. Engineering and logistic support for the maturity flight test phase will continue. The 1500 hour acceleration test to determine engine failure modes will be completed and the component improvement program phase of production engines will be initiated. The following training courses are planned to be conducted: System familiarization for 25 Army and 2 Navy personnel; flight transition training for 10 Army and 2 Navy Personnel; mechanic training for 31 Army personnel. The Army will begin receiving production aircraft in August 1978.

3. FY 1979 Planned Program: Airworthiness and flight characteristics and cold regions (Arctic) tests , will be completed. GE will continue with the component improvement program on the engine. All planned R&D effort will be completed. A decision for entry into the follow-on production phase will be made 4QFY79. With the receipt of its full complement of aircraft and mission equipment the first unit will achieve its initial operational capability (IOC). Decrease in required funding from FY 1978 is due to the planned completion of the Research and Development phase and increase in the production efforts.

4. FY 1980 Planned Program: No current funding requirements for FY 1980 are reflected in view of R&D program planned completion in FY 1979.

5. Program to Completion: After completion of the maturity phase and force development testing and experimentation (FDTE), no further research, development, test and evaluation (RDTE) effort is contemplated.

Program Element: #6.42.06.A

Title: BLACK HAWK - YUH-60A (Formerly Utility Tactical Transport Aircraft System (UTTAS)

DoD Mission Area: #441 - Airlift

Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation: Full scale engineering development testing of the BLACK HAWK continues. Testing is currently being conducted by General Electric (GE) (T700-GE-700) and Sikorsky (YUH-60A). After successfully completing over 1800 hours of contractor development ground and flight testing, the BLACK HAWK candidate prototypes were accepted by the Army in March 1976 for the Government Competitive Test (GCT). The GCT, which consisted of approximately 800 hours per candidate design, was accomplished during Development Test/Operational Test II (DT/OT II) from March to December 1976. The GCT demonstrated that the BLACK HAWK was ready to transition into production and final engineering development (Maturity Phase) testing. Test results demonstrated that engineering was reasonably complete and that solutions to minimal design changes were in hand. Testing was sufficient to provide accurate assessment of technical performance including reliability, availability and maintainability (RAM), supportability considerations, environmental effects, and demonstrated a satisfactory man/machine interface. Deficiencies identified during GCT included restricted visibility during landing approach, reduced vertical climb and partial main rotor blade separation. Corrective action has been taken to improve visability by redesigning the instrument panel size and reprograming the moveable stabilator. Vertical rate of climb is projected to be at least 480 feet per minute based on the reduced weight of the production model (16450 lbs. vs prototype weight of 16790 lbs.). The blade tip has been redesigned to preclude the aerodynamic influence that caused the failure during the GCT. These deficiencies have been corrected and incorporated into production aircraft. Artificial icing tests were conducted in Alaska and all test objectives were met. Improved maintainability and reliability is a major technical goal for the BLACK HAWK. The maintainability and reliability goals and values demonstrated during GCT established that interim RAM requirements have been achieved and that production goals will be met. In the maturity phase which commenced in January 1977, the BLACK HAWK prototypes have accumulated over 400 flight hours. Included are 110 hours of Government testing at Fort Drum, New York in a cold weather environment of sub-freezing temperatures and moisture in the form of wet snow and freezing rain, a radar reflectivity survey and an armament subsystem demonstration. Snow/freezing moisture related deficiencies were discovered during the testing and fixes, i.e., better sealing, tail rotor boots and engine inlet covers have been designed and incorporated in production.

2. Operational Test and Evaluation:

a. OT II was conducted in two phases by the US Army Operational Test and Evaluation Agency (OTEA) and provided data upon which to assess the effectiveness of the BLACK HAWK candidates in an operational environment. Phase I included the training of aviators and maintenance personnel. Formal maintenance training was conducted by contractor personnel at their facilities and at Fort Rucker, Alabama during DT II. The pilots were given transition training by the contractor at the beginning of DT II. Phase II was conducted by elements of the 101st Airborne (Air Assault) Division at Fort Campbell, Kentucky, over a ten week period beginning 21 June 1976 and ending 2 September 1976. Included was a one week high altitude test in the Cherokee National Forest in eastern Tennessee. Simulated combat missions were flown during which data were collected on

performance, human factors and RAM. The two BLACK HAWK candidates were flown over 500 hours 254 for YUH-60A, (Sikorsky version) and 260 for YUH-61A (Boeing version). The prototype aircraft provided were basically representative of the configuration to be procured. OTEA's position, as briefed to the Army Systems Acquisition Review Council (ASARC) in November 1976, was that there were no outstanding critical issues which would require OT III. OTEA recommended that unresolved operational test issues, (e.g., forward visibility and main rotor blade separation (cited above), be evaluated during the conduct of an Initial Operational Capability Force Development Test and Experimentation (IOC-FDTE)).

b. The IOC-FDTE, scheduled from January to May 1979, will be a 20 week, 600 hour, user test utilizing eight production aircraft and will be conducted at Fort Campbell, Kentucky, by elements of the 101st Airborne (Air Assault) Division. This test will evaluate the operational effectiveness, to include flight effectiveness and mission performance capability; assess the operational reliability, maintainability and availability (RAM) of the system when employed by field forces; evaluate the adequacy and effectiveness of the pilot and maintenance training programs; and validate the logistics support concept. The mission events conducted will be based on US Army Training and Doctrine Command (TRADOC) established doctrine and procedures. The US Army Operational Test and Evaluation Agency (OTEA) will monitor test execution and provide an independent evaluation to ASARC IIIa.

3. Systems Characteristics: Performance is required at Design Gross Weight (approximately 16450 lbs.), 4000 feet pressure altitude and 95°F ambient temperature conditions. In addition, the Vertical Flight Performance Characteristics (VFPC) is required under zero wind conditions using not more than 95% intermediate rated power.

Characteristics	Objective	Demonstrated Performance (Government Evaluation)
Cruise Speed (max continuous power, knots true air speed (KTAS)	145-175	145
Endurance, (hours)	2.3	2.3
VFPC, feet per minute (FPM)	450-550	450 @ 2850 ft/95°F[1/]
Maneuver, (feet distance to clear 200 foot object at 150 KTAS)	1100-1300	Less than 1100 feet
Vibration Levels (cockpit force level changes, g's)	.05	.1[2/]
Vulnerable Area (prime threat square feet)	0	0
Air Transportability - C130[3/]	1	1 - using mockup
C141	2	2
C5A	6	[3/]
System Mean Time Between Failure (MTBF) hours (Government Competitive Tests)/ASARC IIIa	2.6/4.0	3.07/[3/]

1/ Projected to be 480 FPM @ 4000 ft/95°F with airframe weight reduction.
2/ .1 is contract specification; compatible with military specifications for comfort, reliability maintainability.
3/ To be determined during FDTE.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.42.07.A
DoD Mission Area: #413 - Fire Support

Title: Advanced Attack Helicopter
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	130816	164870	177449	172827	118496	986203
	Quantity						9
D425	Advanced Attack Helicopter	130816	164870	177449	172827	118496	986203

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Under this program, the Army is developing an Advanced Attack Helicopter (YAH-64) anti-armor weapon system. The YAH-64 is a twin engine rotary wing aircraft designed as a stable, manned aerial weapon vehicle. It will be capable of defeating a wide range of targets, but is optimized for destruction of armored vehicles. It will provide responsive direct aerial fires as an integral element of the ground units and be capable of performing its mission at night and under adverse weather conditions. This weapon system is required to contribute highly mobile, effective and accurate firepower to the anti-armor capability of the Army in the field. Aircraft armament includes the HELLFIRE anti-tank missile system, 30mm automatic gun and 2.75" rockets. The YAH-64 will become the primary attack helicopter and will be complemented by the AH-1 series attack helicopters. The program is currently in Full Scale Engineering Development (Phase 2), which was preceded by competitive airframe development.

C. BASIS FOR FY 1979 RDTE REQUEST: During FY 1979 fabrication of the three Phase 2 flying prototypes will continue. Design, development and testing of mission essential subsystems will also continue and include functional integration of the competing TADS/PNVS, HELLFIRE missile system and area weapons related equipment into the aircraft.

Major Milestones	Date
Award Aerial Vehicle Development Contract (Phase I)	Jun 1973
First Flight	Sep 1975

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Program Element: #6.42.07.A
DoD Mission Area: #413 - Fire Support

Title: Advanced Attack Helicopter
Budget Activity: #4 - Tactical Programs

Complete Air Vehicles Fly-Off	Sep 1976
Award Full Scale Engineering Development Contract (Phase 2)	Dec 1976
Award Competitive TADS/PNVS Contracts	Mar 1977
Competitive TADS/PNVS Selection	Mar 1980
Complete OT IIa	Sep 1980
Production Contract Award	Dec 1980
Complete OT IIb	Aug 1981
First Production Delivery	Dec 1982
Initial Operational Capability (IOC)	

D. OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Aircraft Procurement Army)					3153100	3153100
Quantity					536	536

E. DETAILED BACKGROUND AND DESCRIPTION: In September 1972, the US Army approved an Advanced Attack Helicopter (AAH) development program to provide greater agility and hover performance and a greater aerial fire support capability than currently available in existing Army aerial weapons systems. The AAH Program was presented to the Defense System Acquisition Review Council (DSARC I) on 28 September 1972. On 10 November 1972 the Deputy Secretary of Defense authorized release of the AAH Request for Proposals (RFP), specifying a $1.4M to $1.6M (FY 72 constant dollars) constraint on the recurring fly-away design-to-unit production cost. The RFP stressed acquisition and operating costs as prime considerations in the program and in the competitive selection between contractors. As a result of the HELLFIRE DSARC on 26 February 1976, it was decided that the HELLFIRE missile would be utilized as the point target weapon for the AAH in lieu of the initially proposed tube launched, optically tracked, wire guided (TOW) missile system. On 23 March 1976 the DSARC directed the Target Acquisition Designation System (TADS) and the Pilot Night Vision System (PNVS) be developed for fly-off on the YAH-64. Development of the AAH consists of two phases. The first phase was conducted as a fly-off of two prototypes each from the competing contractors, Bell Helicopter Textron and Hughes Helicopters, to insure airframe acceptability in the critical areas of flight handling qualities and performance. Government testing (fly-off) was completed on

30 September 1976. The AAH DSARC II was held on 7 December 1977 and resulted in approval of the AAH to enter full scale engineering development (Phase 2). On 10 December 1976 the Secretary of the Army selected Hughes Helicopters (YAH-64) as the prime aircraft system contractor for Phase 2. Phase 2 will consist of modification of the two Phase 1 aircraft, fabrication of three additional air vehicles, sub-systems development, and integration of these subsystems into the aircraft. Of particular importance to the AAH Program is the competitive development of TADS/PNVS currently on contract with Martin-Marietta and Northrop Corporation. Fly-off and selection of the winning contractor is currently scheduled for March 1980, and is considered a critical Milestone in the AAH Program. At the direction of the Office of the Secretary of Defense, development of the 30mm gun ammunition will be ADEN/DEFA compatible to provide interoperability with NATO and other services 30mm guns. The YAH-64 Program Manager has development and acquisition responsibility for this ammunition. Product Managers for TADS/PNVS development and for 30mm Aircraft Gun Type Ammunition have been designated to assist the Advanced Attack Helicopter Program Manager in the development of these programs.

F. RELATED ACTIVITIES: The Army AH-1S COBRA/TOW, Program Element (PE) 6.42.12.A, and the Marine Corps AH-1T are related helicopters. The AH-1S provides the Army an early aerial anti-tank capability with the TOW missile until the availability of the higher performance YAH-64 and is planned as a complement to the YAH-64 in a high-low mix. The AH-1S and AH-1T lack performance, night vision devices and survivability characteristics required in the AAH. The General Electric T700 engine installed in the YAH-64 is being managed by the BLACK HAWK Project Manager (PE 6.42.06.A). The Heliborne Missile - HELLFIRE is being developed under PE 6.43.10.A. The 30mm ADEN/DEFA ammunition is being developed under PE 6.42.02.A, Aircraft Weapons.

G. WORK PERFORMED BY: Hughes Helicopters, Summa Corporation, Culver City, California, is the airframe developer and responsible for the total weapon system integration in Phase 2. General Electric Company, Lynn, Massachusetts, is the manufacturer of the government furnished T700 engine. Martin-Marietta, Orlando, Florida, and Northrop Corporation, Anaheim, California, are the two competitive contractors for development of the Target Acquisition Designation System (TADS) and the Pilot Night Vision System (PNVS). The Advanced Attack Helicopter Program Manager's Office, located at the US Army Aviation Research and Development Command, St. Louis, Missouri, is responsible for the development program.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Competitive development contracts for Phase I were awarded to Bell Helicopter Textron and Hughes Helicopters on 22 June 1973. Phase I concentrated on aerial vehicle development with Phase II scheduled for subsystems

development and total weapon system integration. During FY 1974 through the latter part of FY 1976, each of the contractors designed, fabricated and tested a Ground Test Vehicle (GTV) and two prototype air vehicles. On 30 September and 1 October 1975, Hughes Helicopters and Bell Helicopter Textron, respectively, made first flights with the prototype and began the contractor flight test program. On 31 May 1976 each contractor delivered two flyable prototypes to the Government for flight training, testing and evaluation. Flight testing was successfully accomplished on 30 September 1976. Source selection activities, begun in July 1976 when the Army received the contractor's Phase 2 proposals, were completed upon selection of Hughes Helicopters. A contract was awarded for full scale engineering development on 10 December 1976. The Army received Target Acquisition Designation System (TADS) and Pilot Night Vision System (PNVS) proposals from industry in November 1976 and awarded contracts on 10 March 1977. During FY 1977, Hughes Helicopters initiated the engineering design and fabrication effort for modifications to the Phase 1 vehicles identified by the Source Selection Evaluation Board. Design support testing was also initiated on the GTV and air vehicles to support the Phase 2 prototype modification effort. Due to a restructuring of the original FY 1978 budget request, fabrication of the additional three flight prototypes was delayed until FY 1978.

2. FY 1978 Program: The prime contractor will continue modification and testing of the two Phase 1 prototype aircraft. Effort on design, fabrication and assembly of three additional prototype aircraft will commence. Design and fabrication of the major subsystems, particularly those associated with the fire control, will continue and begin their integration into the airframes. The Target Acquisition Designation System (TADS) and Pilot Night Vision System (PNVS) contractors will finalize designs, fabricate, assemble and ground test the systems. Delivery of the first TADS/PNVS articles is scheduled for August 1978 to Hughes Helicopters for subsequent integration into the air vehicles.

3. FY 1979 Planned Program: A major effort will be expended toward fabrication of the three additional flying prototypes, with two of the aircraft being readied for flight in the latter part of the year. Delivery of the remaining TADS/PNVS systems will be made to Hughes by the associate contractors and these systems will be given a thorough ground evaluation on the mission subsystems simulator prior to integration on the flight vehicles. A major effort will also be directed toward integration of all elements of the fire control system into the prototypes. The first HELLFIRE missiles will be fired commencing with ballistic missiles and moving toward the live firing phase in the latter part of the fiscal year. The Ground Test Vehicles (GTV) will be completely updated to incorporate the latest engineering changes and will begin the series of tests to formally qualify the various dynamic components and support the reliability objectives. The Phase 1 air vehicles will be utilized in the initial part of the fiscal year for flight loads surveys, stores jettison tests, dynamic stability tests and flying qualities evaluations to include a partial expansion of the height velocity spectrum. In the latter part of the fiscal year, the armament and fire control surveys will begin and government pilot training will take place in preparation for the TADS/PNVS evaluation and flyoff early in the following year. The increase of funds over the previous year results from the material fabrication of the additional prototypes, the acquisition of missiles for testing on the air vehicles, and the extensive testing to be accomplished.

4. FY 1980 Planned Program: First flight will be conducted on the third additional flight prototype. The Government will conduct a flight evaluation of the competing Target Acquisition Designation/Pilot Night Vision Systems (TADS/PNVS) and select the system for integration into the air vehicles for further developmental and operational testing. Subsequent to contractor flight testing and qualifications, the Government will conduct a user Operational Test (OT) IIa to evaluate the full subsystems equipped aircraft.

5. Program to Completion: The Advanced Attack Helicopter Defense Systems Acquisition Review Council (DSARC) III will be held in November 1980 with the production contract for the YAH-64 to be awarded in December 1980. Development and operational testing of the total weapon system, with emphasis on maturity of the TADS/PNVS subsystems will be accomplished. OT II b is scheduled to complete the operational suitability testing of the YAH-64 with emphasis on reliability, availability and maintainability. Prototype testing, including physical tear down, airworthiness and flight characteristics, and climatic hanger work will be completed by August 1981 when Phase 2 engineering development ends.

Program Element: #6.42.07.A
DoD Mission Area: #413 - Fire Support

Title: Advanced Attack Helicopter (AAH)
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation (DT&E): Competing AAH contractors, Bell Helicopter Textron and Hughes Helicopters, successfully completed Phase I development testing on 30 September 1976. Phase I testing included contractor design support tests, testing of individual components to verify structural integrity and establish fatigue life, and bench testing of dynamic components. Complete dynamic system testing was conducted utilizing the Ground Test Vehicle (GTV) beginning in April 1975. Following successful completion of GTV qualification testing, first flights occurred on 30 September and 1 October 1975 for Hughes and Bell, respectively. Each contractor completed more than 300 hours of flight testing prior to delivery of two flight vehicles each to the Army on 31 May 1976. This contractor flight testing was oriented primarily toward flight envelope development, demonstration of structural integrity, and evaluation and verification of aircraft flight handling qualities. Limited in-flight firing tests of the 30mm cannon and 2.75-inch rockets were also conducted.

Development Test (DT) I was conducted by the Army Engineering Flight Activity (AEFA) at Edwards Air Force Base, California, during July-September 1976. These tests were conducted primarily to evaluate flight handling qualities and aircraft performance and included in-flight firing of the 30mm cannon and 2.75-inch rockets. Reliability, availability and maintainability (RAM) data were obtained throughout the DT test program. The Hughes YAH-64 was selected by the Army to enter Engineering Development (Phase II) and a contract was awarded on 10 December 1976.

Since Phase I was primarily a competitive airframe development program, testing to date has not included the complete mission equipment package. YAH-64 testing has not included the HELLFIRE Missile system, Target Acquisition Designation System/Pilot Night Vision System (TADS/PNVS), weapons fire control, or navigation systems. The development, integration, test and evaluation of these critical subsystems is the primary purpose of the Phase II program.

Phase II DT will make maximum use of contractor/Government integrated tests to eliminate duplication. Initial DT in Phase II will further expand the aircraft flight envelope and evaluate any changes/modifications that have been processed to the Phase I design. Concurrently, bench testing of subsystem components will be conducted prior to the first flight of a full subsystem equipped aircraft. Since the TADS/PNVS program is also a competitive development, one each of the two TADS/PNVS designs will be installed on two YAH-64 prototypes to be used in a competitive selection. Following TADS/PNVS selection, all four subsystem aircraft will be equipped with the winning TADS/PNVS for final qualification testing and for use in Operational Tests (OT) II. Firing of the weapons systems, HELLFIRE, 30mm and 2.75-inch rockets, will also be conducted. Approximately 1,570 hours of contractor and 350 hours of Government DT II flight testing is scheduled in Phase II. Production testing will be scheduled to evaluate production aircraft.

2. Operational Test and Evaluation: Operational Test (OT) I was conducted in September 1976 at Edwards Air Force Base, California, by the US Army Operational Test and Evaluation Agency (OTEA) in conjunction with Development Test (DT) I. Approximately 16 hours were flown on each contractor's design during this test utilizing representative attack helicopter mission profiles. Emphasis was placed on evaluating aircraft flight and detectability characteristics and mission performance in a low level and nap-of-the-earth (NOE) operational environment. Military crews for the competitive flight tests consisted of Army Engineering Flight Activity (AEFA) test pilots as pilot, and experienced attack helicopter pilots from the US Army Forces Command (FORSCOM) units as co-pilot/gunner. Operational Army maintenance personnel observed all maintenance activities. The current Army attack helicopter (AH-1S) was concurrently flown on all YAH-64 missions to establish comparative baseline information. The full weapons, visionics, and navigation subsystems were not tested during OT I. OTEA prepared an independent evaluation of OT I which was briefed by the Project Manager to the Army Systems Acquisition Review Council in December 1976.

OT II testing will be conducted in two phases. OT IIa is scheduled to be conducted by OTEA, separate from development tests, during September 1980 at Yuma Proving Grounds, Arizona. The primary purpose of this test is to permit operational evaluation of the full subsystems equipped aircraft. This test will include firing of the HELLFIRE, 30mm, and 2.75-inch rocket systems and nonfiring exercises. Four YAH-64 aircraft equipped with the selected Target Acquisition Designation System/Pilot Night Vision System (TADS/PNVS) subsystems will be utilized, for a total of approximately 110 flight hours. Flight crews and maintenance personnel will be provided by FORSCOM. OTEA will prepare an independent evaluation of OT IIa.

OT IIb is scheduled to be conducted by OTEA during July-August 1981 at a site yet to be selected. An estimated 240 hours will be flown utilizing three fully equipped YAH-64 helicopters under a complete range of flying conditions and mission profiles. OT IIb is designed to continue the operational suitability testing, with emphasis on reliability, availability and maintainability (RAM). OTEA will prepare and present an independent evaluation of OT IIb.

3. Systems Characteristics: Following are the major performance characteristics that are basis for technical assessments during the second phase of development. Performance requirements are at 4000 feet/95 degrees Fahrenheit.

Characteristics*	Objective	Demonstrated Performance **
Vertical Rate of Climb (feet per minute)	450	470
Cruise Airspeed (knots	145	142
Endurance (hours)	1.83	1.83
Ordnance Payload		
30mm Ammunition (rounds)	320	320
Antitank Missiles	8	8

NOTES: * Performance required at primary mission gross weight, operating within specified mission profiles.
** From the Source Selection Evaluation Board (SSEB) final report; based on Government Development (DT) I YAH-64 data and adjusted to the approved armament configuration.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.42.12.A
DoD Mission Area: #412 - Close Combat

Title: COBRA/TOW
Budget Activity: #4 - Tactical Programs

A. RESOURCES/PROJECT LISTING: ($ in Thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	7158	14398	10827	2000	0	59063
D639	COBRA/TOW	7158	14398	10827	2000	0	59063

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The COBRA/TOW is a single rotor, two seat attack helicopter designed to provide the Army with an early heliborne anti-tank capability. Earlier, RDTE funds were used to integrate the TOW missile system with the AH-1G (COBRA) helicopter and initiate a program to improve the aircraft agility and maneuverability. Development effort continues to improve the aircraft rocket subsystem, fire control, an automatic gun type weapon and initiation of improvement in the main rotor hub.

C. BASIS FOR FY 1979 RDTE REQUEST: The requested funds will be directed toward continuation of the development contract for a more operationally effective secondary armament subsystem for the COBRA. This subsystem is required to fulfill tactical needs for aerial fire support, stand-off capabilities and improved survivability. The requested funds also provide for continued development of a 30mm cannon capability in the Universal Turret to ultimately replace the interim 20mm cannon.

Major Milestones:	Weapons Fire Control	Upgunning	30MM Cannon
Development Contract Award	Dec 1976	Jun 1976	Apr 1978
Delivery of Prototype Hardware	Feb 1978	Sep 1977	Nov 1978
Informal In-Process Review	Sep 1978	Jun 1977	Mar 1980
Initial Production Contract Award	Oct 1978	Jul 1977	Apr 1980

Program Element: #6.42.12.A
DoD Mission Area: #412 - Close Combat

Title: COBRA/TOW
Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement, Army						
Funds	124100	130100	140700	3130	0	506900
Quantities	82	83	78	15	0	324

E. DETAILED BACKGROUND AND DESCRIPTION: To fulfill an urgent requirement for an operational aerial anti-tank system, the Army initiated a development program to equip the AH-1G (COBRA) aircraft with the aerial Tube launched Optically tracked Wire guided (TOW) missile system. The development contract to accomplish this was awarded in March 1972. Eight AH-1G aircraft were modified with the aerial TOW system for the development and testing efforts that began in FY 1973. An AH-1G modified with the TOW missile system was designated AH-1Q. During operational testing of the AH-1Q, it was determined that it had certain performance limitations resulting from the additional weight of the TOW missile system. A Product Improvement Program (PIP), designed to alleviate the performance limitations in the area of hover performance and payload capabilities, was initiated during FY 1974. The program was low risk as the engine was state-of-the-art and is similar to an engine that had already undergone extensive testing. The transmission gear boxes and tail rotor were components already in service on the Marine Corps AH-1J helicopter. An AH-1Q modified by the installation of these components has an increase in maximum gross weight from 9,500 pounds to 10,000 pounds and was designated the AH-1S. Funds were approved in FY 1974 and FY 1975 to modify 290 existing AH-1Gs. Additional funds were approved in FY 1978 to convert and modernize 11 more AH-1G COBRAs to the AH-1S COBRA/TOW configuration as the initial effort toward modernizing the remainder of the existing AH-1G fleet. Funds were approved in FY 1975 thru FY 1978 to procure 231 AH-1S COBRA/TOWs as part of a 297 total new buy procurement program.

F. RELATED ACTIVITIES: Prior to the revised FY 1973 budget, the Improved COBRA Armament Program (ICAP), which incorporated the TOW missile system on the COBRA, had been previously identified in Program Element 6.42.02.A, Aircraft Weapons. The funds for this armament subsystem was shifted in FY 1977 to this program element. Also shifted to this element was the advanced technology program to develop a new COBRA main rotor blade. This advanced composite material blade was previously funded under Advanced Structures, PE 6.32.11.A. This restructuring consolidates all on-going developmental COBRA improvement projects under this single Program Element (6.42.12.A) to obtain optimum program management. Office of the Secretary of Defense approved development of both the Army AH-1S and Marine AH-1J helicopters because of the different mission requirements.

G. WORK PERFORMED BY: Contractors: Bell Helicopter Textron, Ft. Worth, TX - Airframe; AVCO Lycoming, Stratford, CT - Engine; Hughes Helicopter Co, Culver City, CA - 30mm Cannon; General Electric Armament Div, Burlington, VT - Turret. The program is managed by the Project Manager, COBRA, US Army Aviation Troop Support and Aviation Readiness Command, St. Louis, MO.

Program Element: #6.42.12.A
DoD Mission Area: #412 - Close Combat

Title: COBRA/TOW
Budget Activity: #4 - Tactical Programs

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Engineering design and integration of the TOW missile subsystems on the AH-1 COBRA helicopter and Development Test (DT) I and Operational Test (OT) of the AH-1Q were completed in FY 1973. Service testing was conducted August thru September 1973 and OT II conducted in October 1973. A follow-on evaluation (FOE) to the AH-1Q OT II was conducted at Ft. Hood, TX from April thru June 1974. This FOE was designed to assess the operational effectiveness of the AH-1Q, modified as a result of DT and OT II. These tests identified that the AH-1Q has marginal performance when hovering out-of-ground-effect at combat gross weight. To correct this deficiency, the Army initiated a program to improve performance. Contracts were awarded to Bell and Lycoming for development of the upgraded components and engine. A Military Potential Test of prototype fire control configurations was conducted in March 1974. Congress appropriated $4.5M in FY 1975 to support the COBRA/TOW performance improvement. First flight occurred on 7 December 1974 and developmental testing was conducted from January thru March 1975. A follow-on evaluation conducted during 7-28 May 1975 confirmed the operational effectiveness of the higher gross weight and that engine and power train modifications did not degrade missile hit performance. Development Test III and the Initial Production Test, conducted August 1975 to January 1976, evaluated the maintenance support package and compliance with contract modification specifications. The overall assessment was that the AH-1Q aircraft met the significant technical requirements of the production contract. The Project Manager's Office initiated a performance validation demonstration of the modified AH-1S in June 1976, which verified the quality and performance of the production aircraft. There have been 289 aircraft delivered to the Army as of 30 September 1977. Fielding of the accompanying support equipment and trained personnel began in January 1976. A Phase I engineering contract was awarded on *30 June 1976 and provided for source selection* of the universal turret upgunning and external ammunition stores management/remote set fuzing subsystem. The successful first flight of the Improved Main Rotor Blade was conducted 26 July 1976. Contractor flight testing of the improved main rotor blade, and fire control and turret development continued. A request for procurement was released to Kaman Aerospace Corporation in October 1976 with subsequent limited rate of initial production contract for 215 blades awarded in May 1977. The contractor portion of the blade flight test program was completed in February 1977. A contract award to Bell Helicopter Textron was made in December 1976 for development of turret and stores management/remote set fuzing subsystem, with the production contract being awarded in July 1977.

2. FY 1978 Program: Development and qualification, including contractor and government testing, of turret and stores management/remote set fuzing subsystems will continue to August 1978. Production deliveries of this subsystem will begin in September 1978. Initiation of Engineering development for the 30mm Cannon will begin. Fabrication of the prototype fire control subsystems will be completed and initial testing will culminate in the critical issues demonstration scheduled for July thru September 1978.

3. FY 1979 Planned Program: Development and testing of the weapons fire control and turret will be completed and development effort on the 30mm Cannon program will continue.

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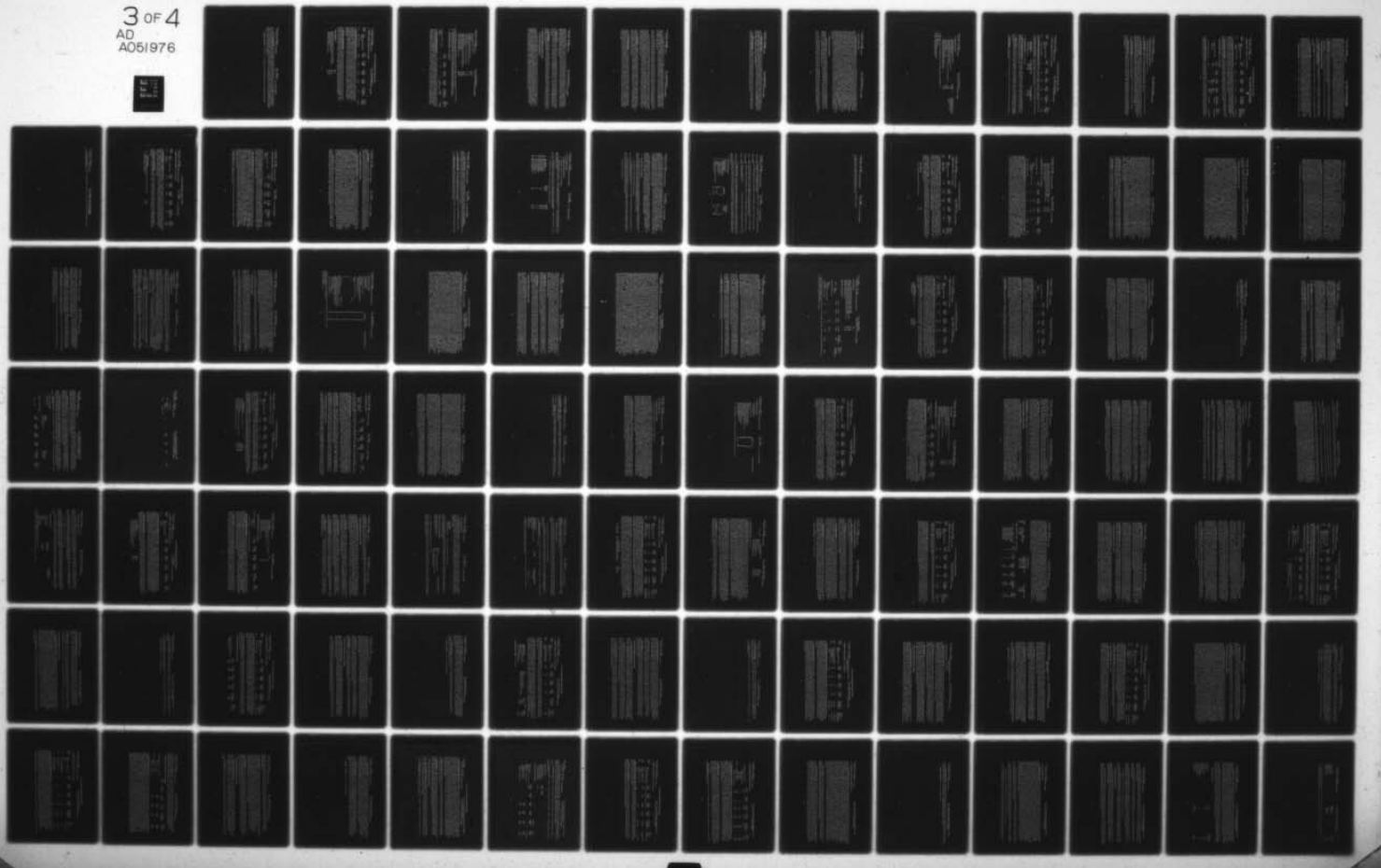

Program Element: #6.42.12.A
Title: COBRA/TOW
DoD Mission Area: #412 - Close Combat
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: The 30mm Cannon will complete development and the first aircraft delivery is scheduled for April 1981. A development program for improvement of the main rotor hub will be a new start in FY 1980. The proposed effort will encompass the design, development, and flight qualification of an "all elastomeric" bearing main rotor hub, which will consist of the existing elastomeric flapping axis bearings and a new feathering axis elastomeric bearing installation utilizing tension torsion strap transfer of centrifugal force loads. All necessary experimental work has been performed and the proposed system is ready for full scale development.

5. Program to Completion: Currently, it is anticipated that all development efforts will be completed in FY 1980.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.42.13.A
DoD Mission Area: #441 - Airlift

Title: CH-47 Modernization
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	25895	32022	19540	10146	564	104649
	Quantities						3
DC37	CH-47 Modernization	25895	32022	19540	10146	564	104649

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The need for a medium lift helicopter capability is projected to continue through the 1990's. The age of the current fleet requires that a modernization and/or procurement program be established. A modernization of the CH-47 fleet was determined to be the most cost effective approach. This program provides for incorporation of advances in design technology developed since introduction of CH-47 Helicopters into Army inventory. Effort will be expended to modify the current CH-47 fleet through development, testing and incorporation of seven modernized systems: rotor, drive, hydraulic, electrical, advanced flight control, cargo handling, and auxiliary power unit. Integration of these changes will result in improved reliability, availability, maintainability, safety, and survivability, while reducing vulnerability and extending the life of the aircraft twenty years.

C. BASIS FOR FY 1979 RDTE REQUEST: The funds requested will provide for completion of: the completion of five each T55-L-11D test engines to T55-L-712 configuration, the transmission dynamic strain milestone, the 50 hour transmission survey run milestone, and qualification of the fiberglass rotor blade, transmission, and hydraulics. Final assembly of two prototypes will also be completed with 85 percent of the third prototype being accomplished. The two completed prototypes will be rolled out and first flight accomplished. Major milestones are as follows:

Major Milestones 1/	Date
Army Systems Acquisition Review Council (ASARC) II	Aug 75
Defense Systems Acquisition Review Council (DSARC) II	Oct 75
Modernization R&D Contract Award	Jun 76
110 Hour Blade Whirl	Mar 78 2/
Transmission Dynamic Strain Survey	Mar 79

50-Hour Transmission Survey Run	Apr 79
First Flight	Sep 79
Preliminary Airworthiness Evaluation 3/	Dec 79
Development Testing (DT) II/Operational Testing (OT) II Start	Jan 80
Development Testing (DT) II/Operational Testing (OT) II Complete	Jun 80
Army Systems Acquisition Review Council (ASARC) III	Aug 80
Defense Systems Acquisition Review Council (DSARC) III	Sep 80
Production Contract Award	Oct 80 4/
Production Delivery Begins	May 82
Initial Operational Capability (IOC)	Aug 83

1/ Decision Coordinating Paper (DCP) milestones for Low Rate Initial Production (LRIP) and DT/OT III were deleted.
2/ Milestone slipped from December 1977 due to a design-to-cost change to the rotor blade.
3/ Terminology change. Army Preliminary Evaluation was change to Preliminary Airworthiness Evaluation.
4/ Rescheduled from September 1980 to allow for sufficient funding lead time following DSARC III approval.

D. OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Aircraft, Army)						
Funds	0	0	0	39554	1472061	1511615
Quantity	0	0	0	(Long Lead Items)	361	361

E. DETAILED BACKGROUND AND DESCRIPTION: The CH-47 (Chinook) medium lift helicopter (MLH) was developed in the late 50's with the first CH-47s being procured in 1962. The Chinook provided invaluable battlefield mobility in Vietnam for tactical vehicles, artillery and engineering equipment, personnel, and logistical support equipment. The Chinook will continue in service to meet the Army medium lift requirement during the 1990's. The current Army inventory consists of 167 CH-47A models, 78B models, and 208C models. The CH-47A and B models fail to meet the Required Operational Capability (ROC) of 15 thousand pound payload for medium lift helicopters. All models have high operating costs, large maintenance require-

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ments and require modernization. The objectives of this program are to develop fiberglass rotor blades; a 7500 horsepower integrally lubricated transmission and drive system; modularized hydraulics system components; and accomplish the necessary engineering and design required to install a new electrical system, an improved auxiliary power unit, multiple cargo hooks, and advanced flight control system in a prototype of each of the three models. The program goals are to improve reliability, availability, maintainability, and safety while reducing operating costs and standardizing the Medium Lift Helicopter (MLH) fleet lift capability at 15 thousand pounds.

F. RELATED ACTIVITIES: The automatic tape lay-up program (Program Element 6.42.04.A) Project Number DC31, Aircraft Subsystems and Components was redirected in FY 1974 to support development of the advanced technology, composite-fiberglass rotor blades for use on the CH-47. It was incorporated into the modernization program in FY 1976. Advanced Development (AD) effort in FY 1975, CH-47 Modernization, Project Number DB31, (Program Element 6.32.14.A), preceded the current Engineering Development (ED) effort.

G. WORK PERFORMED BY: A contract for engineering development of the airframe was awarded on 4 June 1976 to the Boeing Vertol Company, Philadelphia, Pennsylvania; and on 28 July 1976, a contract for engine support was awarded to AVCO Lycoming, Stratford, Connecticut. The CH-47 Modernization Project Manager's Office, CH-47 Modernization, St. Louis, Missouri, is the responsible developing organization.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments:

a. Life cycle cost estimates and economic analysis of the CH-47 fleet indicated that it was more cost effective to modernize CH-47s than to retire these aircraft and procure new helicopters. A Required Operational Capability (ROC) was approved in October 1974 (Revised October 1975) and a Special Study Group (SSG) was formed in December 1974 to prepare the program for Army System Acquisition Review Council (ASARC) II and Defense System Acquisition Review Council (DSARC) II. Based on the SSG, it was determined that modernization could best be accomplished by the incorporation of seven modernized systems: rotor system, drive system, hydraulic system, auxiliary power unit, electrical system, advanced flight control system and the cargo handling system. A Cost Operational Effectiveness Analysis (COEA) was conducted which determined that the most cost effective approach would be to modernize a total of 361 CH-47As, Bs, and Cs.

b. Army System Acquisition Review Council (ASARC) II was conducted on 4 August 1975 and Defense System Acquisition Review Council (DSARC) II on 16 October 1975. The Councils approved transition into Engineering Development and a three prototype R&D (Research and Development) program leading to modernization of the CH-47 fleet at a rate of three per month for a total of 361 aircraft. A contract for research and development effort by Boeing Vertol was negotiated in March 1976 and awarded 4 June 1976. In early June, three CH-47 aircraft, one each A, B, and C, were delivered to Boeing Vertol for initiation of prototype effort.

c. On 28 July 1976, a contract for support of the CH-47 Modernization Program was awarded to the engine contractor, AVCO Lycoming. An interface agreement between the engine and the airframe contractor provides for exchange of data regarding configuration control, interface change requirements, engine and hardware requirements and test program requirements.

d. Four of the nine Government Furnished Equipment (GFE) engines, together with nine GFE fuel controls were inducted into the engine conversion program in FY 1977. Eighty percent of all engineering drawings have been completed. Hydraulic system module vendors have been selected and on contract. Electrical system components are on contract and testing initiated. The Advance Flight Control System (AFCS) sub-contract has been let which will provide significantly reduced operating and support O&S) costs. Fiberglass rotor blade components have been completed and final assembly is in process. Prototype aircraft have all been inspected and airframe preparation completed on #1 prototype and is in process on #2 prototype. Aircraft modernization was initiated on #1 prototype. Initial delivery of minor transmission components has begun with major components being completed by the vendor.

2. FY 1978 Program: Fiberglass rotor blade 110 hour whirl test will be conducted. Subcomponents of the drive and hydraulic systems will be received from subvendors, assembled, and preliminary testing accomplished. Airframe preparation of the #2 and #3 prototypes will be completed and modification will continue. The first forward rotor blade will be completed and first ship set of rotor blades will be available. Remaining five engines will be inducted for conversion. Out of the total nine engines inducted, four will be completed and shipped to the airframe contractor. Producibility, Engineering and Planning (PEP) effort will be initiated.

3. FY 1979 Planned Program: Five engines will be delivered for interfacing with the #2 and #3 prototype airframes. Fiberglass rotor blade development will be completed, second and third ship sets made available, and fatigue tests run. Dynamic strain survey of the five transmissions, 50-hour milestone run on the forward and after transmission and 150-hour milestone run on the combining transmission will be completed. Additionally, 300 hours each of forward/after transmission testing and 350 hours of combiner transmission testing will be accomplished. First Flight of prototype #1 will be accomplished. FY 1979 funding decrease from FY 1978 level is the result of reduced development effort as the program proceeds to first flight.

Program Element: #6.42.13.A
DoD Mission Area: #441 - Airlift

Title: CH-47 Modernization
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: Prototypes #2 and #3 will complete first flights and delivery of all prototypes will be made to the Government. Preliminary Army preliminary evaluation and DT/OT II testing, to assure validity of design, ascertain accomplishment of RAM objectives, and substantiate flight safety improvements, will be accomplished in the January-June 1980 time frame. Completion of these tests will provide the basis for definitive improvements to be accomplished in the production phase for the CH-47 fleet. Decision for production contract award will be determined by Army Systems Acquisition Review Council/Defense Systems Review Council (ASARC/DSARC) III.

5. Program to Completion: Producibility, Engineering and Planning (PEP) effort to assure effective producibility will be finalized. Initial production contract will be awarded and reliability, availability, maintainability (RAM) testing will complete the final research and development phase of the CH-47 Modernization Program in FY 1981.

Program Element: #6.42.13.A
DoD Mission Area: #441 - Airlift

Title: CH-47 Modernization
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation: Development test and evaluation will be conducted by the contractor, Boeing Vertol, and the US Army Test and Evaluation Command (TECOM) with contractor testing on all three models and Government testing on the B and C models prototyped. Development Testing (DT II) will include ground and bench testing of new components and Prototype Qualification Testing (PQT-C) on three prototype aircraft. Fiberglass Rotor Blade testing started in 1977 and will culminate with a 110 hour whirl tower test milestone in 1978. Transmission and hydraulic bench tests will begin in 1978 with the transmission dynamic strain survey and the 50-hour qualification test scheduled for early 1979, to confirm the design adequacy. A total of 950 hours of bench testing on all five transmissions will be accumulated with first flight scheduled for mid-1979. The contractor flight test program is approximately 167 hours. Government testing will consist of the (Army) Preliminary Airworthiness Evaluation (PAE), Icing, Military Functional, Operational Test, Climatic Hangar, and Reliability, Availability, and Maintainability (RAM) Verification. Government testing will begin in the Fall of 1979 with 25 flight hours during the PAE to verify flight safety and flight envelope. The Icing Test, will be conducted during the winter of 1979 and consists of five flight hours to provide data verifying the aircraft flight envelope in icing conditions. The Military Functional testing, including aircraft performance, reliability, availability and maintainability (RAM), and operability requirements will be evaluated utilizing two aircraft for a total of 280 flight hours in 1980. The climatic hangar tests in mid-1980 includes 30 hours of extreme environmental testing to demonstrate the modernized CH-47s capability to meet stated specifications. Supplemental Government testing entitled RAM Verification will be an extension of the Military Functional test. The YCH-47D data base including RAM, performance in extreme environments, logistic support, etc., will be expanded. Approximately 700 flight hours will be accumulated from mid-1980 through early 1981. Follow-On Evaluation (FOE) tests will be accomplished starting with production delivery. A total of 175 flight test hours are planned for FOE over a period of 15 months, commencing in October 1981.

2. Operational Test and Evaluation:

a. Operational test II (OT II) will be conducted at Fort Bragg, North Carolina by the US Army Operational Test and Evaluation Agency (OTEA) using the same two prototypes used in Development Tests II. A total of 120 flight hours of OT II testing will be conducted during the Spring of 1980. Typical military user personnel will operate and provide unit level maintenance. Intermediate level maintenance will be provided by the contractor. The milestone objectives, schedules, and criteria for this phase of testing have been approved.

b. Follow-On Evaluation (FOE) tests will consist of approximately 800 hours on early production models commencing in Spring 1982. Approximately 617 hours of testing will be completed prior to the initial production contract award. Approximately 1592 hours of testing will be completed prior to the full scale production contract award planned for September 1982.

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Program Element: #6.42.13.A
DoD Mission Area: #441 - Airlift

Title: C!-47 Modernization
Budget Activity: #4 - Tactical Programs

3. System Characteristics:

Operational/Technical Characteristics	Objectives	Demonstrated Performance
Max Gross Weight (lbs.)	50,000	To be determined through testing of prototype aircraft.
Max Cruise Speed (Kts.) 1/ (Design Gross Weight)	155	
Combat Radius (NM) 2/ (ROC 3/ Mission)	30	
Service Ceiling (ft.) (Design Gross Weight, One Engine Inoperative)	10,000	
Ferry Range (NM)	1,000	
Payload (ROC Mission) (lbs.)	15,000	
Hardware Systems Reliability (MTBF) 4/ (hours)	1.52*	
Systems Operational Reliability (MTBF) (hours)	.76*	

* Reliability values to be demonstrated prior to production decision ASARC/DSARC III.
1/ Kts - Knots
2/ NM - Nautical Miles
3/ ROC - Required Operational Capability
4/ MTBF - Mean Time Between Failures.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.42.15.A
DoD Mission Area: #413 - Fire Support

Title: Composite Rotor Blades
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	211	2502	6500	4223	13235
	Quantities						70
D147	Composite Rotor Blades	0	211	2502	6500	4223	13235

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will provide the Army with composite structures main rotor blades for the UH-1 and OH-58 helicopters at a lower cost, better reliability and improved performance.

C. BASIS FOR FY 1979 RDTE REQUEST: Design, development, and qualification of UH-1 and OH-58 helicopter composite main rotor blades will begin with the award of a competitive contract for each in FY 1979.

Major Milestones	UH-1H Main Rotor Blade	OH-58C Main Rotor Blade
Contract Award	1Q FY 1979	3Q FY 1979
First Flight	4Q FY 1980	1Q FY 1981
Government Flight Test	1Q FY 1981	3Q FY 1981

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to equip all Army UH-1 and OH-58 helicopters with composite rotor blades. The benefits from this program include lower cost, better reliability and improved performance, survivability, producibility and safety. This will be accomplished by a competitive contract award for the design, testing and qualification of the two main rotor blades.

F. RELATED ACTIVITIES: The Army has recently concluded a successful program for the design, development and qualification of a composite main rotor blade for the AH-1 helicopter. The first production contract was awarded in May 1977. A competitive OH-58 main rotor blade advanced development preliminary design effort will be completed in FY 1978 under Advanced Development PE 6.32.11.

G. WORK PERFORMED BY: US Army Aviation Research and Development Command, St Louis, Missouri, and contractors to be selected by a source selection evaluation board.

Program Element: #6.42.15.A
DoD Mission Area: #413 - Fire Support

Title: Composite Rotor Blades
Budget Activity: #4 - Tactical Programs

II. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Not Applicable.

2. FY 1978 Program: The UH-1H composite rotor blade (CRB) request for proposals will be prepared and Source Selection Evaluation Board held for selection of the UH-1H CRB engineering development contractor.

3. FY 1979 Planned Program: The design and development of the OH-58 and UH-1H composite main rotor blades will be initiated in FY 1979. Both development activities will be competitive engineering development efforts, to include blade design, tool design and testing. Fabrication of the UH-1H blades will start during this year. Improved composite main rotor blades for the UH-1H and OH-58C helicopters provide: potential for performance improvement for both helicopters; extended blade life; positive return on investment with reduction in blade replacement quantities and reduced maintainence requirements. All necessary experimental work will have been performed and the proposed system will be ready for full scale development.

4. FY 1980 Planned Program: Fabrication of the first UH-1 blade will be completed and the OH-58 blade started. Qualification testing of both blades will continue during FY 1980.

5. Program to Completion: Fabrication of all the development blades and qualification testing will be finished for the UH-1 blade in FY 1981. A production contract will be signed in FY 1982. The OH-58 fabrication and qualification testing will be completed in FY 1982, with a production contract awarded in FY 1983. Additional main rotor and tail rotor blade programs will be initiated.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.42.17.A
DoD Mission Area: #441 - Airlift

Title: Synthetic Flight Training Systems
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5363	5671	4590	13497	Continuing	Not Applicable
	Quantities						Not Applicable
D275	Synthetic Flight Training Systems	5363	5671	4590	13497	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops high fidelity operational flight, weapon, and mission helicopter simulators to support initial entry rotary wing training, transition training, and combat operational training. Major considerations are to produce a simulation of the combat environment, to include tactical flight, weapons engagement, and enemy interaction, in order to provide realistic and cost effective training. The simulations are used to compliment the training accomplished in the actual helicopters in the maintenance of combat readiness.

C. BASIS FOR FY 1979 RDTE REQUEST: The UH-60 Flight Simulator, formerly the Utility Tactical Transport Aircraft System (UTTAS), prototype development will continue with testing occurring in the latter part of the year. The prototype development of the AH-64 Flight and Weapons Simulator, formerly the Advanced Attack Helicopter (AAH), will be initiated.

D. OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Aircraft Procurement, Army:						
Funds	12100	0	29800	62200	Continuing	Not Applicable
Quantities	4 (UH-1)	0	1 (CH-47) 2 (AH-1)	2 (CH-47) 2 (AH-1) 3 (UH-60)		
Military Construction, Army	3874	0	1660	8896	Continuing	Not Applicable

E. DETAILED BACKGROUND AND DESCRIPTION: This program develops the Army's flight and weapons simulators. These helicopter simulators, mounted on six degree freedom-of-motion systems, consist of a replica of the helicopter's cockpit, an instructor and operator station, and a visual system. They provide realistic and cost effective visual flight, instrument flight, emergency

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procedures, and weapons engagement training in a totally safe environment. The CH-47 Flight Simulator uses a closed circuit television camera which moves across a three-dimensional terrain model board in response to the pilots control inputs. The AH-1 Flight and Weapons Simulator, using a camera model-board visual system similar to the CH-47 Flight Simulator, but with two 48 by 36 degree windows instead of one, has the capability to simulate the firing of all the COBRA weapon systems. The UH-60 Flight Simulator which will replicate the flight performance of the UH-60A BLACK HAWK helicopter, now being introduced into the Army inventory, will have one cockpit equipped with a camera model-board visual system and the other with a computer generated imagery (CGI) visual system. During testing the training transfer of the two visual systems will be evaluated. The impact of CGI is dramatic. Not only will operating cost be less, but the gaming area will be expanded from 96 sq miles to 1600 sq miles with the capability of producing enemy interaction. The AH-64 Flight and Weapons Simulator will be the first of the devices to be a combat mission simulator.

F. RELATED ACTIVITIES: Program Elements 6.32.16.A, Synthetic Flight Simulators; 6.22.09, Aeronautical Technology; and 6.27.27.A, Non-Systems Training Device Technology. These activities are engaged in flight simulation component research and the development of simulators used for aeronautical engineering and training research.

G. WORK PERFORMED BY: The Project Manager, Training Devices, Orlando, FL; and Naval Equipment Training Center, Orlando, FL.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Completed development of the UH-1 Flight Simulator used for instrument flight training in FY 1972. Completed testing of CH-47 Flight Simulator (FS). Continued development of the AH-1 Flight and Weapons Simulator (FWS) and UH-60 Flight Simulator.

2. FY 1978 Program: Type classify the CH-47 FS. Complete testing of the AH-1 FWS. Continue development of the UH-60 FS prototype.

3. FY 1979 Planned Program: Type classify the AH-1 FWS. This will allow the fielding of the first helicopter simulator which has the capability of providing the full range of gunnery training, from the firing of the TOW missile to the firing of the 7.62 millimeter mini guns and 2.75 inch rockets, in addition to the maintenance of operational flight proficiency. Complete the prototype development and start testing of the UH-60 FS. This flight training simulator will provide for the maintenance of operational flight proficiency and will be the first simulator which will allow the training of flight crews in the avoidance of threat anti-aircraft fire. Initiate the development of the AH-64 Flight and Weapons Simulator prototype. This will be the first simulator which will allow for both the training of attack helicopter crews in the employment of their weapons against a simulated threat and also allow for their training in the avoidance of threat anti-aircraft fire.

4. FY 1980 Planned Program: Complete the testing of the UH-60 FS. Continue the development of the AH-64 FWS prototype.

Program Element: #6.42.17.A
DoD Mission Area: #441 - Airlift

Title: Synthetic Flight Training Systems
Budget Activity: #4 - Tactical Programs

5. Program to Completion: Complete testing and type classification of AH-64 FWS and initiate the development of a scout helicopter simulator in FY 1983.

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FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.43.06.A
DoD Mission Area: #414 - Field Army Air Defense

Title: STINGER
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	27348	11957	24582	17576	5385	200230
D646	STINGER	27348	11957	24582	17576	5385	200230
	Quantities						208

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for full scale development of a Manportable Air Defense Weapon System (MANPADS). MANPADS is a self defense air defense weapon system needed to effectively counter enemy low altitude high speed tactical aircraft and helicopter threats to company size units operating near the Forward Edge of the Battle Area (FEBA). STINGER has been designed to replace the current REDEYE system. Engineering Development (ED) of the basic STINGER system will essentially be completed with FY 1978 funds. A third generation Infrared Seeker Post (Passive Optical Seeker Technique) is now in full scale development.

C. BASIS FOR FY 1979 RDTE REQUEST: Continuation of programmed full scale development of a new advanced seeker (POST) is planned. Design of the seeker and guidance changes, test and test support targets, and production engineering planning are major costs to be supported. Development of this new seeker will provide a marked improvement in an infrared countermeasures environment.

Major Milestones

a. Initiation of Engineering Development (ED) of the POST Seeker — Jun 77
b. Completion of ED of POST Seeker — Jan 81
c. Seeker available in Europe —

Program Element: #6.43.06.A Title: STINGER

DoD Mission Area: #414 - Field Army Air Defense Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Missile Procurement, Army*						
Funds	0	34000	104900	79300	894100	1112400
Quantities	0	258	2250	2400		

* NOTE: Procurement Fund total includes programed phase-in of the POST Seeker into STINGER production beginning 1981. An estimated 7025 Basic STINGER missiles will be provided prior to POST phase-in with the remaining 23428 to be equipped with POST Seekers. Basic STINGER missiles initially fielded will replace the obsolete REDEYE's with US Forces in Europe. These assets can eventually be used for training requirements. Procurement strategy for missiles equipped with the POST Seeker will be competitive if possible. Present program is considered a very conservative estimate for cost total and continues to be analyzed. Strategy is to be finalized in 1981.

E. DETAILED BACKGROUND AND DESCRIPTION: The currently fielded REDEYE Guided Missile System exhibits serious limitations in view of the current and postulated threat posed by enemy support and interdiction jet aircraft. REDEYE can attack only receding aircraft flying at speeds less than knots and is vulnerable to a variety of infrared countermeasures. The purpose of this program is to develop, test and field STINGER as the successor to REDEYE. As a successor to REDEYE, STINGER is expected to overcome the above cited deficiencies by being capable of engaging threat aircraft from any aspect flying at speeds up to knots with a immunity to all known infrared countermeasures. STINGER will complement PATRIOT, ROLAND and DIVAD GUN in air defense of the field Army. STINGER will be deployed with both Army and Marine Corps forward combat elements and is expected to replace REDEYE generally on a one-for-one basis. STINGER is similar to REDEYE in that it is a shoulder fired, passive infrared homing guided missile system. STINGER will have a higher performance rocket motor, an advanced seeker, a separable reusable gripstock, a new launcher and a lightweight Identification, Friend or Foe (IFF) device. The total weight of the missile and its launcher in the ready-to-fire configuration will be 33.9 pounds. The fire unit will be a two-man team, authorized a basic load of six missiles. An advanced seeker (POST) has demonstrated feasibility of a two color (infrared and ultraviolet) design which will be virtually immune to countermeasures. Full scale development began in FY 1977.

F. RELATED ACTIVITIES: This program is a joint development with the United States Marine Corps. Production requirements for that service are fully coordinated with the Army.

Program Element: #6.43.06.A Title: STINGER
DoD Mission Area: #414 - Field Army Air Defense Budget Activity: #4 - Tactical Programs

G. WORK PERFORMED BY: Development of the STINGER basic system and the POST seeker is under the direction of the US Army Missile Research and Development Command, Huntsville, AL. The prime contractor is the Pomona Division of General Dynamics, Pomona, CA. Atlantic Research division of the Susquehanna Corporation, Greenville, VA, is the developer of the rocket motor. Other Government agencies which will contribute during the development phase are the US Army Armament Research and Development Command, Dover, NJ (missile warhead), and the US Army Electronics Research and Development Command, Fort Monmouth, NJ (battery).

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: In 1965, a series of advanced development efforts were begun to demonstrate the critical components required for an improved, shoulder-fired air defense missile which would engage low flying aircraft from any engagement aspect flying at speeds up to knots. The effort demonstrated through firings at jet aircraft targets that such components were feasible. In June 1972, STINGER entered formal Engineering Development. The Baseline design was completed in 1974. A logical progression of component/assembly tests was accomplished. Propulsion qualification was completed. Guided Test Vechicle (GTV) firings were initiated. Technical problems demonstrated in early GTV tests were solved and tested with hardware demonstrations. A cost reduction effort titled STINGTHRIFT was completed resulting in an estimated $29 million savings in procurement. In FY 1975, the GTV series of tests were completed with positive indications of system performance criteria being met. A total of 16 GTV firings conducted demonstrated 75 percent success rate against threat representative targets. A design flight test program (18 rounds) was initiated to confirm design parameters. Producti-bility Engineering Planning (PEP) was initiated which will cause delivery of Special Acceptance Inspection Equipment and drawings for the Initial Production Facilities (IPF). In FY 1976 and FY 197T, further tests continued with the Prototype Qualification Tests-Contractor (PQT-C). These flights were to determine if the contractor has met his contract specifications. The government initiated Prototype Qualification Test-Government (PQT-G) to independently evaluate system performance against requirements. There were 25 flights conducted in Prototype Qualification Test-Contractor (PQT-C) under varying environmental conditions. The US Army Operational Test and Evaluation Agency (OTEA) also tested the system (Operational Test II) with both non-firing tactical exercises and troops firing a total of 11 rounds. An 18 round Production Prototype Test was initiated in July 1977 and completed in November 1977. The POST seeker entered full scale development in June 1977.

2. FY 1978 Program: Management of remaining research and development functions for the POST Seeker will be continued. Hardware fabrication of prototype samples for evaluation in both laboratory and flight environments is planned. Range and target support to the contractor efforts are included. Simulation and system engineering efforts are planned. The basic STINGER system will undergo Artic testing and complete Production Engineering Planning.

Program Element: #6.43.06.A Title: STINGER
DoD Mission Area: #414 - Field Army Air Defense Budget Activity: #4 - Tactical Programs

3. FY 1979 Planned Program: Development of the advanced seeker POST will be continued. Production Engineering Planning (PEP) program is to be initiated as well as intensive testing to validate the design in both environmental and vibration extremes. Total funds required in FY 1979 exceeds that in FY 1978 because Production Engineering Planning (PEP) efforts are to be increased this fiscal year as well as target acquisition for test support.

4. FY 1980 Planned Program: POST Engineering Development is to continue with similar engineering tasks as FY 1979 with increased emphasis on PEP efforts but reduced expenditures for target support.

5. Program to Completion: Completion of Engineering Development of the POST Seeker will be pursued to completion in FY 1981. Tests, test support and Producibility Engineering Planning will be completed.

Program Element: #6.43.06.A
DoD Mission Area: #414 - Field Army Air Defense

Title: STINGER
Budget Activity: #4 - Tactical Programs

1. Test and Evaluation Data:

1. Development Test and Evaluation:

a. Development contractor - General Dynamics.

b. STINGER development is complete. There were no major differences revealed in tests to preclude production. The required system weapon round reliability was __ and the demonstrated reliability was __. This supports the planned certified round maintenance concept.

c. Development Test I (DT I). There were no system tests in Advanced Development. Component tests were run to verify feasibility of improvements to REDEYE and concept of second generation Infra Red seeker.

d. Development Test II (DT II). The following are completed or planned:

	Type of Test	Number of Missiles	Completion Date
(1)	Eject Test Vehicles	10	Oct 73
(2)	Launch Test Vehicles	7	Aug 73
(3)	Control Test Vehicles	6	Sep 74
(4)	Guided Test Vehicles	16	Jul 75
(5)	Design Test Vehicles	18	Jan 76
(6)	Prototype Qualification Test - Contractor	26	Oct 76
(7)	Prototype Qualification Test - Government	35	Apr 77
(8)	Production Prototype Test	18	Oct 77
(9)	POST Development Test	29	Jan 81

Technical problems experienced during the Guided Test Vehicle Series were in guidance and propulsion. The second half of that series used a corrected configuration. Their success demonstrated corrective actions were proper. This was further demonstrated by the Design Flight (DF) Test program. Prototype Qualification Tests - Contractor (PQT-C) have further demonstrated design maturity. Manufacturing process problems (Quality Control) were experienced initially in laboratory environmental tests. Corrective action was proven adequate in subsequent tests. Total system performance was demonstrated in DT II. Eighteen additional Production Prototype Test rounds were added to confirm the production configuration resulting from prototype qualification tests by the Government. An advanced seeker called POST (Passive Optical Seeker Technique) is now in Engineering Development which will enhance STINGER capability in a countermeasures environment. Countermeasures evaluation is a major consideration in the development program.

A non-firing contractor demonstration was conducted Jan/Mar 1975. This consisted of field handling and tracking tests within an operational scenario. The US Army Operational Test and Evaluation Agency (OTEA) assisted in test design and observed conduct of the test. Operationally critical issues were addressed to verify attainment of significant weapon system characteristics. Additional non-firing demonstration tests were conducted in the Federal Republic of Germany (FRG) in June 1976. These tests demonstrated the system effectiveness in a typical European environment.

2. Operational Test and Evaluation:

a. Operational Test I (OT I) was not conducted. Instead, OTEA monitored the contractor demonstration at Fort Bliss, Texas, during Jan-Mar 1975. The objective of the contractor demonstration was to demonstrate, to a limited degree, the capability of the system utilizing a STINGER Tracking Head Training device in areas such as:

(1) Human factors and weapon performance effectiveness.

(2) Preliminary weapon system reaction times of the weapon and associated command, control and communications, early warning and employment/deployment doctrine.

b. The Stinger Weapon System Operational Test II was conducted in two separate subtests. Subtest I was conducted at Fort Carson, Colorado, over a two week period from 16-26 August 1976. Subtest II was a live firing exercise conducted at White Sands Missile Range, New Mexico, from 18-22 October 1976.

c. Operational Test II Results:

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(1) General. The Stinger Weapon System has been evaluated in terms of performance of the Redeye Weapon System, which was used as the baseline. This evaluation concluded:

(a) The Stinger Weapon System has a substantial forward hemisphere capability not available with the Redeye Weapon System.

(b) Functional operations of the Stinger Weapon System are basically the same as those of the Redeye Weapon System. Stinger operator errors, when they occur, are similar to those made by Redeye operators.

(c) Stinger possesses an Identification, Friend or Foe (IFF) system which is adequate when used as an aid for identification.

(d) Infrared countermeasures are against the Stinger Weapon System than against the Redeye Weapon System. However, Stinger can still be

(2) Overall conclusion. Given the demonstrated forward hemisphere capability of the Stinger Weapon System and the demonstrated similarity of the weapon system overall to the Redeye Weapon System, test results support a production decision.

d. Based upon the extent of testing to date, and the performance achieved by the Stinger Weapon System during this testing, there has been no demonstrable need for an Operational Test III. Therefore Operational Test III has been dropped from the program.

3. Systems Characteristics:

Operational/Technical Characteristics	Objectives	Demonstrated Performance (DTE)
a. Maximum Target Speed		
b. Maximum Intercept Range		
c. Intercept Altitude (Min/Max) (In Meters)		
d. Weapon Reliability		
e. Weight	34.5 lbs	33.9 lbs
f. Infrared Countermeasures (IRCM) 1/		
g. IFF MARK XII 2/		

Program Element: #6.43.06.A
DoD Mission Area: #414 - Field Army Air Defense

Title: STINGER
Budget Activity: #4 - Tactical Programs

1/ Maximum overall system performance degradation in a countermeasures environment.
2/ Maximum range at which operator may challenge aircraft.
3/ —

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FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.43.07.A
DoD Mission Area: #414 - Field Army Air Defense

Title: PATRIOT (SAM-D)
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	Total For Program Element	179953	216423 1/	228392	122218	24668	1797518 2/
	Quantities						Not Applicable
D212	PATRIOT (SAM-D)	179953	216423 1/	227492	122218	24668	1796618 3/
D291	PATRIOT (NATO)	0	0	900	0	0	900

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: PATRIOT (Project Number D212) is an advanced surface-to-air guided missile system with a high single shot kill probability capable of operation in an Electronic Countermeasure environment, and able to conduct multiple simultaneous engagements against the high performance air-breathing targets likely to be encountered by deployed United Sates forces during the 1980's and beyond. In the field Army, PATRIOT defenses will be complemented by short range, low altitude forward area air defense weapons and will be integrated with the U.S. Air Force in the overall air defense of the theater of operations. PATRIOT (Project Number 291) is being considered by European nations as their future surface-to-air missile system. The US is participating in a NATO Project Group on replacement of NATO Nike Hercules with US PATRIOT and a NATO Study Group is considering US PATRIOT as a replacement for NATO Improved HAWK class systems.

C. BASIS FOR FY 1979 RDTE REQUEST: Flight test Modular Digital Airborne Guidance Section (MDAGS) missiles for contractor flight test program and (MDAGS) missiles for Development Test/Operational Test II (DT/OT II). Firing Platoon (FP) #3 and 4 will be used to support the flight tests; FP #5 will undergo climatic tests. Producibility Engineering Planning (PEP) activities will continue. Project D291 PATRIOT (NATO) will support US participation in NATO Groups considering PATRIOT as the future European surface-to-air missile replacement system.

MAJOR MILESTONES:	Date
Start of Producibility Engineering and Planning (PEP)	Oct 77

Program Element: #6.43.07.A Title: PATRIOT (SAM-D)
DoD Mission Area: #414 - Field Army Air Defense Budget Activity: #4 - Tactical Programs

Delivery of FP #3 to White Sands Missile Range (WSMR)	Sep 78
First Modular Digital Airborne Guidance System (FMDAGS) Flight	Oct 78
Delivery of FP #4 to White Sands Missile Range (WSMR)	Jan 79
Contractor Flight Tests Completed and start of DT/OT Testing	Jul 79
Completion of DT/OT Testing	May 80

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Missile Procurement, Army						
Funds	0	0	67321	428112	-	-
Quantities						
Fire Control Sections (FCS)	0	0	0	5		
Missiles	0	0	0	155		
Military Construction, Army	0	0	0	0	11400	11400

E. DETAILED BACKGROUND AND DESCRIPTION: PATRIOT will replace NIKE HERCULES and Improved HAWK in providing improved Army air defense. In the field Army, PATRIOT defense will be complemented by short range, low altitude forward area air defense weapons and will be integrated with the U.S. Air Force in the overall air defense of the theater of operations. The advanced features of PATRIOT will provide an increased capability against saturation attacks, electronic countermeasures (ECM), and maneuvering targets. It will also provide a reduction in manpower and logistical requirements. The PATRIOT requirement evolved from the need for an advanced surface-to-air guided missile system with a high single shot kill probability capable of operation in an ECM environment, and able to conduct multiple simultaneous engagements against the high performance air-breathing targets (ABT) likely to be encountered by deployed United States forces during the 1980's and beyond. To cope with the projected threat, PATRIOT will utilize a trainable, multifunction, electronically-scanned phased array radar. In addition, a digital computer will be used to automatically control the system functions as well as to provide the operator, through various displays, the ability to control and monitor operations. The guidance system combines command and homing guidance (track-via-missile - TVM) systems. In January 1974, the Deputy Secretary of Defense directed the Army to reexamine and redirect the Surface to Air Missile Development (SAM-D) (now PATRIOT) program to emphasize greater austerity and permit early flight verification of the guidance concept.

Program Element: #6.43.07.A
DoD Mission Area: #414 - Field Army Air Defense

Title: PATRIOT (SAM-D)
Budget Activity: #4 - Tactical Programs

A new cost effectiveness study was undertaken due to the concern expressed by the Congress and the Office of Management and Budget (OMB) on the projected system cost and the complexity of the advanced technology involved. The cost-effectiveness study concluded that the technological characteristics embodied in the PATRIOT system assure that the cost effectiveness of such a system will be superior to those of the other, older, less capable high/medium altitude air defense systems. A meeting of the Defense System Acquisition Review Council (DSARC) was held on 6 June 1974 to review the reoriented PATRIOT program. On 27 June 1974, the Deputy Secretary of Defense approved continuation of the RDTE program for a system to replace NIKE HERCULES and Improved HAWK. The following activities were approved for funding: (1) Track via-Missile (TVM) Proof-of-Principle (POP) tests; (2) minimum PATRIOT development to permit continuation of full-scale development after successful completion of POP; (3) cost reduction efforts; and (4) a complementary effort to examine backup guidance concepts as insurance against TVM failure during POP tests. The POP tests were successfully completed and ASARC/DSARC decisions in January 1976 approved the program to resume full-scale Engineering Development. The Surface to Air Missile Development (SAM-D) program was officially named PATRIOT on 21 May 1976. On 4 Aug 76, a contract to complete the contractor portion of the PATRIOT system development was awarded to Raytheon Company, the Prime Contractor. The PATRIOT Missile System flight program was resumed on 2 December 1976 at White Sands Missile Range (WSMR) with the firing of Engineering Development Model (EDM-15) using the tactical prototype firing platoon (FP-1). A February 1977 special Army System Acquisition Review Council (ASARC) approved acceleration of the PATRIOT production and deployment phase. At the end of June 1977, consecutive successful PATRIOT flight tests (EDM flight through EDM flight had been conducted in a countermeasures environment using FP-1. Additionally, twenty-four search/track tests had been sucessfully conducted in a wide range of electronic countermeasure (ECM) and clutter environments with various maneuver and range/altitude conditions. Tactical prototype firing platoon #2 (FP-2) was delivered to White Sands Missile Range (WSMR) on 1 Jul 77. The system is undergoing integration and checkout in preparation for the upcoming missile firings and search/track missions. These tests will be conducted in threat level electronic countermeasures (ECM) and clutter environments with various maneuver and range/altitude conditions.

F. RELATED ACTIVITIES: System commonality with the Navy AEGIS has been studied and although separate developments are required, continuous coordination insures the use of common components whenever feasible. The PATRIOT system, through the Battalion Command and Control Set, will be interoperable with other Army Group/Brigade level command and control systems through the Army Air Defense Command and Control System (AN/TSQ-73). It will also be interoperable and directly interface with the Air Force or Marines when the Group/Brigade level AN/TSQ-73 is not available.

G. WORK PERFORMED BY: The Raytheon Company of Bedford, MA, is prime contractor with Martin-Marietta Corporation of Orlando, FL, as missile subcontractor. Thiokol Chemical Coproration of Huntsville, AL, is a subcontractor for the rocket motor. IBM Corporation of Huntsville, AL, is the System Engineering Cost Reduction Assistance Contractor (SECRAC). Teledyne Brown, Huntsville, AL,

is the Software Verification and Validation Contractor; Science Applications Incorporated, Huntsville, AL, is developing a Tactical Operation Simulator (TOS). Government Agency in-house work is managed by the PATRIOT Project Management Office, Huntsville, AL.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The project was initiated as the Army Air Defense System for the 1970's (AADS-70's) in 1963. The program was reoriented and renamed SAM-D in FY 1965. Contract Definition was completed and a contract for Advanced Development (AD) was awarded in May 1967. SAM-D hardware was designed, fabricated and tested. The Advanced Development program proved the ability of the multi-function phased array radar to carry out time-shared search and track functions under computer control. Performance was demonstrated by tracking tests on 112 controlled aircraft targets and a multitude of targets of opportunity in 164 hours of testing. Missile parameters such as chamber pressure, temperature, aeroballistics, and control systems were verified by eight propulsion and control test flights. The airborne guidance section was tested in over 100 captive flight tests. Flights were conducted against single and multiple targets in both clutter and electronic countermeasure environments. The Guidance Test and Simulation Facility was built and computer simulated flights were compared to results of propulsion, control, and captive flights. As a result of the successful completion of Advanced Development objectives, PATRIOT (formerly SAM-D) was approved for entry into Engineering Development (ED) in March 1972. The SAM-D Nuclear and Antimissile Capability Study was approved in December 1972. This study recommended: (1) deletion of the nuclear warhead, (2) programing of reduced number of fire sections for Continental United States (CONUS) air defense, and (3) development of an improved non-nuclear warhead. The program was reoriented on 10 January 1974 to emphasize greater austerity while permitting early flight verification of the track-via-missile (TVM) guidance principle. A stop work order was issued to the prime contractor on 4 February 1974. As a result of this order, all effort in support of a major portion of the hardware development and some engineering activities were deferred until a Defense System Acquisition Review Council (DSARC) met to approve the reoriented program. On-going efforts remaining after the stop work order were in support of the TVM demonstration and an austere development program. The Defense System Acquisition Review Council (DSARC) met on 6 June 1974 to review the reoriented program. In accordance with the Deputy Secretary of Defense directive, based on the DSARC recommendations, program efforts continued in the following areas: (1) preparation for the track-via-missile (TVM) demonstration flights; (2) continuation of the austere development program; (3) initiation of cost reduction; and (4) development of a backup guidance. The final Certified Test Vehicle (CTV) flight was completed on 28 August 1974. Of the 10 flights, were rated as successes with full accomplishment of flight objectives. The major objectives of the captive carry flight test program, a prerequisite to the Engineering Development Missile (EDM) #1 flight, were successfully demonstrated and repeated during November 1974. Proof-of-Principle flight tests demonstrated through missile firings that TVM guidance functions successfully against benign targets which are maneuvering, in

formation, and at low altitudes. consecutive successful flight tests proved the principle of track-via-missile; the remaining missiles were used to obtain additional engineering data. An ASARC/DCARC was held in January 1976 which allowed the resumption of full-scale Engineering Development. The Surface to Air Missile Development (SAM-D) program was officially named PATRIOT on 21 May 1976. On 4 Aug 1976, a contract to complete the contractor portion of the PATRIOT system development was awarded to Raytheon Company, the Prime Contractor. The PATRIOT Missile System flight program was resumed on 2 December 1976 at White Sands Missile Range (WSMR) with the firing of Engineering Development Model (EDM-15) using the tactical prototype firing platoon (FP-1). A special Army System Acquisition Review Council (ASARC) held in Feb 1977 approved the Accelerated Program. At the end of June 1977, consecutive successful PATRIOT flight tests (EDM flight through EDM flight has been conducted in a countermeasures environment using FP-1. Additionally, twenty-four search/track tests had been successfully conducted in a wide range of electronic countermeasures (ECM) and clutter environments with various maneuver and range/altitude conditions. Tactical prototype firing platoon #2 (FP-2) was delivered to White Sands Missile Range (WSMR) on 1 Jul 77. The system is undergoing integration and checkout in preparation for the upcoming missile firings and search track missions. These tests will be conducted in threat level ECM and clutter environments with various maneuver and range/altitude conditions. Cost reduction efforts continue to include the assistance provided by the System Engineering Cost Reduction Assistance Contractor (SECRAC).

2. FY 1978 Program: The eight remaining Engineering Development Missiles (EDM) produced in Phase II will be flight tested using firing platoon (FP) #2 and launch station (LS) #2. Eight Modular Digital Airborne Guidance Section (MDAGS) forebodies (TVM Guidance Section and Warhead Section, less Warhead and Safe and Arming Device), are scheduled to be delivered with three allocated for ground tests and two allocated for the first MDAGS flights. FP #2 will be used to support the missile firing program. FP #3, updated from FP #1, will be shipped to White Sands Missile Range (WSMR) for use in flight test program in FY79. FP #4 fabrication and assembly will be completed and undergo climatic testing at contractor's plant prior to shipment to WSMR in FY79 for use in flight test program. FP #5 will be in the final stages of assembly prior to undergoing Army climatic tests in FY79. LS #1, updated and designated as LS #3, will be shipped to WSMR for use in flight test program during future fiscal years. LS #3 and LS #4 will be used in conjuction with FP #3 and #4 in missile flight test program. LS #5 will undergo climatic tests with FP #5. Command and Control Group (CCG) will be nearing completion of fabrication and assembly; scheduled for delivery to WSMR in early FY79. A Communications Relay Group (CRG) will be shipped to WSMR for testing in FY79. Battalion Supply and Maintenance Equipment (BSME) #1 will be integrated with FP #4 and #5 prior to delivery to WSMR in FY79. BSME #2 will be in final stages of assembly prior to delivery in early FY79. CRG will be in final stages of assembly prior to delivery in early 1979. Cost reduction efforts will continue to include the assistance provided by System Engineering Cost Reduction Assistance Contractor (SECRAC). Producibility Engineering Planning (PEP) activities will be initiated and the Initial Production Facilities (IPF) plan developed during this fiscal year.

3. FY 1979 Planned Program: Thirteen MDAG missiles are scheduled to be flight tested as the conclusion of the contractor

flight test program. Ten MDAC missiles are scheduled to be flight tested as the start of Development Test/Operational Test II. FP #3 and #4 will support the firing programs during this fiscal year. FP #5 will continue to undergo Army climate tests during this fiscal year. All other Engineering Development (ED) ground equipment is scheduled for delivery, plus eleven MDAC missiles for use, in FY80. SECRAC will continue to pursue cost reduction efforts. PEP activities continue in special tooling areas, prepare make or buy analysis, and establish production product assurance plans. Continue US participation in NATO Groups considering PATRIOT as the future European surface-to-air replacement system.

4. FY 1980 Planned Program: Thirty MDAC missiles are scheduled to be flight tested as the completion of DT/OT II tests, following completed delivery of the final nineteen (19) MDACS missiles. The environmental qualification program is scheduled for completion. PEP activities conclude with completion of manufacturing data packages, completion of design and documentation of special tooling and completion of design of special test equipment.

5. Program to Completion: Development Test/Operational Test (DT/OT) II is scheduled to be completed in FY 1980, to be followed by a procurement program leading to an initial operational capability in

1/ A FY 1978 RDTE apportionment decision subsequent to the Army budget submission changed estimated FY 1978 RDTE funding from $216423 thousand to $214558 thousand.
2/ Revised total per footnote #1 is $1795265 thousand.
3/ Revised total per footnote #1 is $1794365 thousand.

Program Element: #6.43.07.A
DoD Mission Area: #414 - Field Army Air Defense

Title: PATRIOT (SAM-D)
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation:

a. The Initial Advanced Development (AD) contract was awarded to Raytheon Company of Bedford, Massachusetts in May 1967. As a result of the successful AD program, on 31 March 1972 the Deputy Secretary of Defense approved PATRIOT entry into engineering development (ED) and a contract was executed with Raytheon Company. The ED program was interrupted in January 1974 to demonstrate the Track-Via-Missile (TVM) guidance concept through the Proof-Of-Principle firing program.

b. Phase I system demonstration firings were initiated in February 1975. This firing phase, comprised of missiles, demonstrated Proof-Of-Principle of the Track-Via-Missile guidance, the guidance modes, and fuzing functions. As a prerequisite to the five firings, Captive Carry Flight Tests were conducted. These tests used an abbreviated missile (without rocket motor) mounted on an aircraft to simulate the free space guidance conditions of a missile intercepting a target. Due to the outstanding success of the missile firings, the Department of Defense of Defense objectives of Proof-Of-Principle demonstration were met with the first PATRIOT guided missile flights against target aircraft. The target conditions included in a benign environment. additional engineering evaluation firings were performed against targets of very low altitude, high altitude, high speed, very long range and high clutter conditions. An additional missiles were fired as control test vehicles to complete the matrix of missile aerodynamic data. of the missile flights were successful. At the conclusion of Proof-Of-Principle firings, full ED status was restored.

c. Phase II tests demonstrated system performance against various electronic countermeasures. An extensive search/track test program was conducted to exercise the system against various electronic countermeasures (ECM) and target scenarios. These tests included
Benign, chaff, weather and natural clutter environments were employed. Target conditions included
Most tests included up to stand-off jammers radiating barrage noise. In addition, the data from these tests were used to evaluate system diagnostic capabilities, built-in test equipment (BITE), reliability, availability, and maintainability (RAM), system status monitor and the adequacy of system displays and controls.

Multiple simultaneous engagements were performed to demonstrate the capability to control multiple missiles in terminal guidance while simultaneously conducting surveillance functions. The final Phase II firing test was conducted in November 1977 with Fire Platoon Number 2.

d. Phase III tests are continuing missile flights in electronic countermeasures (ECM) environments in addition to system environmental and battalion tests. Thirty-two (32) missiles are scheduled to be fired by the Contractor and an additional by the Government to complete the Protype Qualification Tests (PQT) firing program. Environmental tests are being performed to determine the effects of natural and induced environments. This testing includes mobility, transportability, chemical, biological, climatic, altitude, electromagnetic radiation and electromagnetic pulse environments. Battalion tests will be performed to demonstrate that system requirements have been met, evaluate troop proficiency and demonstrate the system's capability in a variety of deployments and environments. Prototype Qualification Tests by the Government (PQT-C) will measure the technical performance of the system and determine the degree to which the performance meets stated specifications or characteristics. Military personnel are being incorporated into the program to assess these critical man-machine interfaces. The Government will monitor and participate in the Contractor Prototype Qualification Testing (PQT-C) to satisfy as many PQT-G requirements as practicable to preclude duplicative testing. PQT-C and Operational Test (OT) II evaluators will also share equipment and test data for independent evaluation.

e. A First Article - Initial Production Test will be conducted on the first production units to assure that necessary changes have been successfully accomplished and that the technical requirements of the contract are met.

2. Operational Test and Evaluation:

a. The US Army Operational Testing and Evaluation Agency (OTEA) will schedule and conduct Operational Test II (OT II) and a Follow-On-Evaluation (FOE). Ground equipment used for OT II will be common to that used for Development Test (DT) II. Nine of the above mentioned forty missiles are designed to be fired under the control of OTEA. An independent evaluation will be provided by OTEA to the decision review prior to the production decision. OT II will be conducted at White Sands Missile Range (WSMR) on prototype equipment manned by user type troops. Since the production decision will be made after DT/OT II, logistic support and training activities have been expanded so that the evaluation will better support a production decision.

b. OT III was originally scheduled but was replaced with a Follow-On-Evaluation (FOE) as part of a modified procurement program. Since the Defense System Acquisition Review Council (DSARC) III becomes the production decision in lieu of DSARC IIIA, OT III is not necessary. The FOE will involve evaluation of production line equipment.

c. The FOE will be conducted in two phases. Phase I will be at Fort Bliss, TX, during the last sixty (60) days of Unit Training of the 1st Battalion to be deployed. Phase II will be conducted at the deployed location five (5) months after deployment.

Program Element: #6.43.07.A
DoD Mission Area: #414 - Field Army Air Defense

Title: PATRIOT (SAM-D)
Budget Activity: #4 - Tactical Programs

3. Systems Characteristics:

Operational/Technical Characteristics	Objective	Demonstrated Performance 1/
Firing Platoon Static Inherent Availability		
Missile Reliability (launch) and flight)		
Single Shot Kill Probability, PSSK (Reliable missile MIG-21)		
Maximum Intercept Range for Single Target (km)		
a.		
b.		
c.		
d.		
e.		
f.		
Max Intercept (Alt/Rg) (km)		
Max SOJ Intercept Range (km)		
Max Inner Intercept Dead Zone (cyl rad about ea launcher group and fire control section) (km)		
Number Simultaneous Engagements/Firing Platoon		
Max Number Simultaneous Target Tracks/Fire Control Sec (FCS)		
Max Target Detection Range (km)		
Reaction Time (auto mode) (sec)		

1/ System performance is to be demonstrated during developmental and operational testing.
2/ Single Shot Engagement Kill Probability.
3/ Standoff Jammer.
4/ Effective Radiated Power.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D212 Title: PATRIOT (SAM-D)
Program Element: #6.43.07.A Title: PATRIOT (SAM-D)
DoD Mission Area: #414 - Field Army Air Defense Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: PATRIOT will replace NIKE HERCULES and Improved HAWK in providing improved Army air defense. In the field Army, PATRIOT defense will be complemented by short range, low altitude forward area air defense weapons and will be integrated with the U.S. Air Force in the overall air defense of the theater of operations. The advanced features of PATRIOT will provide an increased capability against saturation attacks, electronic countermeasures (ECM), and maneuvering targets. It will also provide a reduction in manpower and logistical requirements. The PATRIOT requirement evolved from the need for an advanced surface-to-air guided missile system with a high single shot kill probability capable of operation in an ECM environment, and able to conduct multiple simultaneous engagements against the high performance air-breathing targets (ABT) likely to be encountered by deployed United States forces during the 1980's and beyond. To cope with the projected threat, PATRIOT will utilize a trainable, multifunction, electronically-scanned phased array radar. In addition, a digital computer will be used to automatically control the system functions as well as to provide the operator, through various displays, the ability to control and monitor operations. The guidance system combines command and homing guidance (track-via-missile - TVM) systems. In January 1974, the Deputy Secretary of Defense directed the Army to reexamine and redirect the Surface to Air Missile Development (SAM-D) (now PATRIOT) program to emphasize greater austerity and permit early flight verification of the guidance concept. A new cost effectiveness study was undertaken due to the concern expressed by the Congress and the Office of Management and Budget (OMB) on the projected system cost and the complexity of the advanced technology involved. The cost-effectiveness study concluded that the technological characteristics embodied in the PATRIOT system assure that the cost effectiveness of such a system will be superior to those of the other, older, less capable high/medium altitude air defense systems. A meeting of the Defense System Acquisition Review Council (DSARC) was held on 6 June 1974 to review the reoriented PATRIOT program. On 27 June 1974, the Deputy Secretary of Defense approved continuation of the RDTE program for a system to replace NIKE HERCULES and Improved HAWK. The following activities were approved for funding: (1) Track via-Missile (TVM) Proof-of-Principle (POP) tests; (2) minimum PATRIOT development to permit continuation of full-scale development after successful completion of POP; (3) cost reduction efforts; and (4) a complementary effort to examine backup guidance concepts as insurance against TVM failure during POP tests. The POP tests were successfully completed and ASARC/DSARC decisions in January 1976 approved the program to resume full-scale Engineering Development. The Surface to Air Missile Development (SAM-D) program was officially named PATRIOT on 21 May 1976. On 4 Aug 76, a contract to complete the contractor portion of the PATRIOT system development was awarded to Raytheon Company, the Prime Contractor. The PATRIOT Missile System flight program was resumed on 2 December 1976 at White Sands

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(Missile Range (WSMR) with the firing of Engineering Development Model (EDM-15) using the tactical prototype firing platoon (FP-1). A February 1977 special Army System Acquisition Review Council (ASARC) approved acceleration of the PATRIOT production and deployment phase. At the end of June 1977, consecutive successful PATRIOT flight tests (EDM flight through EDM flight had been conducted in a countermeasures environment using FP-1. Additionally, twenty-four search/track tests had been sucessfully conducted in a wide range of electronic countermeasure (ECM) and clutter environments with various maneuver and range/altitude conditions. Tactical prototype firing platoon #2 (FP-2) was delivered to White Sands Missile Range (WSMR) on 1 Jul 77. The system is undergoing integration and checkout in preparation for the upcoming missile firings and search/track missions. These tests will be conducted in threat level electronic countermeasures (ECM) and clutter environments with various maneuver and range/altitude conditions.

B. RELATED ACTIVITIES: System commonality with the Navy AEGIS has been studied and although separate developments are required, continuous coordination insures the use of common components whenever feasible. The PATRIOT system, through the Battalion Command and Control Set, will be interoperable with other Army Group/Brigade level command and control systems through the Army Air Defense Command and Control System (AN/TSQ-73). It will also be interoperable and directly interface with the Air Force or Marines when the Group/Brigade level AN/TSQ-73 is not available.

C. WORK PERFORMED BY: The Raytheon Company of Bedford, MA, is prime contractor with Martin-Marietta Corporation of Orlando, FL, as missile subcontractor. Thiokol Chemical Coproration of Huntsville, AL, is a subcontractor for the rocket motor. IBM Corporation of Huntsville, AL, is the System Engineering Cost Reduction Assistance Contractor (SECRAC). Teledyne Brown, Huntsville, AL, is the Software Verification and Validation Contractor; Science Applications Incorporated, Huntsville, AL, is developing a Tactical Operation Simulator (TOS). Government Agency in-house work is managed by the PATRIOT Project Management Office, Huntsville, AL.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The project was initiated as the Army Air Defense System for the 1970's (AADS-70's) in 1963. The program was reoriented and renamed SAM-D in FY 1965. Contract Definition was completed and a contract for Advanced Development (AD) was awarded in May 1967. SAM-D hardware was designed, fabricated and tested. The Advanced Development program proved the ability of the multi-function phased array radar to carry out time-shared search and track functions under computer control. Performance was demonstrated by tracking tests on 112 controlled aircraft targets and a multitude of targets of opportunity in 164 hours of testing. Missile parameters such as chamber pressure, temperature, aeroballistics, and control systems were verified by eight propulsion and control test flights. The airborne guidance section was tested in over 100 captive

flight tests. Flights were conducted against single and multiple targets in both clutter and electronic countermeasure environments. The Guidance Test and Simulation Facility was built and computer simulated flights were compared to results of propulsion, control, and captive flights. As a result of the successful completion of Advanced Development objectives, PATRIOT (formerly SAM-D) was approved for entry into Engineering Development (ED) in March 1972. The SAM-D Nuclear and Antimissile Capability Study was approved in December 1972. This study recommended: (1) deletion of the nuclear warhead, (2) programing of reduced number of fire sections for Continental United States (CONUS) air defense, and (3) development of an improved non-nuclear warhead. The program was reoriented on 10 January 1974 to emphasize greater austerity while permitting early flight verification of the track-via-missile (TVM) guidance principle. A stop work order was issued to the prime contractor on 4 February 1974. As a result of this order, all effort in support of a major portion of the hardware development and some engineering activities were deferred until a Defense System Acquisition Review Council (DSARC) met to approve the reoriented program. On-going efforts remaining after the stop work order were in support of the TVM demonstration and an austere development program. The Defense System Acquisition Review Council (DSARC) met on 6 June 1974 to review the reoriented program. In accordance with the Deputy Secretary of Defense directive, based on the DSARC recommendations, program efforts continued in the following areas: (1) preparation for the track-via-missile (TVM) demonstration flights; (2) continuation of the austere development program; (3) initiation of cost reduction; and (4) development of a backup guidance. The final Certified Test Vehicle (CTV) flight was completed on 28 August 1974. Of the 10 flights, were rated as successes with full accomplishment of flight objectives. The major objectives of the captive carry flight test program, a prerequisite to the Engineering Development Missile (EDM) #1 flight, were successfully demonstrated and repeated during November 1974. Proof-of-Principle flight tests demonstrated through missile firings that TVM guidance functions successfully against benign targets which are maneuvering, in formation, and at low altitudes. Six consecutive successful flight tests proved the principle of track-via-missile; the remaining missiles were used to obtain additional engineering data. An ASARC/DCARC was held in January 1976 which allowed the resumption of full-scale Engineering Development. The Surface to Air Missile Development (SAM-D) program was officially named PATRIOT on 21 May 1976. On 4 Aug 1976, a contract to complete the contractor portion of the PATRIOT system development was awarded to Raytheon Company, the Prime Contractor. The PATRIOT Missile System flight program was resumed on 2 December 1976 at White Sands Missile Range (WSMR) with the firing of Engineering Development Model (EDM-15) using the tactical prototype firing platoon (FP-1). A special Army System Acquisition Review Council (ASARC) held in Feb 1977 approved the Accelerated Program. At the end of June 1977, consecutive successful PATRIOT flight tests (EDM flight through EDM flight has been conducted in a countermeasures environment using FP-1. Additionally, twenty-four search/track tests had been successfully conducted in a wide range of electronic countermeasures (ECM) and clutter environments with various maneuver and range/altitude conditions. Tactical prototype firing platoon #2 (FP-2) was delivered to White Sands Missile Range (WSMR) on 1 Jul 77. The system is undergoing integration and checkout in preparation for the upcoming missile firings and search track missions. These tests will be conducted in threat level ECM and clutter environments with various maneuver and range/altitude conditions. Cost reduction efforts continue to include the assistance provided by the System Engineering Cost Reduction Assistance Contractor (SECRAC).

Project: #D212 Title: PATRIOT (SAM-D)
Program Element: #6.43.07.A Title: PATRIOT (SAM-D)
DoD Mission Area: #414 - Field Army Air Defense Budget Activity: #4 - Tactical Program

2. FY 1978 Program: The eight remaining Engineering Development Missiles (EDM) produced in Phase II will be flight tested using firing platoon (FP) #2 and launch station (LS) #2. Eight Modular Digital Airborne Guidance Section (MDAGS) forebodies (TVM Guidance Section and Warhead Section, less Warhead and Safe and Arming Device), are scheduled to be delivered with three allocated for ground tests and two allocated for the first MDAGS flights. FP #2 will be used to support the missile firing program. FP #3, updated from FP #1, will be shipped to White Sands Missile Range (WSMR) for use in flight test program in FY79. FP #4 fabrication and assembly will be completed and undergo climatic testing at contractor's plant prior to shipment to WSMR in FY79 for use in flight test program. FP #5 will be in the final stages of assembly prior to undergoing Army climatic tests in FY79. LS #1, updated and designated as LS #3, will be shipped to WSMR for use in flight test program during future fiscal years. LS #3 and LS #4 will be used in conjuction with FP #3 and #4 in missile flight test program. LS #5 will undergo climatic tests with FP #5. Command and Control Group (CCG) will be nearing completion of fabrication and assembly; scheduled for delivery to WSMR in early FY79. A Communications Relay Group (CRG) will be shipped to WSMR for testing in FY79. Battalion Supply and Maintenance Equipment (BSME) #1 will be integrated with FP #4 and #5 prior to delivery to WSMR in FY79. BSME #2 will be in final stages of assembly prior to delivery in early FY79. CRG will be in final stages of assembly prior to delivery in early 1979. Cost reduction efforts will continue to include the assistance provided by System Engineering Cost Reduction Assistance Contractor (SECRAC). Producibility Engineering Planning (PEP) activities will be initiated and the Initial Production Facilities (IPF) plan developed during this fiscal year.

3. FY 1979 Planned Program: Thirteen MDAG missiles are scheduled to be flight tested as the conclusion of the contractor flight test program. Ten MDAG missiles are scheduled to be flight tested as the start of Development Test/Operational Test II. FP #3 and #4 will support the firing programs during this fiscal year. FP #5 will continue to undergo Army climate tests during this fiscal year. All other Engineering Development (ED) ground equipment is scheduled for delivery, plus eleven MDAG missiles for use, in FY80. SECRAC will continue to pursue cost reduction efforts. PEP activities continue in special tooling areas, prepare make or buy analysis, and establish production product assurance plans.

4. FY 1980 Planned Program: Thirty MDAG missiles are scheduled to be flight tested as the completion of DT/OT II tests, following completed delivery of the final nineteen (19) MDAGS missiles. The environmental qualification program is scheduled for completion. PEP activities conclude with completion of manufacturing data packages, completion of design and documentation of special tooling and completion of design of special test equipment.

5. Program to Completion: Development Test/Operational Test (DT/OT) II is scheduled to be completed in FY 1980, to be followed by a procurement program leading to an initial operational capability in

Project: #D212 Title: PATRIOT (SAM-D)
Program Element: #6.43.07.A Title: PATRIOT (SAM-D)
DoD Mission Area: #414 - Field Army Air Defense Budget Activity: #4 - Tactical Program

6. Major Milestones:

	Date
Start of Producibility Engineering and Planning (PEP)	Oct 77
Delivery of FP #3 to White Sands Missile Range (WSMR)	Sep 78
First Modular Digital Airborne Guidance System (FMDAGS) Flight	Oct 78
Delivery of FP #4 to White Sands Missile Range (WSMR)	Jan 79
Contractor Flight Tests Completed and start of DT/OT Testing	Jul 79
Completion of DT/OT Testing	May 80

7. Resources ($ in thousands):

	FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Cost
RDTE,A: Funds	179953	216423[1/]	227492	122218	24668	1796618[2/]
Quantities						Not Applicable
Missile Procurement, Army						
Funds	0	0	67321	428112		
Quantities						
Fire Control Sections (FCS)	0	0	0	5		
Missiles	0	0	0	155		
Military Construction, Army	0	0	0	0	11400	11400

1/ A FY 1978 RDTE apportionment decision subsequent to the Army budget submission changed estimated FY 1978 RDTE funding from $216423 thousand to $214558 thousand.
2/ Revised total per footnote #1 is $1794365 thousand.

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FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.43.08.A
DoD Mission Area: #413 - Fire Support

Title: Precision Laser Designator
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	6350	4091	12593	4400	0	52469
	Quantities						22
D075	Ground Laser Locator Designator (GLLD)	5974	4091	8693	800	0	42918
DF30	Protective Laser Devices	376	0	3900	3600	0	9551

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the development of a precision laser designator to be used in either a ground tripod or vehicular mounted configuration. The GLLD provides the critically needed capability for long range precision designation of either stationary or moving tank sized targets to allow a high probability of a first round kill with laser guided weapons such as the cannon launched guided projectile - COPPERHEAD, and the helicborne missile - HELLFIRE; and determination of target bearing and range relative to the GLLD to enhance conventional artillery effectiveness against stationary and moving targets. There is no ground laser designator in the operational inventory that can be used adequately with laser terminally guided munitions. COPPERHEAD and HELLFIRE are dependent on the GLLD for operational employment. A second project within this program element is Protective Laser Devices, which includes a development program for spoofers, devices which simulate the laser designator, and a periscope adaptation for the GLLD to enhance designator and operator survivability.

C. BASIS FOR FY 1979 RDTE REQUEST: Conclude the GLLD engineering development contract. Plans will be completed for a production contract award during the second quarter of FY 1979. Effort will continue to complete the GLLD technical effort and confirm by testing. Continue GLLD support of terminal homing weapons systems tests. Spoofer and periscope engineering development programs will begin.

Major Milestones	Date
Development Test/Operational Test II	April 1978
Production Decision	January 1979
Contract Award	March 1979

Program Element: #6.43.08.A
DoD Mission Area: #413 - Fire Support

Title: Precision Laser Designator
Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: ($ in Thousands)

Other Procurement, Army	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Funds	0	0	26500	16800	66,700	110,000
Quantities	0	0	130	222		

* Plus beyond FY 1983.

E. DETAILED BACKGROUND AND DESCRIPTION: This program was initiated in FY 1974 to provide for engineering development of precision laser designators to be used in conjunction with laser guided weapons of all services. The Ground Laser Locater Designator (GLLD) consists of a laser designator/rangefinder, tracking unit, and mount. It also has an interface for mounting a night observation device. The system weighs 51 pounds, determines target bearing, designates moving targets visible through the optics, and ranges to targets. The primary user of the GLLD is the artillery forward observer. In a vehicular mounted configuration, it will also be used by maneuver units. The development of a spoofer and periscope within this program is to enhance the survivability of the designator/operator. The use of low cost spoofers will confuse an enemy searching for the position of the laser designator. A periscope adaptation for the GLLD will reduce operator exposure to enemy counterfire.

F. RELATED ACTIVITIES: The US Navy, US Air Force, and US Marine Corps use the same technologies in their laser homing weapon system programs. There is close coordination between the services, which includes technology working groups and tri-service agreements to provide exchange of technology efforts, to allow use of common components or equipments, where practical, and to insure system compatibility in the field. The Army has been designated the lead service for the development of all ground laser designators. Army experimental ground laser designators have supported live firings of the Navy's 8-inch guided projectile program, the Navy's BULLDOG Missile, the Air Force Close Air Support Missile, and the Army's HELLFIRE and COPPERHEAD programs. The US Army Missile Research and Development Command has also developed a Laser Target Designator (LTD) under Program Element 6.47.23.A, Project DL71, Special Purpose Detectors, and is developing a Modular Universal Laser Equipment (MULE) for the US Marine Corps under Program Element 6.47.65M. The MULE is a tripod mounted version of the LTD equipped with a rangefinder. The MULE utilizes unit/tripod design with some component commonality. The Air Force has selected LTD for its designator requirement for tactical air control parties.

G. WORK PERFORMED BY: In-house work is performed by the Project Manager, Ground Laser Designators, US Army Missile Research and Development Command, Redstone Arsenal, AL. The GLLD engineering development contractor is Hughes Aircraft Company, Culver City, CA.

Program Element: #6.43.08.A
DoD Mission Area: #413 - Fire Support

Title: Precision Laser Designator
Budget Activity: #4 - Tactical Programs

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The first Ground Laser Locator Designator (GLLD) engineering development unit was delivered in December 1976 by Hughes. Subsequently, 22 GLLD systems, 4 trainers, ground support equipment including repair parts, and most manuals have been delivered. A maintainability demonstration on the GLLD system was conducted in August 1977. Early GLLD systems underwent engineering tests to demonstrate readiness for formal testing. Development Test (DT) II is approximately 70 percent complete. Performance of the Hughes GLLD system is expected to satisfy Required Operational Capability (ROC) requirements. A vehicle adaption kit program for the GLLD was initiated in FY 1975. Adaption kits for the M113 Armored Personnel Carrier and M151 1/4 ton truck have been built and will support the GLLD test program. Testing indicates that GLLD system performance on stationary vehicles is essentially the same as the ground mount. The protective laser device project was initiated in FY 1975 and continued through FY 1977 with the development and testing of several different spoofer concepts, i.e., a low brightness laser, a medium brightness laser, two different injection laser light sources, an electronically pulsed light source, and a mechanically chopped light source. These laser spoofer concepts have been formulated and acceptance and equipment validation tests and analyses have been conducted on available spoofer equipment. Two day-only periscopes to be used with the GLLD have undergone laboratoy and field (test range) tests at Redstone Arsenal.

2. FY 1978 Program: Engineering Development units of the GLLD to be used for DT II have been delivered and testing is to be completed in FY 1978. Units for Operational Test (OT) II have been delivered. OT testing began in October 1977. In-house effort is continuing in the areas of contract and overall program management, design reliability enhancement, test planning and conduct, design-to-unit cost and production planning. There is no planned effort under the GLLD program to further develop vehicle adaption kits or equipment for vehicular pointing and tracking. Congressional reduction of the FY 1978 budget request resulted in the delay of the GLLD procurement start which caused an extension of the RDTE program and a deferral to FY 1979 of continued spoofer and periscope development. Data from tests conducted on the various spoofers, the conclusions of a counter-measure threat analysis, and the results of a user requirements study will be used to make a decision on the direction of a full engineering development survivability program to begin 1st Qtr, FY 1979. The configuration to enter engineering development will be determined after test and evaluation of the two day-only periscopes, and the two day/night periscopes in DT/OT II.

3. FY 1979 Planned Program: Initiate engineering development of protective laser devices to enhance operator and designator survivability. Continue GLLD Support of COPPERHEAD, HELLFIRE, and Air Force and Navy laser guided terminal homing weapons systems tests. Complete GLLD engineering development contract, correction of technical problems resulting from Development/Operational Test (DT/OT) II, and producibility planning and documentation efforts. Investigate areas of significant technological advance, such as batteries, laser rods, and optical coatings. Increase of funding from FY 1978 is due to the initiation of engineering development of the Protective Laser Devices, and extension of the GLLD development effort. Production is being delayed due to deletion of FY 1978 planned procurement funding.

Program Element: #6.43.08.A
DoD Mission Area: #413 - Fire Support

Title: Precision Laser Designator
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: Engineering development of Protective Laser Devices will be completed. Support of laser terminal weapon systems testing for the tri-services will continue. RDTE efforts on the GLLD and Protective Laser Devices projects will be completed in FY 1980.

5. Program to Completion: Not Applicable.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D075 Title: Ground Laser Locator Designator (GLLD)
Program Element: #6.43.08.A Title: Precision Laser Designator
DoD Mission Area: #413 - Fire Support Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: This project was initiated in FY 1974 to provide for engineering development (ED) of the GLLD. The GLLD will be used with laser-guided weapons of all Services. It is the primary designator for COPPERHEAD. The combination of COPPERHEAD and GLLD will give the Army a highly effective capability to counter the massive Soviet/Warsaw Pact armored threat by attacking tanks at extended ranges using existing artillery resources. The GLLD consists of a laser designator/rangefinder, day sight, tracking unit, mount, and an interface for mounting a night observation device. The primary user is the Artillery Forward Observer. The system weighs 51 pounds; determines target bearing and elevation; designates moving targets, visible through the optics, to and ranges to targets at distances to

B. RELATED ACTIVITIES: The US Navy, US Air Force, and US Marine Corps use the same technologies in their laser-homing weapon system programs. There is close coordination between the Services, which includes technology working groups and tri-Service agreements to provide exchange of technology efforts, allow use of common components or equipments, where practical, and to insure system compatibility. The Army has been designated the lead Service for development of all ground laser designators. Army experimental ground laser designators have supported live firings of the Navy's 8-inch guided projectile program, the Navy's BULLDOG missile, the Air Force Close Air Support Missile, and the Army's COPPERHEAD and HELLFIRE programs. The US Army Missile Research and Development Command has also developed a Laser Target Designator (LTD) under Program Element (PE) 6.47.23.A, Project DL71, Special Purpose Detectors, and is developing a Modular Universal Laser Equipment (MULE) for the Marine Corps under PE 6.47.65.M.

C. WORK PERFORMED BY: In-house work is performed by the Project Manager, Ground Laser Designators, US Army Missile Research and Development Command, Redstone Arsenal, AL. The GLLD ED contractor is Hughes Aircraft Company, Culver City, CA.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Following a successful advanced development (AD) phase which demonstrated the feasibility and military potential of the terminal homing weapon system concept, an ED contract for the GLLD was awarded to Hughes Aircraft Company in April 1974. The first GLLD ED unit was delivered in December 1976. Subsequently, 22 GLLD systems, 4 trainers, ground support equipment including repair parts, and most manuals have been delivered. Early GLLD systems underwent

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engineering tests to demonstrate readiness for formal testing. A maintainability demonstration was conducted in August 1977. Development Test (DT) II is approximately 70 percent complete. System performance is expected to satisfy Required Operational Capability (ROC) requirements. A vehicle adaption kit program was initiated in FY 1975. Adaption kits for the M113 Armored Personnel Carrier and M151 1/4 Ton Truck will support the GLLD test program. Testing indicates the GLLD system performance on stationary vehicles is essentially the same as with the ground mount.

2. FY 1978 Program: Complete DT II. Operational Test (OT) II began in October 1977 and will be completed during this year. In-house effort is continuing in the areas of contract and overall program management, design reliability enhancement, test planning and conduct, design-to-unit cost, and production planning. There is no planned effort to further develop vehicle adaption kits or equipment for vehicular pointing and tracking. Congressional reduction of the FY 1978 budget request resulted in the delay of the GLLD procurement start, causing an extension of the RDTE program.

3. FY 1979 Planned Program: Complete the GLLD engineering development (ED) contract, correction of technical problems resulting from formal testing, and producibility planning and documentation efforts. Investigate areas of significant technological advance, such as batteries, laser rods, and optical coatings. Increase of funding from FY 1978 is primarily due to the extension of the GLLD RDTE effort. Production is being delayed due to deletion of FY 1978 planned procurement funding.

4. FY 1980 Planned Program: Complete GLLD RDTE efforts. Continue support of laser terminal homing weapon systems testing for the Tri-Services.

5. Program to Completion:

6. Major Milestones:

Milestone	Date
DT/OT II	April 1978
Production Decision	January 1979
Contract Award	March 1979

7. Resources ($ in thousands):

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
RDTE,A: Funds	5974	4091	8693	800	0	42918

Project: #D075
Program Element: #6.43.08.A
DoD Mission Area: #413 - Fire Support

Title: Ground Laser Locator Designator (GLLD)
Title: Precision Laser Designator
Budget Activity: #4 - Tactical Programs

Quantities						22
Other Procurement, Army						
Funds	0	0	26500	16800	66700	110000
Quantities	0	0	130	222		

*Plus beyond FY 1983.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.43.09.A
DoD Mission Area: #414 - Field Army Air Defense

Title: ROLAND
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	85001	75403	22663	6218	0	276246
	Quantities						4
D647	ROLAND	85001	75403	22663	6218	0	276246

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the transfer of the design of the French/German ROLAND II Short Range Air Defense (SHORAD) missile system to the US. A US version has been fabricated for testing and subsequently a US production base will produce ROLAND for use to meet the all-weather SHORAD missile requirement. This system is required to fill the Army's need for an all-weather Short Range Air Defense system to defend vital targets in Corps areas against low flying high speed aircraft.

C. BASIS FOR FY 1979 RDTE REQUEST: $22.7 million in FY 1979 is needed to complete the technology transfer from Europe and complete Development Test/Operational Test (DT/OT) II. An integrated test program was initiated in early FY 1978. This included a joint US/European test in which both US and European missiles were fired from a European production fire unit and integrated development and operational testing using US fire units. Arctic and Tropic Tests will begin early in the year.

Major Milestones	Date
Defense System Acquisition Review Council I/II	February 1974
Source Selection	January 1975
Joint Test (US/European)	November 1977
Defense System Acquisition Review Council III (Production)	September 1978
Low Rate Production	October 1978
Initial Operational Capability (Training Battery)	

Program Element: #6.43.09.A Title: ROLAND
DoD Mission Area: #414 - Field Army Air Defense Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS:

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Missile Procurement, Army	0	55643	202738	213900		1/
Quantity - Fire Units	0	0	15	20		
Quantity - Missiles	0	0	314	500		

1/ Procurement funding reflects the purchase of ROLAND fire units and equipment including initial spares for non-divisional air defense. Additional procurement for divisional ROLAND, is being proposed in FY 1980 and if approved is estimated at $1.5 billion (Escalated $).

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to transfer technology and fabricate hardware for the conduct of engineering development tests on a US-built ROLAND air defense system. The ROLAND missile system will provide an all-weather surface-to-air missile for use in defense of airbases and other rear area target complexes. The system could also defend divisional combat units. The ROLAND fire units will replace the presently deployed European nondivisional CHAPARRAL/VULCAN units. The US ROLAND missile system will consist of a fire unit module (two missile launchers, internal missile storage compartment for 8 missiles, acquisition and tracking radar, and other fire control equipment) mounted on a single M109 tracked vehicle. The system will engage low flying targets at ranges in excess of 6 km and altitudes up to 5 km. The missile may be launched in the optical mode (without using the tracking radar) or in the tracking radar mode for all-weather capability. At intercept, warhead detonation is initiated by a

F. RELATED ACTIVITIES: Evaluations to verify the technical performance of three foreign developed air defense systems (the German/French ROLAND II, the United Kingdom RAPIER, and the French CROTALE) were conducted under Project D699 (Evaluation of Foreign Weapon Systems) of Program Element 6.33.01.A (Advanced Forward Area Air Defense Systems). Close liaison is maintained with the development/production efforts of the French/German ROLAND II program.

G. WORK PERFORMED BY: The program is managed by the US Army Missile Research and Development Command, Huntsville, AL. The prime contractor is Hughes Aircraft Company, Canoga Park, CA. Boeing Corporation, Seattle, WA, is the major subcontractor. Hughes and Boeing are the US co-licensees for Messerschmitt Bolkow Blohm, Munich, Germany, and Aerospatiale of Paris, France.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The Short Range Air Defense (SHORAD) Requirements Study concluded that a requirement existed for an all-weather low altitude air defense system. This requirement was approved by the Army in August 1973. The SHORAD missile program was approved by the Defense System Acquisition Review Council in February 1974. Four contractors responded to

the Army's request for proposals: Philco-Ford for the all-weather CHAPARRAL missile system; Rockwell International for the CROTALE missile system; United Aircraft for the RAPIER system; and Hughes Aircraft for the ROLAND system. Hughes was awarded the contract on 9 January 1975 and initiated the transfer of design technology and fabrication of hardware. A cooperative test program was initiated with the German Government. This test was designed to reduce the risk of the engineering development phase by filling the gaps in the foreign testing. In August 1975 the US contractor, Hughes Aircraft Company, projected a cost growth in the Technology Transfer, Fabrication and Test contract. A special Army Systems Acquisition Review Council (ASARC), held on 17 October 1975, directed that the program be restructured to provide an opportunity for the European system design to stabilize and to provide an opportunity to reassess the US program. Hughes provided a revised cost proposal for a restructured contract modification. During FY 1976 the contractor's program was closely monitored by issuing funds in monthly incremental allotments sufficient to permit completion of the design transfer. Fabrication of electrical and mechanical subcomponents of the missile and fire units was begun. The cooperative test program was completed in February 1976 at Patrick AFB, FL. During FY 197T activities toward the fabrication of prototype hardware continued and the first prototype missile was completed. The restructured contract modification proposed by Hughes was negotiated in August 1976 and a special ASARC was held in 16 September 1976. The ASARC recommended continuation of the program to a special Defense Systems Acquisition Review Council (DSARC) which met on 24 September 1976. During FY 1977 prototyping of four fire units and ninety missiles to be used in testing were 90% completed.

2. FY 1978 Program: Delivery of four prototype fire units and prototype missiles will occur in the first two quarters. Full system testing commenced in January 1978 with a coordinated operational and developmental test. Design and fabrication of a US National Field Maintenance Test Set (FMTS) will be completed and fabrication of prototype hardware will commence, to be delivered late in the fiscal year. Cooperative efforts on international interchangeability continue with 500-plus subcomponents already identified for approval by the Joint ROLAND Control Committee (Germany, France and US). Initial Production Facilitization (IPF) funds will be released in mid-FY 1978 with an initial production decision to follow at the end of the fiscal year, after the completion of a major portion of the testing. Joint testing (European and US) will commence in May 1978 to supplement and complement US testing and to prove-out the concept of International Interchangeability. A strike occurred at the Boeing, Seattle plant which lasted from October 4, 1977 to November 17, 1977. The contractor is now developing the possible cost and schedule impact The Army will be working closely with the contractor to determine that effect of the strike and to minimize any changes to the contract which may be necessary.

3. FY 1979 Planned Program: Procurement qualification testing/operational testing will be completed and Arctic-Tropic Testing will continue. Prototype fire units will be refurbished to be equivalent to Initial Production items and will ultimately be used to fill the Authorized Acquisition Objective (AAO). Based on the approval of the Defense System Acquisition Review Council (DSARC) III, initial production will be initiated in early FY 1979. Training will begin for personnel to support the Initial Operational Capability (IOC). A reduction in the RDTE funding level from FY 1978 is a result of the pending completion of the Technology Transfer effort and switch to procurement.

Program Element: #6.43.09.A
DoD Mission Area: #414 - Field Army Air Defense

Title: ROLAND
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: Complete Arctic and Tropic testing, analyze data and conduct activities incident to close-out of technology transfer. Initial production continues with hardware being delivered for initiating training of personnel in preparation for the first tactical capability in

5. Program to Completion: Low rate production continues, aimed at deployment of the first tactical battalion to Europe in A confirmatory test on production hardware will be initiated in FY 1981. Units to complete the Corps deployment will be operational by the end of

Program Element: #6.43.09.A
DoD Mission Area: #414 - Field Army Air Defense

Title: ROLAND
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation:

a. The US contractor is Hughes Aircraft Company, Canoga Park, CA.

b. The All-Weather (AW) Short Range Air Defense (SHORAD) missile system is the ROLAND II air defense system developed jointly by Germany and France. ROLAND is in series production in Europe in a fair-weather version (ROLAND I) and in the all-weather version (ROLAND II). A US test of the ROLAND II was concluded in the US in early 1973. This test verified the ability of the system, with some modification, to meet the US AW SHORAD requirement. The primary modification is repackaging the system into a module, thus permitting its use on a US vehicle. In January 1975, the US Army entered into a cooperative test with Germany to obtain further test data on ROLAND II to aid the ROLAND program. The cooperative test employed German prototype hardware, and the testing included performance evaluation. The European phase of the test occurred between January and July 1975. This phase included ROLAND I (fair-weather version) performance testing. The US phase of the cooperative test was conducted between August 1975 and February 1976. This phase included training and performance testing involving four ROLAND I and one ROLAND II missile firings at White Sands Missile Range (WSMR). The test program for US ROLAND integrates, as much as possible, European, testing. Data from European tests will be analyzed to supplement that collected during the US tests. This approach reduces test cost and schedule without sacrificing necessary test data. Prototype qualification testing at the contractor's plant began on US equipment in November 1977. The first fire unit moved to WSMR in January 1978. Confirmatory Follow-on-Evaluation (FOE) tests will be conducted in FY 1981 on early production hardware.

2. Operational Test and Evaluation: The US Army Operational Test and Evaluation Agency (OTEA) participated in the testing of the ROLAND II during the Cooperative Test in FY 1975. US and foreign crews were used during the test. OTEA is scheduled to conduct operational testing (OT II) commencing in June 1978. Operational test crews will participate in systems firings commencing in February 1978. OTEA will provide an independent evaluation of the system prior to Low Rate Production decision in September 1978. OTEA will participate in the confirmatory FOE test on production models of the system in FY 1981 Operational testing will be conducted using US user personnel as operators. Limited reliability, availability, maintainability (RAM) and supportability data will be obtained during all operational testing.

Program Element: #6.43.09.A
DoD Mission Area: #414 - Field Army Air Defense

Title: ROLAND
Budget Activity: #4 - Tactical Programs

3. System Characteristics:

Operational/Technical Characteristics	Objectives	Demonstrated Performance 1/
Target Intercept Range		
Altitude		
System Operational Effectiveness, Benign/Electronic, Countermeasures		
Target Speed Intercept Capability		
System Response Time (Target Acquisition to Missile First Motion)		
Reload Time (Magazine to Launcher)		
System Operational Availability		
March Order/Emplacement Time		
Air Transportability		

1/ Actual performance to be demonstrated during development and operational testing.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.43.10.A
DoD Mission Area: #413 - Fire Support

Title: Heliborne Missile - HELLFIRE
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	19164	50482	65058	64586	47615	281846
	Quantities						241
D074	Heliborne Missile - HELLFIRE	19164	50482	65058	64586	47615	281846

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: HELLFIRE is an anti-armor terminal homing modular missile system which uses a shaped charge warhead to defeat individual hardpoint targets with minimal exposure of the delivery vehicle to enemy fire. HELLFIRE will initially utilize semi-active laser terminal homing guidance and will be designed to accept various other guidance packages. The missile system will be employed from Advanced Attack Helicopters (YAH 64's) against heavily armored vehicles at longer stand-off ranges than missiles currently in the inventory. HELLFIRE will provide accurate fire on targets acquired and autonomously designated by the attack helicopter or remotely designated by ground observers and aerial scout helicopters. HELLFIRE can be employed in a wide variety of firing modes in day or night operations. It is being developed to meet the armored vehicle and other hardpoint target threats of the 1980-1990 time frame.

C. BASIS FOR FY 1979 RDTE REQUEST: The HELLFIRE Modular Missile System prime contractor will continue engineering development activities including design, fabrication, and testing. Development and tactical missile prototype flight tests and component and system qualification tests will be conducted. Preparation will begin for operational tests using an AH-1 (COBRA) test bed helicopter, environmental storage tests will be initiated, and low cost seeker efforts will be continued. In addition the system prime contractor will support Advanced Attack Helicopter (YAH-64)/HELLFIRE integration tests. Significant contractor planned accomplishments are the development of flight test success criteria, a design freeze, and identification of long lead items for production.

Program Element: #6.43.10.A
DoD Mission Area: #413 - Fire Support

Title: Heliborne Missile - HELLFIRE
Budget Activity: #4 - Tactical Programs

Major Milestones	Date
Army Systems Acquisition Review Council/Defense Systems Acquisition Review Council (ASARC/DSARC) II	Feb 76
Engineering Development (ED) Contract Award	Oct 76
Operational Test (OT) II Start	Oct 79
ASARC/DSARC III	Apr 80
Low Rate Initial Production (LRIP) Contract Award	Oct 80
ASARC/DSARC IIIA	Nov 81
Missile & Launcher Availability	
Initial Operational Capability (IOC) on Advanced Attack Helicopter (AAH)	

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Missile Procurement, Army						
Funds	0	0	0	14743	506642	521385
Quantities	0	0	0	0		

E. DETAILED BACKGROUND AND DESCRIPTION: This program began with exploratory development in laser guidance. Previous work by the Army, Navy and Air Force established the technical feasibility of using lasers to designate targets for terminal homing of laser seeker equipped ordnance. The Army conducted a successful prototype flight test program using the Air Force HORNET missile modified with laser terminal homing capabilities. These flight tests reduced the developmental risk and demonstrated the feasibility of helicopter launched laser guided missiles. Exploratory flight tests consisted of fifty-six missiles which were fired from ground and aerial launch platforms and used ground and airborne designation. Competitive Advanced Development (AD) contracts were awarded to Hughes Aircraft Company and Rockewell International Corporation in June 1974 to develop competitive system design concepts. Rockwell was selected as the prime contractor in October 1976 for the Engineering Development (ED). Earlier in 1974 the Air Force was designated by the Department of Defense as the executive agent for the Tri-Service Laser Seeker. An Air Force contract was awarded for the Engineering Development of seekers to be used on the Air Force Maverick missile and the Army's HELLFIRE missile. Due to the projected high production cost of this tri-Service seeker, the Army and Air Force are pursuing a joint cost reduction effort for the tri-Service seeker. In addition, the Army initiated a low cost seeker program with Martin-Marietta Corporation to provide competition in the seeker development with the purpose of reducing production seeker costs. HELLFIRE will be effective against targets out to in the direct fire mode and out to in the indirect mode. The longer stand-off range and the ability of the helicopter to mask behind terrain features

provides a significant increase in helicopter survivability over anti-armor missiles currently in the inventory. The 7-inch diameter missile will weigh 95 pounds, penetrate a minimum of and be capable of defeating potential enemy tanks of the time frame. This system will provide the Army with a common missile airframe capable of accepting a family of terminal homing seeker modules to engage a variety of targets. The initial seeker module will be a laser seeker which provides the capability to deliver accurate fire on hard point targets which have been designated by a laser designator. Other seeker modules may include a "fire and forget" infrared seeker and an air defense suppression seeker.

F. RELATED ACTIVITIES: The HELLFIRE Missile System is related to Air Force, Navy and other Army systems which utilize similar technology. Coordination is effected through technology coordination groups, frequent liaison visits, exchange of components and subsystems, and exchange of analyses, simulation, and hardware test results. The exploratory prototype program was conducted under Program Element (PE) 6.23.03.A, Missile Technology, and the Advanced Development effort was conducted under PE 6.33.10.A, Heliborne Missile - HELLFIRE. Work on the infrared seeker will be done under PE 6.33.16.A, Heliborne Missile Guidance Technology, currently programed for funding in FY 1980. The Air Defense Suppression Missile (ADSM) program is programed for funding under PE 6.33.07.A, Air Defense Suppression Missile, in FY 1980. The US Air Force portion of the Tri-Service Seeker development is funded under PE 6.46.08.F, Close Air Support Weapon Systems. The Advanced Attack Helicopter is funded under PE 6.42.07.A.

G. WORK PERFORMED BY: Contractors are Rockwell International Corporation, Columbus, Ohio, and Anaheim, California; and Martin-Marietta Corporation, Orlando, Florida.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Exploratory development work commenced in FY 1971. The FY 1972 program initiated concept formulation activities. The effort included work on fire control integration, laser measurements, countermeasure investigations, and warhead design. Exploratory flight tests were conducted with field of view seekers to obtain information on the achieveability of terminal accuracy and designator tracking accuracy. Additionally, the funding provided exploratory configuration hardware for operational tests. The FY 1973 program provided for completion of a cost effectiveness study, and two phases of Military Potential Test (MPT). These efforts were designed to provide a basis for a decision to enter full-scale development of a laser guided missile in FY 1974. The results from the MPT and Cost and Operational Effectiveness Analysis, however, revealed some operational uncertainties that warranted further investigation. Consequently, during the 3rd quarter of FY 1974 the decision was made to retain the laser missile program in Advanced Development (AD) for two more years. These questions were answered in further exploratory tests. Rockwell International Corporation and Hughes Aircraft Company, were selected in 1974 to continue development of modular missile technology for eventual competitive selection of one Engineering Development (ED) contractor. Efforts during FY 1974 included follow-on technical tests, field tests, and extensive use of simulation to resolve the operational questions. Additional firings using the earlier experimental hardware were accomplished at Redstone Arsenal, Alabama. The two contractors were awarded contracts to conduct HELLFIRE Modularity/Verification

Flight Tests. Because of FY 1976 funding constraints, the flight tests were not conducted. Consequently, no missiles using HELLFIRE configured hardware have been fired to date. The contractors performed hardware-in-loop simulation and alternate missile design concept effort in FY 1976. In-house effort in FY 1976 and FY 197T supported the cost and operational effectiveness analysis (COEA), Army Systems Acquisition Review Council/Defense Systems Acquisition Review Council (ASARC/DSARC), and preparation for award of the ED contract. In FY 1977 the ED contract was awarded, the contract performance baseline established, the design effort initiated, major subcontracts awarded, and test plans developed.

2. FY 1978 Program: The major effort in FY 1978 is the continuation of the Engineering Development (ED). Component and subsystem performance tests will be completed and component qualification tests will begin. The AH-1 (COBRA) test bed helicopter will be flight-certified and development prototype flight testing will begin. Support of the Advanced Attack Helicopter (YAH-64)/ HELLFIRE integration tests will be initiated in FY 1978. Low cost seeker efforts will be continued.

3. FY 1979 Planned Program: The increase of 14.6 million over the FY 1978 program is required for the procurement and fabrication of hardware for testing. Missile flight test success criteria will be established, and development and tactical prototype firings will be conducted. The tactical prototype design will be released and long lead items identified. Tests to be completed in FY 1979 are development prototype component qualification, component qualification, and YAH-64/HELLFIRE integration and development tests. Physical teardown evaluation will also be completed. The first tactical HELLFIRE missile will be fired. The Production Engineering Planning (PEP) effort will continue and New Equipment Training (NET) courses will be conducted. Environmental storage tests conducted by the government will start in FY 1979. Competitive low cost laser seeker efforts will be continued. Delivery of seekers by both contractors will start and seeker qualification tests will be conducted.

4. FY 1980 Planned Program: Engineering Development and Testing will continue at a high level during FY 1980. Operational Test (OT) II using the AH-1 (COBRA) helicopter will be conducted by the government and supported by the system prime contractor. System qualification tests will also be completed. Functional and physical configuration audits will be conducted and the Technical Data Package (TDP) will be approved. The Production Engineering and Planning (PEP) effort will be completed and the Initial Production Facilities (IPF) effort will start. The Army Systems Acquisition Review Council/Defense Systems Acquisition Review Council (ASARC/DSARC) III reviews will be held and, given a favorable decision, preparation will begin for award of the Low Rate Initial Production (LRIP) contract.

5. Program to Completion: Operational Test (OT) II of HELLFIRE on the YAH-64 Helicopter will be conducted in FY 1981 and environmental storage tests will be completed in the same year. Low Rate Initial Production will begin in FY 1981 with Production Validation Tests (PVT) scheduled for FY 1982. Availability of production HELLFIRE missiles and launchers is scheduled for its operational debut on the YAH-64 is scheduled for

Program Element: #6.43.10.A
DoD Mission Area: #413 - Fire Support

Title: Heliborne Missile - HELLFIRE
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation:

a. Competitive advanced development (AD) contracts were awarded to Rockwell International Corporation and Hughes Aircraft Company in June 1974. Rockwell International was selected as the engineering development (ED) contractor in October 1976 after an evaluation of proposals submitted by the two competing contractors and an evaluation of each contractor's performance during the AD phase.

b. The Development Test and Evaluation of HELLFIRE consists of completed exploratory flight testing, which demonstrated conceptual feasibility, and planned engineering development tests to demonstrate design performance and operational suitability of tactically configured hardware. All exploratory testing was conducted with modified Air Force HORNET missiles equipped with modified FALCOM motors, which were used as test bed missiles to flight test laser seekers. This exploratory flight testing began in 1970 and extended into the 1974 AD time phase; however, the only hardware configuration tested was the one described above. No HELLFIRE missiles were flight tested during the AD contractual effort due to reduction in funds. Therefore, the first flight test of a HELLFIRE missile will be conducted under the ED contract in FY 1978. The exploratory flight test program, the advanced development test, and the planned engineering development tests are described as follows:

(1) The exploratory flight test program consisted of fifty-six missiles; were successful. Twenty-nine of the fifty-six missiles tested were equipped with the Army Laser Seeker; were successful. Forty-three of the missiles were launched from helicopters at ranges of and 13 were ground launched. Targets were illuminated by a laser designator at various ranges extending to This exploratory test program was conducted by the US Army Missile Research and Development Command and consisted of two separate programs: (1) Terminal Homing Accuracy Demonstration (THAD) Program; and (2) Technical Tests.

(a) The THAD Program began in 1970 to demonstrate that semi-active terminal homing would provide a viable kill technique against tanks. In 1971 and 1972 a series of 15 guided rounds were fired demonstrating a one foot overall system Circular Error Probable (CEP).

(b) The Technical Test Program objective was to demonstrate the technical feasibility of various operational firing modes. These firing modes were successfully demonstrated and a description of each follows:

1 Ripple Fire - Two or more missiles are fired from the same launch platform at different targets using two or more separate laser target designators, each operating on different codes. Missiles can be successively launched at time intervals of approximately

2 Rapid Fire - Two or more missiles are fired from the same launch platform at multiple targets and designated successively by one laser target designator on a single code. Missiles can be launched at time intervals of approximately

3 Night Firing - Missile is fired at a target designated by a ground laser designator equipped with a night sight.

4 Autonomous Designation - Missile is fired from a helicopter equipped with an airborne laser target designator.

5 Remote Airborne Designation - Missile is fired from one helicopter at a target designated by an airborne laser target designator on board another helicopter.

6 Indirect Launch - Missile is fired from an airborne or ground launch platform while remaining behind terrain features.

(2) The Advanced Development Program was for the purpose of developing competitive system designs and did not include any missile flight testing due to funding constraints. Environmental testing was accomplished on the launcher and missile container.

(3) Planned development testing (DT) during the engineering development (ED) phase: Engineering design tests (EDT) to be completed in the 1st quarter FY 1980 will consist of component/subsystem Performance Tests, Helicopter Airworthiness and Flight Certification Tests, Missile Flight Tests, Safety Tests, Mutual Interference Tests, Countermeasures Tests, Electromagnetic Tests, Maintainability Tests and Nuclear Radiation Tests. Advanced Attack Helicopter (YAH-64)/HELLFIRE Modular Missile System Integration and Development Tests will be conducted by the YAH-64 prime contractor and supported by the HELLFIRE prime contractor during CY 1978-1980. It will include a series of missile flights to demonstrate the YAH-64 fire control and the HELLFIRE Missile System. Component Qualification Tests will be conducted by the HELLFIRE prime contractor and the US Army Missile Research and Development Command in the 4th Quarter FY 1980. Missiles, launchers, and ground support equipment will be tested in actual and simulated operational environments to demonstrate performance and reliability of the design. Test conditions will include temperature, vibration, shock, acceleration, and storage. Environmental/Storage Tests will be conducted by the US Army Test and Evaluation Command and supported by the contractor during 3d Quarter FY 1979-4th Quarter FY 1981. After storage in adverse operational environments, some missiles will be flight tested and others will undergo physical teardown to assess degradation. Production Validation Tests will be conducted by the contractor on the first production hardware to demonstrate that performance characteristics of production hardware are the same as demonstrated by prototypes. These tests will be conducted during 4th Quarter FY 1981-1st Quarter FY 1982.

2. Operational Test and Evaluation:

a. Laser Guided Missile System (LAGUMS) Military Potential Tests were was conducted in 1972 and 1973. These tests evaluated the ability of the helicopter gunner during target engagement and examined the tactical employment of LAGUMS-equipped helicopters. The tests also provided data on exposure and detectability of the launch aircraft and target designators. The results of these tests were used in lieu of Operational Test (OT) I.

b. Additional operational tests were conducted by the Combat Developments Experimentation Command (CDEC) during August-December 1974. These tests measured the vulnerability of the ground target designator. They also compared the mission effectiveness and operational performance of HELLFIRE versus extended range TOW.

c. OT II is scheduled to be conducted in two phases:

(1) The first phase will be conducted with engineering development (ED) hardware to validate the operational capability of HELLFIRE using the COBRA helicopter as the test bed vehicle. Operational performance, safety characteristics, reliability, availability and maintainability (RAM) will be assessed during these tests. These tests will be conducted by the US Army Operational Test and Evaluation Agency (OTEA) in FY 1980.

(2) The second phase of HELLFIRE OT will be conducted during the Advanced Attack Helicopter (YAH-64) OT II in 1981 and will validate the operational capability of HELLFIRE on the YAH-64. These tests will be conducted by OTEA at Yuma Proving Ground AZ.

3. System Characteristics:

	Objective*	Demonstrated Performance ***
Weight (total)	75-95 pounds**	
Warhead Weight		
Range		
Diameter	7 inches**	
Length	65 inches**	
Time of Flight		
Time of Flight		

* As specified in 30 September 1977 System Acquisition Report.
** As specified in the Development Concept Paper.
*** Data will be reflected when available from development and operational testing.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.43.11.A
DoD Mission Area: #422 - Interdiction

Title: PERSHING II
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT						
	Quantities						54
D599	PERSHING II						

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Previously titled PERSHING II Advanced Technology Development (Program Element (PE) 6.33.11.A), PERSHING II is an evolutionary step forward, based on PERSHING Ia, which includes development of an improved reentry vehicle and ground support equipment changes that provide enhanced system reliability, accuracy and targeting flexibility plus reduced operating and support costs. PERSHING II is designed to meet the Supreme Allied Commander, Europe's (SACEUR's) stated need for a land mobile, surface-to-surface missile system that has high accuracy and lower yield warheads for reduced collateral damage and better targeting flexibility; immediate responsiveness for time sensitive targets; battlefield survivability; target area penetrability; and all-weather strike capability for the Joint Chiefs of Staff (JCS)/North Atlantic Treaty Organization (NATO) Quick Reaction Alert (QRA) role. Six missile test flights are scheduled during the advanced development (AD) phase in FY 1978 to demonstrate the capability of the new terminal guidance technique to achieve the required system accuracy.

C. BASIS FOR FY 1979 RDTE REQUEST: Full scale Engineering Development will start in FY 1979 (October 1978) assuming a favorable decision following Defense Systems Acquisition Review Council (DSARC) II in June 1978. During the first year of the planned engineering development (ED) phase, effort will include reentry vehicle structure and ground support equipment production design; integrated guidance unit electronics prototype design; warhead adaption kit and guidance reference scene equipment prototype design; and initial subsystem component tests.

Major Milestones	Date
Start Development Test I	Nov 77
Complete Development Test I	Mar 78
Defense Systems Acquisition Review Council II	Jun 78
Award Engineering Development Contracts	Oct 78
Start Development/Operational Test II	

Program Element: #6.43.11.A
DoD Mission Area: #422 - Interdiction

Title: PERSHING II
Budget Activity: #4 - Tactical Programs

Major Milestones	Date
Defense Systems Acquisition Review Council (DSARC) III	
Start Full Scale Production	
Complete Development/Operational Test II	
Production (Buy 2)	
Production (Buy 3)	
Production (Buy 4)	
Production Deliveries Complete	

D. OTHER APPROPRIATION FUNDS ($ in thousands):

Missile Procurement, Army	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Funds	0	0	0	0	L	
Quantities						

* reentry vehicles; 1st and 2d Stage Propulsion Units.

E. DETAILED BACKGROUND AND DESCRIPTION: In order to meet the Supreme Allied Commander, Europe's (SACEUR's), expressed need for an improved mobile surface-to-surface missile system, a Special Task Force was formed in January 1973 to validate the need for an Improved PERSHING system and to develop a Concept Formulation Package for the system. In October 1973 the Decision Coordination Paper (DCP) for PERSHING II was presented to and approved by the Army Systems Acquisition Review Council (ASARC) and forwarded to the DSARC on 22 January 1974. As a result of a favorable DSARC recommendation, the Deputy Secretary of Defense (DEPSECDEF) directed the Army to proceed with the advanced development (AD) of PERSHING II. PERSHING II is a product improvement of the currently fielded PERSHING Ia system using the same propulsion system and modified ground support equipment but incorporating Radar Area Correlation Terminal Guidance to provide accuracy in the range of meters Circular Error Probable (CEP) and thus the capability to effectively use low yield specialized warheads.

F. RELATED ACTIVITIES: Close coordination is maintained with the Air Force on advanced ballistic reentry developments. Prior year efforts in surface-to-surface missile PERSHING (Program Elements (PE) 2.21.62.A and 2.22.54.A), Radar Area Correlation (PE 6.33.06.A) under the US Army Materiel Development and Readiness Command and the PERSHING II Advanced Development Program (PE 6.33.11.A) have been conducted by the same Project Manager (PM) selected to develop this project. These efforts have been closely coordinated with the US Army Missile Research and Development Command funded under PE 6.23.03.A, Missile Technology.

Program Element: #6.43.11.A
DoD Mission Area: #422 - Interdiction

Title: PERSHING II
Budget Activity: #4 - Tactical Programs

G. WORK PERFORMED BY: US Army Missile Research and Development Command, Redstone Arsenal, AL; White Sands Missile Range, NM; Martin-Marietta, Orlando, FL; Goodyear Aerospace Corporation, Akron, OH; Singer Company (Kearfott Division), Little Falls, NJ; and Bendix Corporation (Navigation and Control Division), Teterboro, NJ.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The PERSHING II program started in FY 1975. The primary effort during that year was directed toward design of the reentry vehicle (RV) for the missile flight program in FY 1978. The RV underwent design changes during FY 1975 as a result of the Radar Area Correlation fixed wing flight demonstration program. The US Army Armament Research and Development Command, Dover, NJ, was tasked with the responsibility for developing the adaption kit for the airburst/surface burst warhead section. The Department of Energy (DOE) was tasked with developing the earth penetrator. The earth penetrator integrated design was completed and successfully tested at higher velocities into Design of the RV was completed. The major prototype components were delivered and RV fabrication and testing neared completion for the advanced development (AD) missile flight hardware.

2. FY 1978 Program: The six missile flight demonstration program to demonstrate the capability of the Radar Area Correlation Guidance Systems to attain an accuracy of meters Circular Error Probable (CEP) is being conducted during the November 1977 to March 1978 time frame. The payload is an earth penetrator. The Defense Systems Acquisition Review Council (DSARC) II will convene after completion of the advanced development (AD) flight phase. The need for PERSHING II will be justified for the DSARC prior to receiving authority to enter Full Scale Development.

3. FY 1979 Planned Program: The engineering development (ED) phase will be initiated in preparation for Development Test (DT)/Operational Test (OT) II and subsequent production go-ahead. Reentry vehicle structure and ground support equipment production design; integrated guidance unit electronics prototype design; warhead adaption kit and guidance reference scene equipment prototype design; and initial subsystem component tests will be conducted. FY 1979 is the first year of the ED phase. Effort is primarily associated with system design and is not hardware intensive.

4. FY 1980 Planned Program: Procurement of DT/OT II flight hardware will be initiated and limited assembly begun. Testing of the prototype integrated guidance unit electronics will be conducted. Producibility Engineering Planning, and initial production tooling design/procurement and drawing release will occur. Software development will begin.

5. Program to Completion: Prototype hardware will be completed and intensive system tests conducted. DT/OT II will be conducted on production hardware in preparation for a production decision during The Initial Operational Capability should occur in late providing troop units in Europe and the Continental United States with a modernized system designed to meet the threat.

Program Element: #6.43.11.A
DoD Mission Area: #422 - Interdiction

Title: PERSHING II
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation: The PERSHING II development contractor is Martin Marietta Aerospace. During FY 1977 extensive component, subsystem, system and captive flight tests were performed and feasibility of the radar area correlation concept has been proven. These tests were performed in preparation for Development Test (DT) I which will be conducted in the November 1977 to March 1978 time frame. Elements of the PERSHING II DT I include assembly, subsystem, system, captive, warhead/adaption kit, flight, and reliability, availability and maintainability tests. The DT I flight test mission chart is provided as follows:

Flight Number	1	2	3	4	5	6
Range (NM)*						
Warhead Configuration	Telemetry with ballasted earth penetrator.					

* Since the inertial and radar correlation guidance techniques function the same regardless of range to the target area, all Advanced Development firings can be fired from a single launch site without loss of significant data. The missile time of flight is virtually range independent.

Specific Goals in Advanced Development:

	Objective	Demonstrated Performance 1/
Inertial Measuring Unit (IMU)	CEP without terminal guidance	
Sensor Correlator Subsystems (SCS)	CEP	
Reentry Vehicle (RV)	RV will withstand the flight environment (heat, shock and vibration)	

1/ To be demonstrated during Development Test I in FY 1978.

Full scale engineering development is scheduled to start in October 1978. During the first year of Engineering Development (ED) limited component and subsystem tests will be conducted. Detail planning will be performed for system tests. The ED flight program is scheduled to start in

Warhead Tests: Warhead testing, to include the adaption kit, will involve component qualification, laboratory preflight, environmental, electromagnetic radiation and fire vulnerability, and explosive ordnance render safe procedures. Systems compatibility will be verified during flight tests.

2. Operational Test and Evaluation:

a. Decisions regarding tests to be performed and schedules for Operational Test and Evaluation (OTE) have not been completed at this time. No operational testing was planned for the advanced development phase. During DT 1, the US Army Operational Test and Evaluation Agency (OTEA) participation will be to observe with a broad view toward refining operational issues.

b. No operational experience has been gained from PERSHING II.

c. The 56th Brigade in Europe conducted a successful large scale field test of PERSHING Ia during October 1977 that will provide input data for Army PERSHING II survivability studies for use in the Defense Systems Acquisition Review Council.

3. System Characteristics: There is no demonstrated PERSHING II flight test performance to date. Selected operational and technical characteristics are as follows:

Operational/Technical Characteristics	Objective	Demonstrated Performance
Maintainability (mean time to repair)		To be determined
Range Requirements		1/
Accuracy		
Horizontal CEP		2/
Height of Burst		To be determined

1/ PERSHING II uses the PERSHING Ia propulsion system, thus at least equal range performance can be expected.
2/ Demonstrated during tests using fixed-wing aircraft.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.01.A
DoD Mission Area: #412 - Close Combat

Title: Infantry Support Weapons
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1899	3629	7015	7085	Continuing	Not Applicable
	Quantities	0	0	18	0		18
D029	Lightweight Company Mortar Systems	1899	629	1220	987	Continuing	Not Applicable
D144	Smoke Mortar Rounds	0	0	2795	3098	Continuing	Not Applicable
D227	Battalion Mortar System	0	3000	3000	3000	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: In past years this program supported infantry related developments in flame weapons, Vehicle Rapid Fire Weapon Systems (BUSHMASTER), and pyrotechnics. The program now supports the development of companion rounds of 60mm mortar ammunition for the Lightweight Company Mortar System (LWCMS), the test and evaluation of the United Kingdom (UK) L16A2 81mm mortar, and related 81mm mortar ammunition. The 60mm ammunition program is in support of illumination and sub-caliber training rounds for the M224 60mm mortar, classified standard July 1977. There is a Draft Proposed Required Operational Capability (DPROC) for an Improved 81mm mortar. The test and evaluation of the UKL16A2 is in support of this requirement. Smoke development is in support of both mortar programs, 81mm and 60mm. Requirement is to produce long lasting screening smoke to give the US an improved *battlefield* obscuration capability.

C. BASIS FOR FY 1979 RDTE REQUEST: The request for $3 million for the Battalion Mortar System will permit the acquisition of 18 UKL16A2 mortars, 14 thousand rounds of UKL15A3 ammunition and two vehicle mounts. It will permit follow-on Developmental and Operational test of this weapon and ammunition. Current program calls for a Development Acceptance In-Process Review, DEVA IPR, 4th Quarter FY 1979 in support of follow-on procurement. Funds requested for Project D029 are in support of the 60mm Illumination round and the sub-caliber training round. The sub-caliber training round is scheduled for classification standard 4th Quarter FY 1979. Engineering development will continue on the 60mm Illumination round. Project D144 request will initiate engineering development on the 81mm screening smoke cartridge; manufacture submissiles and projectiles for conduct of engineering development (ED) test; establish firm design parameters and conduct studies to ensure end-item producibility.

	Major Milestones	Date
a. Project D029	Type Classification 60mm Training Round	4Q FY 1979
b. Project D144	Type Classification 81mm Smoke Round	4Q FY 1981

	Major Milestones (cont)	Date
c. Project D227	Acquire 18 Test Weapons	1Q FY 1979
	Begin DT/OT Test	1Q FY 1979
	Complete DT/OT Test	3Q FY 1979
	Development Acceptance IPR	3Q FY 1979
	Type Classification	4Q FY 1979
	Initial Operation Capability	1Q FY 1981

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The Lightweight Company Mortar System (LWCMS) consists of an improved 60mm mortar, conventional-style fire control and high explosive ammunition fuzed with a new multi-option electronic fuze. Illuminating and white phosphorus ammunition will also be developed. The Lightweight Company Mortar System will fulfill the requirement to provide a fire support system at the company level which is man-portable. The 47 lb mortar and 3.75 lb round of ammunition weigh less than half the present 96 pound, 81mm mortar and 9 pound round of ammunition. Nevertheless, lethality effectiveness of the LWCMS equals 70% that of the 81mm mortar per round of ammunition fired. The mortar can be fired out to 1000 meters using a small baseplate and no bipod, or out to 3500 meters using the standard baseplate and bipod. The LWCMS will replace the 81mm mortar at company level in all infantry organizations except mechanized infantry. The ammunition for the lightweight mortar includes the 60mm illuminating round and the smoke (white phosphorus) round. The illuminating round will fire to a range sufficient to illuminate targets being engaged with the high explosive (HE) cartridge at maximum range (3500 meters). The smoke round for the lightweight mortar will match ballistically the HE round to its maximum range. The new 81mm mortar will fire newly developed ammunition, employing the new multi-option fuze, to a range of 5500 meters. The United Kingdom (UK) L16A2, 81mm mortar, already developed and fielded for UK forces, is the weapon system which upon successful completion of a detailed evaluation against US Army requirements, will be produced for US use.

F. RELATED ACTIVITIES: This development will also satisfy the US Marine Corps' requirements for a mortar and ammunition. Full coordination of this development with the Marine Corps continues. Program Element (PE) 6.36.08.A, Weapons and Ammunition, LWCMS, supported advanced development of the LWCMS except for the multi-option fuze. PE 6.36.13.A, Advanced Fuze Design, supported the advanced development of the multi-option fuze, XM734. PE 6.46.02.A, Field Artillery Ammunition, supported engineering development of the fuze initially until it was transferred to this PE in FY 1974. PE 6.36.13.A, Advanced Fuze Design, supported the advanced development of a electronic time fuze for one year in FY 1978 in order to demonstrate that technology is in hand to provide an electronic time fuze for the LWCMS illuminating round. The UKL16A2 evaluation has undergone feasibility testing under PE 6.57.09.A, Evaluation of Foreign Components.

G. WORK PERFORMED BY: In-house efforts are accomplished by US Army Armaments Research and Development Command, Dover, NJ; and US Army Test and Evaluation Command, Aberdeen, MD. Major contractors are: Eastman Kodak, Rochester, NY; Bergman Manufacturing, Garland, TX; Ruoff, Inc., Runnemede, NJ; Norris Industries, Los Angeles, CA; IIT Research Institute, Chicago, IL; and the United Kingdom Royal Ordnance Factories.

Program Element: #6.46.01.A
DoD Mission Area: #412 - Close Combat

Title: Infantry Support Weapons
Budget Activity: #4 - Tactical Programs

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The basic lightweight company mortar system, high explosive round of ammunition and revolutionary new multi-option fuze were fully developed and type-classified standard. This system will first be procured in FY 1978. Advance development on the 81mm smoke round was accomplished in Combat Support Munitions, PE 6.36.27.A, Flame, Smoke & Incendiary Material, Project DE82.

2. FY 1978 Program: Minor engineering changes to correct shortcomings and deficiencies revealed by testing will be corrected. Engineering development work on the 60mm Illumination round and sub-caliber training round will continue. Additional Producibility Engineering and Planning (PEP) on the M734 multi-option fuze will be completed to lower procurement cost. The acquisition of two UKL16A2 mortars and 600 rounds of L15A3 ammunition will be incorporated into the M734 Multi-Option Fuze (MOF) compatibility test. This test will adapt the 60mm M734 MOF to the US and UK 81mm mortar rounds. Advanced development on the 81mm smoke round was accomplished under 6.36.27.A/DE82.

3. FY 1979 Planned Program: The program will support the acquisition and testing of 18 United Kingdom mortars and 14,000 rounds of L15A3 ammunition. The test is in support of a US requirement for an Improved 81mm mortar to be used at Battalion level. Development Test II and Operational Test II is scheduled to evaluate technical data and performance characteristics of the UK mortar system. An Improved 81mm mortar will provide a greater range and increased lethality. Current smoke cartridges, in use since the 1940's, are lacking in screening capability. To correct this deficiency and satisfy the Army requirement the 81mm smoke screening cartridge will begin engineering development (ED). Authorization of full scale development is essential even though all prescribed conditions have not been met. The cartridge is currently scheduled to complete advanced development in FY 1978. The 60mm illumination round will continue ED, with the sub-caliber training round scheduled for type classification in 4th Quarter FY 1979. Both 60mm rounds are considered essential to support the Light Weight Company Mortar System.

4. FY 1980 Planned Program: The 81mm mortar smoke screening round is scheduled to be classified standard at the completion of ED. The 60mm mortar smoke round will transition from advanced development into full scale engineering development (ED). Current program plans for all necessary experimental work to be performed and the system will be ready for full scale development in FY 1980. The 60mm illumination round will undergo DT/OT II for type classification. Additional ED for an improved 81mm mortar high explosive round will be required to support US production of an 81mm mortar round compatible with the planned procurement of the UKL16A2 81mm mortar. ED of companion rounds for illumination and training requirements are also forecast.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.02.A
DoD Mission Area: #413 - Fire Support

Title: Weapons and Ammunition
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3548 1/	2052	5552	6477	Continuing	Not Applicable
	Quantities						Not Applicable
DG21	Tank Ammunition	579	0	1902	511	0	2992
D169	Field Artillery Fuze Development	0	77	3300	5966	Continuing	Not Applicable
D454	Fuze XM587	2969	1975	350	0	0	5294

1/ Excludes Project D028 ($777K), Ammunition Cannon, 105MM, which is carried in Program Element 6.46.05.A, Field Artillery Weapons and Ammunition, 105MM; and Project D666 ($3876K), Ammunition Cannon, 8-inch, which is carried in Program Element 6.46.27.A, Field Artillery Weapons and Ammunition, 8-inch.

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of this program is to develop tank ammunition to include fuzes, for tank and artillery ammunition in consonance with fire control equipment enabling increased terminal effectiveness, accuracy, range, and reliability. This program consists of three active projects: the 105mm XM774 cartridge, and the XM797 companion target practice cartridge which is compatible with the XM774 cartridge; development of the XM742 fuze utilized with anti-personnel cartridge fired from the 105mm tank gun system; and the XM587E2/XM724/artillery electronic time fuzes and the XM36E1 fuze setter. This electronic time fuze system is used with artillery ammunition 105mm through 8-inch. This program provides for full scale development of ammunition for tanks configured with the 105mm M68 cannon (M48A5, M60 series and XM1) which yields significantly improved overall effectiveness against known and potential threats.

Program Element: #6.46.02.A
DoD Mission Area: #413 - Fire Support

Title: Weapons and Ammunition
Budget Activity: #4 - Tactical Programs

C. BASIS FOR FY 1979 RDTE REQUEST: RDTE efforts will be devoted to complete the Development Testing phase (DT II), conduct an In-Process Review (IPR III), and complete the Producibility Engineering Program (PEP) for the XM774 cartridge. Continuation of development for the XM797 target practice cartridge (task under project - DG21, Tank Ammunition), the companion cartridge for both the standard M735 and XM774 tank rounds. The XM774 cartridge contains a stabaloy (depleted uranium) penetrator which enables greater ranges and terminal effectiveness over the standard M735 containing a tungsten alloy penetrator. Department of the Army desires to minimize the stockpiling of the M735 due to the uniqueness of process involved in manufacture of the tungsten alloy penetrator. Continuation of development of the XM742 fuze used with anti-personnel ammunition fired from 105mm tank gun systems. Efforts will be directed toward procurement, fabrication, and testing of prototype quantities of XM742 fuzes. The significant increase in funding within the FY 1979 program for the XM742 fuze (Project D169, Field Artillery Fuze Development) is attributable to procurement, testing and evaluating of prototype components and fuzes. Conduct In-Process Review III for the XM587 fuze program with the objective of cross-the-board type classification standard, scheduled for 1st Quarter FY 1979. This fuze will engage the electronics industry as an alternate mobilization base for time fuzes historically dependent upon the Horological industry which is rapidly declining.

Major Milestones

Project	Item	Development Acceptance In-Process Review (DEVA-IPR)	First Production Award
DG21	Cartridge, 105mm, XM774	2nd Qtr, FY 1979	FY 1979
DG21	Cartridge, 105mm, XM797	3rd Qtr, FY 1981	FY 1982
D169	Fuze, XM742	1st Qtr, FY 1982	FY 1982
D454	Fuze, XM587	1st Qtr, FY 1979	FY 1979

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

Procurement of Ammunition, Army	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Funds (XM774 cartridge)	0	0	90000	58200	201800	350000
Quantity (000 cartridge)	0	0	154	96	309	0
Funds (XM742 Fuze)	0	0	0	0	0	0
Quantity (000 Fuzes)	0	0	0	0	0	0
Funds (XM587E2 Fuzes)	0	0	0	6100	27500	33600
Quantity (000 Fuzes)	0	0	0	50	307	0
Funds (XM724 Fuzes)	0	0	49500	6000	55800	111300
Quantity (000 Fuzes)	0	0	225	50	631	0

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Program Element: #6.46.02.A
DoD Mission Area: #413 - Fire Support

Title: Weapons and Ammunition
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: The development of improved fuzes is necessary to complement improvement in weapons and ammunition. The present program includes two active projects for improved fuzing. The objective of Project D454, Fuze, XM587/XM724, is to develop a pair of highly accurate and reliable electronic time fuzes for use on all high explosive and multiple warhead (bomblet) artillery rounds. An advanced electronic time fuze for beehive rounds, developed under Project D169, Field Artillery Fuze Development, will be more producible and cost approximately half as much as the mechanical fuze it replaces. In another project, DG21, Tank Ammunition, development will be conducted for 105mm cartridges XM774 and XM797. These cartridges will be fired from the M68 tank gun systems. The XM774 being a kinetic energy cartridge and the XM797 being a companion target practice cartridge for both cartridges XM774 and the standard M735.

F. RELATED ACTIVITIES: This program is the full-scale development follow-on to fuzing efforts supported under Program Element 6.36.13.A, Advanced Fuze Design, and is dependent on technology developed under the Fuze Technology Program, Program Element 6.26.03 Large Caliber and Nuclear Technology. There are no competing fuze programs within the tri-Services. The efforts being conducted for the tank ammunition are supplemental to the advanced development activities under Program Element 6.36.08.A, Weapons and Ammunition. Projects D028, Field Artillery Ammunition, and D666, 8 Inch High Explosive Rocket Assist Projectile XM650, were supported within this program element through FY 1977; however, the activities are now being supported under Program Element 6.46.05, Field Artillery Weapons and Ammunition 105mm, and 6.46.27, Field Artillery Weapons and Ammunition 8 Inch.

G. WORK PERFORMED BY: In-house agencies include Harry Diamond Laboratories, Adelphi, MD; US Army Armament Research and Development Command (ARRADCOM) Dover, NJ; US Army Test and Evaluation Command, Aberdeen, MD; Yuma Proving Ground, Yuma, AZ. Contractors include: Honeywell, Minneapolis, MN; Motorola, Incorporated, Scottsdale, AZ; Chamberlain MFG. Corp, Waterloo, IA; Flinchbauch Products Inc. Red Lion, PA; Keunametal Inc., Latrube, PA; and Teledyne Firth-Sterling, Pittsburgh, PA.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Program accomplishments include the development of artillery and tank weapons, projectiles, and fuzes. Developments successfully completed include a 155mm multiple warhead (bomblet) round , a rocket-assisted high explosive round, and a mechanical time artillery fuze. The developments of electronic time fuzes and a proximity fuze for artillery were initiated. Development of an improved artillery proximity fuze (for air bursts of high explosive rounds) was completed. This more reliable and less costly fuze will replace all artillery proximity fuzes in stockpile. The artillery electronic time fuzes achieved high reliability scores in field tests. Full-scale development of an electronic time fuze for beehive ammunition was initiated. Development Test II testing of the improved 105mm XM735 tank gun projectile was conducted with satisfactory results and the XM735 Cartridge was type classified as standard (STD). The XM774 is an outgrowth of an exploratory development program undertaken in 1974-1975 to provide a candidate to the growth potential phase of the Tripartite Tank Gun Evaluation in April 1975. It subsequently entered its conceptual and validation phases in October 1975 and October 1976, respectively, having demonstrated during each stage a capability to provide significantly

greater effectiveness than current M392/M728 Armor Piercing Discarding Sabot (APDS) and M735 Armor Piercing Fin Stabilized Discarding Sabot-Tracer (APFSDS-T) ammunition. Utilizing M735 sabot technology and newer penetrator technology, the XM774 demonstrated in the December 1976 Supplemental Trilateral Tank Main Armament Evaluation, that the 105mm M68 tank gun

There are significant cost advantages associated with its design. It successfully completed Development Test I (DT I) in September 1977 and was recommended to proceed into engineering development in October 1977 at In-Process Review II (IPR II). During 1977 the XM797 Target Practice Discarding Sabot-Tracer (TPDS-T) concept underwent a brief conceptual development to explore the concept that an ablative subprojectile launched with an M735-type sabot could meet ballistic match criteria of the M735/XM774 tank rounds at engagement ranges required during training for combat while not exceeding the safety range limitations of current training facilities in USA and Europe.

2. FY 1978 Program: Artillery electronic time fuzes will be fabricated for final development testing. Engineering and planning for production will be conducted. The development of electronic time fuzes for beehive ammunition will continue under Project D169, Field Artillery Fuze Development, with fabrication and testing of a prototype quantity of fuzes. The XM774 tank round will begin engineering design and producibility studies during FY 1978, completing and extending studies begun during FY 1977. All hardware for Development Test II (DT II) will be procured and fabricated and DT II testing will commence in 4th Quarter FY 1978. The XM797 cartridge will commence the validation phase of Advanced Development. Ballistic match, maximum range and safety criteria will be evaluated. Development Test I (DT I) hardware will be fabricated and the DT I test will commence in 4th Quarter FY 1978.

3. FY 1979 Planned Program: Development of artillery electronic time fuzes will be completed and type classified standard. Fabrication and testing of prototype beehive electronic time fuze will continue. DT II testing of the XM774 cartridge will be completed in 2Q FY 1979. Engineering design and producibility studies continued from FY 1978 will be completed and incorporated in the technical documentation to be reviewed at In-Process Review III (IPR III) in 2Q FY 1979. The XM774 cartridge will immediately be incorporated in the FY 1979 procurement of 105mm Armor Piercing Fin Stabilized Discarding Sabot-Tracer (APFSDS-T) cartridges. The XM797 will complete DT I in 1Q FY 1979 and undergo review at IPR II. The XM797 will begin Full Scale Engineering Development with emphasis on design refinement for low cost producibility. The engineering development effort pertinent to the XM797 cartridge is supplemental to the potential demonstrated as a result of efforts conducted under Program Elements 6.26.03, Large Caliber and Nuclear Technology and 6.36.08A, Weapons and Ammunition. Increase in FY 1979 funding over FY 1978 is largely attributable to procurement and testing of a significant quantity of XM742 fuzes.

4. FY 1980 Planned Program: XM797 cartridge DT II test hardware will be procured and testing started. Fabrication, evaluation, and testing of approximately 900 XM742 fuzes will be undertaken as part of the Development Test phase (DT II). Initiation of development for the remote set fuzes for both 2.75 inch and tank fired ammunition will be undertaken, as well as a 200-second battery-less electronic tank fuze for artillery ammunition.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.05.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Weapons and Ammunition, 105mm
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ - thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	6305 1/	1617	1111	4569	Continuing	Not Applicable
	Quantities						Not Applicable
D028	Ammunition, Cannon, 105mm	777	0	0	0	Continuing	Not Applicable
D369	Improved Conventional Ammunition	2773	934	1111	4569	Continuing	Not Applicable
D376	Howitzer, Light, 105mm XM204	2755	683	0	0	Continuing	Not Applicable

1/ Includes Project D028, Ammunition Cannon, 105MM ($777K) which was previously carried in Program Element 6.46.02.A, Weapons and Ammunition.

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the development of 105mm Field Artillery Weapons and Ammunition and improved conventional munition development for all calibers of artillery to provide increased lethality, accuracy, range, reliability and speed in delivering fires. These items will provide significant increased capability to the Army light divisions and those units equipped with 105mm Howitzers.

C. BASIS FOR FY 1979 RDTE REQUEST: Funds requested provide for fabrication of approximately 300 complete M509 8-inch ICM projectiles, and tests with the M577 fuze to establish design suitability, and amending the technical data package.

D. OTHER APPROPRIATION FUNDS:($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Ammunition, Procurement, Army						
Funds		2500				2500
Quantities (thousands)						
XM622E2	0	15	0	0	0	15
Weapons and Tracked Combat Vehicles						
Funds	0	0	(To be determined following Development Acceptance In-Process Review (DEVA IPR))			
Quantity (XM204 Howitzer)	0	0	(To be determined following DEVA IPR)			

Program Element: #6.46.05.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Weapons and Ammunition, 105mm
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: This program consists of one active FY 1979 project, D369, Improved Conventional Ammunition (ICM) which provides for engineering testing of the 8-inch ICM projectile, M509. This program supports the engineering development of the XM204 howitzer, a new soft recoil 105mm towed howitzer which has 360 degrees on carriage traverse, is helicopter transportable and provides extended range and increased capability to infantry, airmobile and airborne units. Items developed are the XM710 improved conventional munition (ICM) and the XM622, 105mm anti-tank projectile.

F. RELATED ACTIVITIES: These items were developed from exploratory development and advanced development research conducted under program elements 6.26.03.A, Large Caliber and Nuclear Technology and 6.36.28.A, Field Artillery Ammunition. The US Marine Corps has expressed an intent to procure the XM204 to replace their current 105mm howitzers.

G. WORK PERFORMED BY: US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; Watervliet, NY; and Rock Island, IL.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Fabricated and tested an XM204 howitzer prototype during FY 68 through FY 70. Full scale engineering development of the XM204 howitzer was approved in FY 73. A special In-Process Review (IPR) was held in June 1974 and provided for a decision to use the XM200 propelling charge for achieving extended range with the XM204. Initial Operational Test (OT) II began in May 1975, and due to problems (misfires, howitzers hop, latch failures and wheel actuater breakages), OT II was terminated in June 1975. Data was used from the initial OT II as guidance in redesigning and modifying the XM204 and prototype modifications were made in 1976. One unmodified weapon was shipped to Australia in Jan 76 to participate in an Australian Standardization Loan/Tropic Test/Tropic Trials. Development of the XM710 improved conventional ammunition projectile continued with design qualifications to meet the XM200 propelling charge environment, and underwent engineering design tests. XM710 projectiles were fabricated for development test II/operational test II (DT II/OT II). Work was conducted on a full frontal area impact switch (FFAIS) for the XM622 105mm High Explosive Anti-Tank (HEAT) cartridge. During FY 1977 development testing and operational testing (DT/OT II) of the XM622 (HEAT) cartridge was initiated. The XM710 projectile program eliminated problems associated with the low zone air detonations of the submunitions upon ejection from the carrier shell. Environmental and handling tests were conducted to ensure acceptance of all components. Producibility engineering planning (PEP) was conducted. OT II of the XM204 howitzer was completed, and preparations made for a development acceptance in-process review (DEVA-IPR). Canada tested one prototype during 1977.

2. FY 1978 Program: DT/OT II of the XM622 HEAT cartridge will be completed and the cartridge will be type classified during the 2d Quarter. The DEVA-IPR for the XM204 howitzer will be held in Feb 1978. The XM710, 105mm ICM projectile development program was terminated.

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3. FY 1979 Planned Program: The M509 8-inch ICM projectile tests with the M577 fuze will be conducted to establish design suitability, and the technical data package amended as required. Funding is reduced as several projects complete their development.

4. FY 1980 Planned Program: Initiate engineering development of the improved multipurpose submunition which was developed in program element 6.36.28.A, Field Artillery Ammunition.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.06.A
DoD Mission Area: #413 - Fire Support

Title: Explosive Demolitions
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	222	95	2063	2115	Continuing	Not Applicable
	Quantities						Not Applicable
D021	Explosive Demolitions	222	95	2063	2115	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides for the development of explosives and devices for general tactical demolitions missions, special purpose items for general Army and Special Forces use, equipment for US Army Technical Escort, and Army peculiar tools and kits for Explosive Ordnance Disposal (EOD) units. Demolitions are used to assist in the rapid creation of obstacles to enemy movement and to aid friendly mobility by clearing enemy obstacles and debris. Technical escort provides for the safe movement of potentially hazardous munitions. EOD units provide a capability to neutralize the hazards existing in explosive ordnance because of unusual circumstances which present a possible threat to operations, installations, personnel, or materiel.

C. BASIS FOR FY 1979 RDTE REQUEST: Initiate Developmental/Operational Testing II (DT II/OT II) on the hard overpack. Initiate efforts on the variable time firing device. Conduct DT III/OT III on the M180 cratering charge and field the system. Complete DT II/OT II on the bulk explosive system and initiate procurement. Type classify the vehicle mounted explosive container and the portable ordnance locator.

D. OTHER APPROPRIATION FUNDS:($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Ammunition Procurement, Army						
Funds (M180 Cratering Charge)	1600	2800	2900	3000	19200	29500
Quantities (ea)	1000	1000	1000	1000	6000	

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Program Element: #6.46.06.A
DoD Mission Area: #413 - Fire Support

Title: Explosive Demolitions
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: In recent years, this program has provided development support for three functions performed by the Army. In the area of tactical demolitions, simple firing devices for explosives have been developed with the goal of increased reliability and a reduction in size and weight. Items have been developed to assist Explosive Ordnance Disposal (EOD) personnel in the neutralization of hazardous munitions. This requirement is continuous because of the introduction of new items into the inventory and the acquisition of foreign items from both friendly and enemy sources. Since the development of joint--Service EOD items has been assumed by the Navy, this program supports Army peculiar developments and integration of Navy-developed items into the Army system. Special purpose items for US Army Technical Escort are developed as required to assist in the movement of hazardous munitions.

F. RELATED ACTIVITIES: Joint Service EOD items are funded and developed by the Navy as the single manager for EOD items in Program Elements 6.36.54.N and 6.46.54.N, EOD Equipment. Efforts on adaptation of commercial explosives (blasting agents) for military application proceeded from advanced development in Program Element 6.36.19.A, Countermine and Barriers and the Corps of Engineers Military Adaptation of Commercial Explosives (MEACE) program.

G. WORK PERFORMED BY: The principal Army agency responsible for this program is the US Army Armament Research and Development Command (ARRADCOM), Dover, NJ. EOD devices are developed by the Naval Explosive Ordnance Disposal Facility, Indian Head, MD. Principal contractor is IRECO Chemical Company, Salt Lake City, UT.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Standardized items developed in this program include an overhead foxhole cover, the M252 cutting and entry tool kit for access to munition fuzes, the general purpose barbed tape obstacle, and the M180 cratering charge for hasty road craters. In FY 1977, the M122 remote firing device was type classified and limited production initiated. Efforts continued on the bulk explosive (blasting agent) system to assist in the rapid creation of obstacles. The vehicle mounted explosive container for transport of hazardous explosive items to safer areas, and the hard overpack to contain leaking chemical munitions were initiated.

2. FY 1978 Program: Continue efforts on the hard overpack for leaking chemical munitions and the vehicle mounted explosive container. Initiated developmental and operational testing (DT II/OT II) on the bulk explosive (blasting agent) system. Finalize actions for the integration of the Navy developed Cryogenics System into Army EOD units.

3. FY 1979 Planned Program: Continue efforts in the hard overpack and initiate Developmental Testing/Operational Testing II (DT II/OT II). Initiate engineering development efforts on the variable time firing device in which all necessary experimental work will have been performed and the proposed system will be ready for full scale development. Conduct DT III/OT III on the M180 cratering charge and field the system. Complete DT II/OT II on the bulk explosives (blasting agent) system, type classify the system, and initiate procurement. Type classify the vehicle mounted explosive container. Integrate the Navy developed ordnance locator into the Army logistics system. Increased funding is required to support testing of the blasting agent and the M180 cratering charge.

4. FY 1980 Planned Program: Continue efforts on the variable time firing device and initiate DT II/OT II. Initiate procurement of the vehicle mounted explosive container. Continue monitorship of the Navy EOD program and integration of Navy developed items into the Army logistics system.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.08.A
Title: Army Small Arms Program
DoD Mission Area: #412 - Close Combat
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	832	1000	1575	1460	0	4867
	Quantities						Not Applicable
DF21	NATO Small Arms Evaluation	722	1000	1575	1460	0	4757
D566	Civilian Disturbance Control Weapon	110	0	0	0	0	110

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides US support (both financially and technically) for the NATO Small Arms Test/Evaluation which has been agreed to by eleven NATO countries in a Memorandum of Understanding (MOU). The purpose of this test is to select and recommend a second standard caliber of small arms ammunition (7.62mm is now standard) and possibly a weapons system.

C. BASIS FOR FY 1979 RDTE REQUEST: Funds US share (approximately 27%) of expense for the conduct of the NATO test for FY 1979. Provides technical support to the international NATO Test Control Commission (TCC), which has been established for the conduct of these tests, and two US permanent members to TCC. Provide support to US control and contender ammunition/weapon systems and conduct the initial planning for the Military Tests. Assist in preparation and assembly of combined test data upon which to base a recommendation. Allows monitoring of raw test data in US to assist US members of TCC in daily decisions and insure US Army has sufficient data to confirm NATO's selection of a new standard caliber of ammunition and recommended weapon.

Major Milestones	Place	Date Start	Date Complete
Ammunition Technical Testing	Cold Meece, United Kingdom	1 Apr 77	Sep 78
Weapon System Technical Test	Meppen, Federal Republic of Germany	1 Apr 77	Mar 79
Military Tests	Hammelburg, Federal Republic of Germany	Jun 78	Jun 79
Start Report Preparation		1 Jul 79	
Report Due to NATO Headquarters			15 Jan 80

D. OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #6.46.08.A
DoD Mission Area: #412 - Close Combat

Title: Army Small Arms Program
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: This program element (PE) supports a Memorandum of Understanding (MOU) signed by eleven NATO countries, including US, for testing, evaluation and selection of a second NATO standard caliber of small arms ammunition. Testing is directed by an international Test Control Commission (TCC) and designed to select a second NATO standard caliber of small arms ammunition and possibly a standard weapon system. Technical tests began on 1 April 1977 at Cold Meece, United Kingdom (UK), and Meppen, Federal Republic of Germany (FRG). Military tests will begin in June 1978 at Hammelburg, FRG. Final test reports are due in NATO headquarters 15 January 1980. The US is committed to adopt the new NATO standard cartridge.

F. RELATED ACTIVITIES: This project represents the primary source of military small arms engineering development for all Services. Other Service representatives attend ad hoc coordinating meetings. Activities in PE 6.36.07.A, Army Small Arms Program, have been coordinated with this PE to insure maximum NATO standardization; i.e., the Army squad automatic weapon will not enter production until the NATO decision on the second standard caliber of small arms ammunition.

G. WORK PERFORMED BY: NATO small arms test is being completed under the direction of an international staff. US in-house efforts are accomplished by the US Army Armaments Research and Development Command, Dover, NJ; US Army Operational Test and Evaluation Agency, Falls Church, VA; Lake City Arsenal, Independence, MO; Army Material Systems Analysis Activity, Human Engineering Laboratory, Chemical Systems Laboratory, Ballistic Research Laboratory, and US Army Test and Evaluation Command, Aberdeen Proving Ground, MD.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Coordination was conducted to draft an international Memorandum of Understanding (MOU) for the establishment of an organization to control the NATO small arms test and evaluation. Initial planning for the type of tests to be conducted at the various test sites was completed. Technical test on the candidate ammunition and weapon system at Cold Meece, United Kingdom (UK), and Meppen, Federal Republic of Germany (FRG), began on 1 April 1977. US nominated the M16A1 rifle and 5.56mm (XM777 and XM778) cartridges as standardization candidates. Provided support for US contender ammunition/weapon.

2. FY 1978 Program: Funds US share of the NATO Test Control Commission (TCC) expenses (approximately 27 percent of test cost for FY 1978) in support of ongoing technical tests at Cold Meece, UK, and Meppen, FRG, and for military tests at Hammelburg, FRG. Provide support to two permanent US members of the TCC, US control and contender weapon systems, expert assistance to TCC, and assist US members in initial planning and conducting military tests. Continue to monitor raw test data in US to assist US members of TCC and insure sufficient data to confirm NATO's selection.

3. FY 1979 Planned Program: DF21 funds US share of FY 1979 expense for TCC, ongoing military trials thru June 1979, and two US permanent members to TCC for FY 1979. Provides support to US Control and Contender Ammunition/Weapon Systems, expert assistance to TCC and US members of TCC. Assist in preparation and assembly of combined test data upon which to base a recommendation. Monitor raw test data in US to insure the US Army has sufficient data to confirm NATO's selection of a new standard caliber of ammunition and a possible weapon recommendation.

Program Element: #6.46.08.A
DoD Mission Area: #412 - Close Combat

Title: Army Small Arms Program
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: Pays US share of NATO Test Control Commission (TCC) expenses of two permanent members to TCC for FY 1980. Provide assistance to TCC and US members of TCC in final report preparation due to the NATO Army Armament Group not later than 15 January 1980. Conduct NATO report evaluation by US agencies to confirm the new recommended caliber of ammunition for NATO standardization.

5. Program to Completion: This program will be completed in FY 1980 with the selection of a second standard caliber of NATO Small Arms Ammunition.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.09.A
Title: Combat Support Systems
DoD Mission Area: #449 - Chemical and Biological Defense/ Chemical Warfare
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2348	2520	2248	3565	Continuing	Not Applicable
	Quantities						Not Applicable
DF96	Tactical CS Agent Munitions	469	0	500	2057	Continuing	Not Applicable
D191	Flame and Smoke Weapons and Equipment	1391	2131	1748	1508	Continuing	Not Applicable
D638	Civil Disturbance Control System	488	389	0	0	Not Applicable	1951

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides the engineering development (ED) support for developing new and improved smoke munitions and systems and more effective riot control agent munitions/devices for tactical and civil disturbance use. Adequate tactical protection of armored vehicles require that they possess the means to rapidly and effectively obscure the enemy's surveillance and thus interfere with his weapons aiming and guidance capabilities. Armored vehicle on-board smoke screening systems being developed will provide the only rapid response protection systems that meet this requirement. In the riot control munitions area it is necessary for tactical forces to have the capability of employing riot control agent (agent CS) under battlefield conditions for such purposes as separating hostile from friendly personnel. To fulfill this requirement ED in this program is necessary to develop munitions for use by tactical forces under battlefield conditions.

C. BASIS FOR FY 1979 RDTE REQUEST: Funds are required to complete development and provide the validation hardware for the smoke grenade launcher system on the M60A2 and XM1 tanks, the Combat Engineer Vehicle (CEV) and the Armored Vehicle Launched Bridge (AVLB). Funds are required to complete engineering development, Development Test II/Operational Test II (DT II/OT II), and to type classify the Armored Vehicle Engine Exhaust Smoke Generating system for the M60A1 tank, and to continue ED on this smoke system for the XM1 tank and other armored vehicles. This very simple system supplements the grenade launcher by providing additional screening while armored vehicles maneuver in a smoke cloud. Finally, funds are required to complete ED and type classify the 66mm Tactical CS Rocket, XM96, and to begin ED on tactical CS systems for isolated personnel rescue and convoy protection.

Program Element: #6.46.09.A Title: Combat Support Systems
DoD Mission Area: #449 - Chemical and Biological Defense/ Chemical Warfare Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: This program supports the development of rapid smoke protection for US armored vehicles to include the following: application of the M239 smoke grenade launcher to M60, M60A1/A3, M60A2, XM1 and M485A tanks, M728, M88, Combat Engineer Vehicle and Tracked Recovery Vehicle; development of a 4-tube discharger launcher system for application to the Mechanized Infantry Combat Vehicle, Improved TOW Vehicle, and other combat vehicles. Additionally, a vehicle exhaust smoke generating system for M60A1/A3 tanks and other US diesel-driven armored vehicles is being developed which will complement the grenade launcher smoke system. The other objective of this program is to develop new and more effective riot control agent munitions, devices and equipment for both tactical use and for controlling civil disturbances.

F. RELATED ACTIVITIES: The Army is the Department of Defense (DOD) executive agent for development of civil disturbance control systems. The other Services sponsor engineering development for materiel unique to each. Liaison personnel from each Service monitor the developing agencies programs and joint committees meet regularly to review Service needs and insure development programs are oriented to satisfy joint needs. This program is supported by Program Elements 6.26.22.A, Chemical Munitions and Chemical Combat Support; and 6.36.27.A, Combat Support Munition. Project D191, Flame and Smoke Weapons and Equipment, was originally part of Program Element 6.46.01.A, Infantry Support Weapons.

G. WORKED PERFORMED BY: The Smoke Systems program is managed by the Project Manager - Smoke/Obscurants. Approximately 80% of the armored vehicle protection systems effort will be in-house by US Army Chemical Systems Laboratory, Edgewood, Maryland; and 20% will be the test effort of the US Army Test and Evaluation Commands, Aberdeen Proving Ground, Maryland. Fifty percent of the vehicle exhaust smoke generating system will be in-house by the US Army Chemical Systems Laboratory, Edgewood, Maryland, and 50% will be contractual effort with Teledyne Continental Motors Corporation, Muskeegon, Michigan. Other efforts supporting this program will be conducted by US Army Test and Evaluation Command, Aberdeen, Maryland; Pine Bluff Arsenal, Arkansas; and US Army Large Caliber Weapons Systems Laboratory, Dover, New Jersey.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Numerous tactical CS munitions and civil disturbance control munitions and devices completed development and were type classified under this program element. Examples include: M629, 105mm Tactical CS projectile; M630, 4.2 inch Tactical CS projectile; M651, 40mm Tactical CS Cartridge; a 2.75 inch CS air-to-ground rocket; M165 Multipoint Source Cluster; and the M674 Riot Control Agent Cartridge. Engineering development was initiated on several other civil disturbance control devices: XM33 riot control agent disperser; XM47 CS filled grenade and XM32 hand held CS disperser for use by military police units. Engineering development continued on the XM96, 66mm Tactical CS rocket. Emphasis was on improving producibility of the warhead and increasing the agent payload. In FY 1974 the M47 CS grenade and M48 training grenade

completed development and were adopted as standard. The M47 grenade was a significant improvement because its spherical shape and skittering characteristics minimize the possibility that rioters can throw the grenade back at the crowd control unit. The M33 Portable, backpack dispenser was adopted for use with CS. Engineering development was initiated on the XM742 Projectile (SOFT RAG) in FY 1976. Concept feasibility testing, user testing and type classification of the M239 launcher (6-tube) and L8A1 Smoke Grenade for M60A1/A3 Tanks were completed in FY76 along with the initiation of design for a 4-tube launcher for other types of armored vehicles. During FY 1977, the US Tank Units in Europe received the initial deployment of the recently type classified M239/L8A1 Grenade Launcher System.

2. FY 1978 Program: Complete development and type classify a 4-tube launcher (XM243) for infantry vehicles; continue development of rapid smoke systems for M60A2 tank and Armored Vehicle Launched Bridge (AVLB); continue engineering development and complete Development Testing (DT) II and Operational Testing (OT) II on the XM742 SOFT RAG projectile; and complete "Mini-Engineering Design Test" on the XM96, 66mm Tactical CS Rocket. Also, complete installation of 1000 M239 Smoke Grenade Launcher System on M60A1 tanks in US Army, Europe and continue engineering development (ED) on a shaped charge incendiary follow-through projectile.

3. FY 1979 Planned Program: A Smoke Grenade Launcher System to provide a rapid smoke protective screen for the M60A2 tank, M728 Combat Engineer Vehicle (CEV) and the Armored Vehicle Launched Bridge (AVLB) will be completed. A Development Validation In-Process Review will be conducted, and type classification of the system will be completed. Development Test II/Operational Test II (DT II/OT II) on the Vehicle Smoke Exhaust System for the M60A1 tank will be conducted and development effort on the smoke system for the XM-1 tank will continue. Engineering development (ED) will begin on convoy protection and isolated personnel rescue systems using riot control agents. FY 1979 effort also includes corrections of shortcomings/deficiencies resulting from the DT II/OT II tests on the 66mm Tactical CS Rocket, XM96, conduct of the Development Acceptance In-Process Review (DEVA-IPR) and type classification of the XM96. The XM742 SOFT RAG projectile will be type classified during 1QFY79.

4. FY 1980 Planned Program: Continue development of a system for rescue missions, a system for convoy protection, and a protective system for internal security. Continue development of smoke grenade launcher systems for all armored and mechanized vehicles for which the requirements have been identified. Also continue vehicle smoke exhaust system development.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.10.A
Title: Lethal Chemical Munitions
DoD Mission Area: #449 - Chemical-Biological Defense/ Chemical Warfare
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2856	2734	213	1887	Continuing	Not Applicable
	Quantities						Not Applicable
DF93	Lethal Chemical Aerial Weapons	0	0	0	54	Continuing	Not Applicable
DF94	Lethal Chemical Ground Munitions	2856	2734	213	1833	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: US chemical warfare policy requires maintaining a credible deterrent/ retaliatory capability. Current US chemical munitions stockpile, however, is aging, deteriorating, and composed of many obsolescent munitions/weapons systems which are costly to maintain. In order to provide more responsive support of the US policy, these dated munitions must be replaced with newer munitions which are reliable and suitable for use with modern weapon systems. The US Army has stated this need through requirements for safer (transit, storage, handling), more reliable binary lethal chemical munitions. This program supports the engineering development (ED) of binary lethal chemical weapons and equipment to support US chemical warfare policy and US Army requirements.

C. BASIS FOR FY 1979 RDTE REQUEST: Funds the continuation of ED efforts on the 8-inch Binary VX Projectile, XM736, to support the national policy of maintaining a deterrent/retaliatory chemical warfare (CW) capability.

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop new binary lethal chemical weapons and equipment for the Army and for other Services when use is also common to the Army. The objectives of this program were changed in 1970 and currently support only the development of chemical munitions which produce the toxic agent via the binary mode. A binary weapon is one in which the agent is produced from its components by means of a chemical reaction occurring during the time of flight of the munition to the target. This system will provide for maximum safety in handling, storage, transportation and demilitarization and at the same time optimize state-of-the-art advances to insure maximum target effectiveness.

F. RELATED ACTIVITIES: The Navy, Air Force, and Marine Corps conduct engineering development (ED) for weapons unique to each. Information is exchanged and efforts are coordinated through exchange of Research, Development, Test and Evaluation (RDTE) documents and liaison visits. Also, formal joint committees meet regularly to avoid duplication of effort in the solution of related problems. Advanced development efforts are supported by Program Element 6.36.15.A, Lethal Chemical Munitions Concepts.

G. WORK PERFORMED BY: US Army Chemical Systems Laboratory, Edgewood, MD, is the primary Army development laboratory with participation by US Army Large Caliber Weapons Systems Laboratory, Dover, NJ; US Army Test and Evaluation Command (TECOM), Aberdeen, MD; and Dugway Proving Ground, Dugway, UT.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The following conventional filled weapons were developed in previous years to provide an offensive lethal chemical warfare capability for the Army: Honest John, Little John and Sergeant missile chemical warheads; chemical rounds for the 155mm and 8-inch howitzers; 155mm lethal chemical multiple rocket system; lethal chemical warhead for the LANCE missile. However, in FY 1971, the conventional filled program was terminated pending the development of a suitable binary submunition. Development of the 155mm Binary GB Projectile (XM687): During FY 1973 engineering development was initiated on the XM687, binary GB, 155mm projectile. In FY 1974 the Development Test (DT) II for the 155mm binary GB projectile, XM687, continued. Problems in achieving ballistic similitude with the M483 projectile (base round for the XM687) caused some delay in the program. However, the program was expanded to include the M483 projectile investigative-corrective efforts which resulted in resolution of the problem. The 2-year DT II effort was completed in 3QFY76 and the results were evaluated satisfactorily against the Materiel Need requirements. Operational Test (OT) II of the 155mm GB2 projectile was conducted in 4QFY76 and FY 7T. During 1QFY77, after the Development Acceptance In-Process Review (DEVA-IPR) was held, the XM687 was type classified standard. Concurrent with the DT II and OT II actions, engineering support efforts were directed toward providing the required production data base. After a successful Validation Phase, engineering development on the 8-inch Binary VX Projectile (XM736) was initiated in 3QFY74. Also, acquisition of the engineering design test hardware was initiated and a draft Coordinated Test Plan (CTP) for the 8-inch projectile was prepared and circulated for coordination. In FY 75 engineering development efforts continued on the 8-inch projectile with completion of projectile metal parts, continuation of internal hardware fabrication and initiation of fill, close, and Load, Assemble and Pack (LAP) operations. The engineering design testing (EDT) of the 8-inch VX projectile was completed and a Prototype System Characteristics Technical Review (PSTR) was conducted in FY 7T. A preliminary technical data package (TDP) was prepared and the operator's manual was updated for the 8-inch binary VX round. Procurement of hardware for Research and Development Acceptance Test (RDAT) and for Development Test II/Operational Test II (DT II/OT II) was initiated. During FY 1977, DT II/OT II continued and two of 34 dissemination tests were conducted. 120 projectiles were fired to support production of firing tables. Testing in the area of safety, storage and transportation, reliability evaluation, adverse environments, chemical simulant dissemination, soldier hazards evaluation and maintenance evaluation continued.

Program Element: #6.46.10.A
DoD Mission Area: #449 - Chemical-Biological Defense/ Chemical Warfare

Title: Lethal Chemical Munitions
Budget Activity: #4 - Tactical Programs

2. FY 1978 Program: Hardware preparation for development test II/operational test II (DT II/OT II) of the 8-inch Binary VX Projectile will be completed. The test results will be independently evaluated by US Army Test and Evaluation Command and US Army Training and Doctrine Command. The Development Acceptance In-Process Review will be held as the prelude to type classification.

3. FY 1979 Planned Program: Engineering development of the 8-inch Binary VX Projectile will be completed followed by type classification. Engineering development efforts on the 155mm intermediate volatility agent (IVA) projectile utilizing the binary principal will commence. Design concepts from advanced development will be engineered and test hardware fabrication will begin. Testing to support the engineering effort and to validate novel design concepts will be performed. An engineering design test (EDT) program will be developed. This will provide the US Army with a more flexible chemical retaliatory capability. Change in funding is due to completion of development of the 8-inch Binary VX Projectile in 1QFY79.

4. FY 1980 Planned Program: Continue development of the 155mm Binary Intermediate Volatility Agent (IVA) projectile.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.12.A
DoD Mission Area: #416 - Land Mine Warfare

Title: Countermine and Barriers
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4921	4756	9738	15586	Continuing	Not Applicable
	Quantity						Not Applicable
D145	Surface Launched Unit, Fuel Air Explosive (SLUFAE)	0	3594	5067	3500	1000	18137
D415	Mine Neutralization/ Detection	4921	1162	4671	7209	Continuing	Not Applicable
D556	Surface Launched Unit, Mine Rocket (SLUMINE)	0	0	0	4877	11077	15954

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Program provides for the engineering development (ED) of a group of mutually supporting mine detection and neutralization devices capable of defeating mines and booby traps which support enemy positions, on lines of communication, and off-route environments. Warsaw Pact doctrine specifies the use of minefields in both the offense and defense. Mines are used offensively for flank protection of advancing formations to deny access to vital terrain and routes of communications. Defensive minefields are selected to take advantage of natural obstacles and to stop or canalize attacking forces. Warsaw Pact Nations can emplace minefields rapidly by mechanical means. Priority is placed on development of detection/neutralization systems and devices which allow friendly forces to maintain the momentum of an attack by rapidly breaching enemy minefields and negating their barrier potential. SLUMINE is included in this program element (PE) because it is fired from the SLUFAE launcher. SLUMINE will provide the capability to deliver a high volume of scatterable antitank mines by rocket from a remote location. Program also supports the development of field fortification techniques and equipment. Field fortifications are employed for the purpose of increasing battlefield survivability of friendly forces.

C. BASIS FOR FY 1979 RDTE REQUEST: Funds will support completion of Developmental Testing II/Operational Testing II (DT II/OT II)

on SLUFAE, compilation and analysis of test data, and type classification standard for Army use. SLUFAE technical data package will be assembled, new equipment training team will be fielded, integrated technical documentation and training package will be completed, and production initiated. ED on the vehicle mounted road mine detector, projected high explosives and dust explosives for minefield neutralization will be initiated. Initiate ED of an overhead cover for the TOW (tube-launched, optically tracked, wire guided antitank missile system). Test the British GIANT VIPER Mine Neutralization System.

D. OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Ammunition Procurement, Army (SLUFAE)						
Funds			6000	41500	70800	118300
Quantities (rounds)			1400	18000	35596	54996
Other Procurement, Army (SLUFAE)						
Funds			440	9200	15300	28900
Quantities (launchers ea)			60	120	190	370

E. DETAILED BACKGROUND AND DESCRIPTION: Providing effective countermeasures to landmines continues to present a significant challenge to the Army developer. In recent years, efforts have been directed towards devices to perform both hasty and deliberate breaches. Breaching must take place while under fire as well as more benign environments. Two distinct activities must be addressed in this program, mine detection and neutralization. The preponderance of developmental effort has been directed towards hasty minefield neutralization and breach with minimum impact on the momentum of the attack. The Surface Launched Unit, Fuel-Air Explosive (SLUFAE) mine neutrallization system has been designed to provide a rapid standoff breach of a minefield up to 300 meters in depth. SLUFAE is simple to employ and intended for use by combat engineers as part of the combined armor-infantry team. SLUFAE is scheduled for type classification standard and initial production during FY 1979. The second major effort in this area, the mineclearing roller, will provide tank units with an integral capability to negate minefield effectiveness. The roller can withstand 2 to 3 direct blasts from threat mines, maintain its integrity, and protect the tank from damage. The mine roller will be type classified standard and initially procured in FY 1979. Follow-on systems in this program will include: evaluation of British GIANT VIPER projected line charge to accomplish both explosive neutralization of mines and NATO standardization; a vehicle mounted road mine detector to rapidly sweep lines of communications; and manportable devices for neutralization of antipersonnel mines and tactical barbed wire. The Surface Launched Unit, Mine Rocket (SLUMINE) is a requirement which evolved from observing the capability of the SLUFAE to deliver a large warhead by rocket to a limited range. SLUMINE will provide the tactical commander with a responsive, dedicated, high density scatterable mine capability to counter a

massive armor attack. In the area of field fortifications, the Army has increased emphasis on battlefield survivability as a result of various analyses on the effects of modern weapons. Fortification measures include clearing fields of fire, digging weapon emplacements and positions for personnel, strengthening natural obstacles, installing artificial obstacles, and providing camouflage.

F. RELATED ACTIVITIES: Developments in this program element (PE) follow from advanced development (AD) efforts in PE 6.36.19.A, Countermine and Barriers. Army countermine efforts are closely coordinated with the Project Manager (PM) for Selected Ammunition, Dover, New Jersey, who is responsible for the development of mine fuzes, sensors, kill mechanisms, and logic in PE 6.36.06.A and 6.46.19.A, Landmine Warfare. The Army has significantly reduced the cost and developmental effort on Surface Launched Unit, Fuel-Air Explosive (SLUFAE) by utilization of Navy-developed fuel-air explosives and rocket technology. The Army continues to monitor the joint Fuel-Air Explosive (FAE) II program. Available Navy in-house capability has been used to produce developmental hardware. During the mine roller development, significant time reduction was realized through use of data acquired during an earlier program to reverse-engineer the Soviet mine clearing roller under the auspices of The Foreign Science and Technology Center. US continues to monitor RDTE efforts of foreign nations particularly NATO for technological breakthroughs in the detection and neutralization of landmines.

G. WORK PERFORMED BY: The US Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, Virginia, is assigned responsibility for the Army Countermine and Barriers program. In-house support is provided by: Naval Weapons Center, China Lake, CA; Naval Surface Weapons Center, White Oak, MD; US Army Test and Evaluation Command, Aberdeen, MD; Yuma Proving Ground, Yuma, Arizona; and the US Army Missile Research and Development Command (MIRADCOM), Huntsville, Alabama. Contractors include: Honeywell Corporation, Hopkins, MN; Lanson Industries, Cullman, AL; Chrysler Corporation, Detroit, MI; Cubic Corporation, La Jolla, CA; and Martin-Marietta, Orlando, FL.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: In FY 1975 a track-width mine plow was developed from a Soviet design but was terminated because of blast vulnerability. The Fuel-Air Explosive, Helicopter Delivered (FAESHED) was terminated and not procured due to helicopter vulnerability. During FY 1976, initial SLUFAE prototype items were fabricated and engineering design tests were conducted against a live minefield. In FY 1977, SLUFAE Development Test (DT) II/Operational Test (OT) II launcher hardware and initial prototype rounds with electronic fuzes were procured. SLUFAE reliability, availability, and maintainability (RAM) tests and logistic support concept tests were conducted. Expedited development of a mine clearing roller was initiated.

2. FY 1978 Program: Complete mine clearing roller technical data package, type classify standard for Army use, and initiate production. Continue DT II/OT II on SLUFAE to include Artic and Tropic testing, and initiate compilation of the technical data package.

3. FY 1979 Planned Program: Complete DT II/OT II on SLUFAE, type classify standard for Army use, complete the technical data package, and initiate production. Complete the SLUFAE integrated technical documentation and training and prepare materials for the new equipment training team. Initiate engineering development of the vehicle mounted road mine detector, a dragmat for tank belly protection against mines, and a lane proofing trailer to be used in conjunction with the mine clearing roller. All necessary experimental work on the detector, dragmat, and proofing trailer will have been performed and the proposed systems will be ready for full scale development. Initiate ED on an overhead cover for the TOW. Conduct performance tests on the British GIANT VIPER to determine acceptability for integration into US units and NATO standardization. Increased funding requirement reflects fielding of the SLUFAE and procurement of ED hardware for the vehicle mounted road mine detector.

4. FY 1980 Planned Program: Conduct Surface Launched Unit, Fuel-Air Explosive (SLUFAE) production acceptance tests and field the new equipment training team. Initiate fielding of the SLUFAE system. Continue engineer design tests on the vehicle mounted road mine detector, dragmat, and the lane proofing trailer. Test the British GIANT VIPER mine neutralization system. Initiate engineering development (ED) of the SLUMINE which will have completed all necessary experimental work and will be ready for full scale development. Type classify the TOW overhead cover. Initiate ED on an overhead cover for crew-served firing positions, protective emplacements for command and control facilities, and hardening for field artillery and aviation units.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D145
Title: Surface Launched Unit, Fuel-Air Explosive (SLUFAE)
Program Element: #6.46.12.A
Title: Countermine and Barriers
DoD Mission Area: #416 - Land Mine Warfare
Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: Providing effective countermeasures to landmines continues to present a significant challenge to the Army developer. Warsaw Pact doctrine specifies the use of minefields in both the offense and defense. Mines are used offensively for flank protection of advancing formations, to deny access to vital terrain and routes of communication. Defensive minefields are carefully selected to take advantage of natural obstacles and are designed to stop or canalize an attacking force. Enemy minefields can be mechanically emplaced rapidly. In recent years, efforts have been directed towards devices to perform both hasty and deliberate breaches. The Army currently has no standoff or long range minefield breaching capability. Standoff capability is particularly important since enemy minefields are habitually covered by protective fire. The Surface Launched Unit, Fuel-Air Explosive (SLUFAE) mine neutralization system will provide a capability to breach minefields and neutralize explosive booby traps from distances up to 1000 meters and can be employed rapidly during daylight or darkness. The SLUFAE system consists of a 30 tube launcher mounted on the M548 fulltracked cargo carrier, a rocket propelled FAE round, a firing control intervalometer, and launcher operating control. The SLUFAE will be the Army's primary means of breaching enemy minefields in the 1980's.

B. RELATED ACTIVITIES: This project follows from advanced development (AD) in Program Element (PE) 6.36.19.A, Countermine and Barriers. The Army has significantly reduced the cost and developmental effort on SLUFAE by utilization of Navy-developed fuel-air explosives and rocket technology.

C. WORK PERFORMED BY: The US Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA, is assigned responsibility for the SLUFAE project through an assigned project officer. In-house support is provided by: Naval Weapons Center, China Lake, CA; Naval Surface Weapons Center, White Oak, MD; US Army Test and Evaluation Command, Aberdeen, MD; Yuma Proving Ground, Yuma, AZ; and the US Army Missile Research and Development Command (MIRADCOM), Huntsville, AL. Contractors include: Honeywell Corporation, Hopkins, MN, and Lanson Industries, Cullman, AL.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: During FY 1976, the SLUFAE entered full scale development and initial engineering design tests were conducted. A new field resettable electronic time fuze was designed and test quantities procured. During FY 1977, test hardware was procured, engineering design tests were concluded, and Developmental/Operational Testing (DT II/OT II) commenced. Maintenance teardown tests were completed.

2. FY 1978 Program: Complete procurement of DT II/OT II test hardware. Continue DT II/OT II to include arctic and tropic testing. Initiate compilation of the technical data package.

Project: #D145 Title: Surface Launched Unit, Fuel-Air Explosive (SLUFAE)
Program Element: #6.46.12.A Title: Countermine and Barriers
DoD Mission Area: #416 - Land Mine Warfare Budget Activity: #4 - Tactical Programs

3. FY 1979 Planned Program: Complete Developmental/Operational Testing (DT II/OT II), type classify standard for Army use, complete the technical data package, and initiate production. Complete integrated technical documentation and training and prepare materials for the new equipment training team. Adapt a smoke grenade launcher to the system. Increased funding reflects completion of technical data package, training and development, and smoke grenade launcher adaptation.

4. FY 1980 Planned Program: Field the new equipment training team. Conduct production acceptance tests and field the system.

5. Program to Completion: Complete fielding of the system and new equipment training. Transition hardware to appropriate readiness commands.

6. Major Milestones:

Development Testing II	1QFY78 - 4QFY78
Operational Testing II	2QFY78 - 4QFY78
Developmental Acceptance In-process Review and Type Classify Standard	2QFY79

7. Resources ($ in thousands):

	FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Cost
RDTE,A Funds	4921*	3594	5067	3500	1000	18082
*Funded in Project D415 in FY 1977 only						
Quantities						Not Applicable
Ammunition Procurement, Army						
Funds			6000	41500	70800	118300
Quantities (rounds)			1400	18000	35596	54996
Other Procurement, Army						
Funds			4400	9200	15300	28900
Quantities (launchers ea)			60	120	190	370

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.14.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Weapons and Ammunition, 155mm
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3432	3495	10535	10468	Continuing	Not Applicable
	Quantities (Not feasible to list due to number of diverse items)						
D373	Ammunition Cannon, 155mm	2291	1996	8170	8412	Continuing	Not Applicable
D379	Howitzer, Medium, 155mm XM198	1141	1499	1965	2056	0	50100
D286	Field Artillery Ammunition (NATO)	0	0	400	0	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports development of 155mm Field Artillery weapons and ammunition to provide increased lethality, range, accuracy, reliability and speed in delivering fires. These items will provide increased fire power to the Army mechanized and armored divisions, Corps artillery units and will be compatible with the highest density artillery weapon system in NATO.

C. BASIS FOR FY 1979 RDTE REQUEST: Funds requested provide for: development of two new propelling charges XM211 and XM201; a new high explosive projectile, XM795; a new smoke projectile; completion of Development Test III on production models of the M198 medium, towed, howitzer; continuation of ammunition compatibility testing with the M198 howitzer; and evaluation of the United Kingdom's stick propelling charge with US projectiles and howitzers.

Program Element: #6.46.14.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Weapons and Ammunition, 155mm
Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS:($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Ammunition Procurement, Army						
Funds	6100	0	20300	73200	488900	588500
Quantities (thousands)						
XM201 Charge	0	0	0	360	2100	2460
XM211 Charge	0	0	0	85	1951	2036
M203 Charge	46	0	117	117	348	628
Weapons & Track Combat Vehicles						
Funds	20100	100	32100	61300	25900	152900
Quantity (M198 Howitzer)	51	0	107	208	83	468

E. DETAILED BACKGROUND AND DESCRIPTION: The program element consists of two active projects covering development of 155mm weapons and ammunition. This provides for the development of the XM211 low zone propelling charge, the XM201 intermediate zone propelling charge, the XM795 high explosive projectile and a new smoke projectile. These items will provide significantly increased firepower to the US Army. The objective of the M198 howitzer program is to develop a 155mm towed howitzer that will meet the requirement for towed, medium artillery with a range of 30 thousand meters. This increased range will enable our medium artillery to be competitive with and survivable against the present Soviet 130mm field gun M46 (25 thousand) meters and will enhance the capability to mass fires. The present 155mm towed howitzer, M114A1, being replaced by the M198, has a range of only 14.6 thousand meters. It was initially fielded in 1942 and is nearing the end of its useful life. The M198 is transportable by the CH-47C helicopter.

F. RELATED ACTIVITIES: This program is the normal engineering development program for advanced development that has been in Program Element 6.36.28.A, Field Artillery Weapon and Ammunition, and is dependent upon technology developed under Program Element 6.26.03, Large Caliber and Nuclear Technology. The US Marine Corps has stated an interest in the M198 and plans an FY 1979 procurement program. Cooperative agreements exist with NATO nations on the characteristics of 155mm howitzers to include the requirement for ammunition interchangeability. The loan of an M198 Development Prototype howitzer was made to the Government of Australia under a Memorandum of Understanding submitted to the Government of Australia in early 1975. Other countries are expressing interest in the M198.

G. WORK PERFORMED BY: US Army Armament Research and Development Command at Rock Island, Illinois; Dover, New Jersey; Aberdeen, MD; and Yuma Proving Ground, Yuma, AZ.

Program Element: #6.46.14.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Weapons and Ammunition, 155mm
Budget Activity: #4 - Tactical Programs

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The M203 high zone propelling charge completed engineering development and was approved for type classification standard. The shape of the XM795 projectile was changed to be ballistically similar to the cargo optimized family of projectiles. The XM164 low zone propelling charge was redesigned to eliminate stickers at low zones and was redesignated as the XM211 charge. The XM201 charge was redesigned to improve precision and reduce tube wear. The XM761 improved smoke projectile development was terminated when instabilities in flight arose at high temperatures. A new advanced development effort was initiated in Program Element 6.36.08.A, Field Artillery Ammunition Development. Concept formulation for the M198 was completed in FY 1973. The first phase durability test was completed 31 October 1973. During the first phase, the M198 was towed 1000 miles. The second phase of the durability test began at Jefferson Proving Ground, Madison, Indiana, in December 1973 and the total durability testing was completed in August 1974. As of 12 August 1974, a total of 15 thousand rounds had been fired on prototype three and the system had been towed 5000 miles. Demonstrated Mean Round Between Failure was 612 rounds which exceeded the prediction at the completion of Development Test (DT)/Operational Test (OT) II. The design of the DT/OT II Prototype weapons was frozen 30 June 1974. Design changes were limited to those necessary to correct deficiencies. The six additional prototypes required for DT/OT II testing were completed and delivered to their respective test sites during the third quarter FY 1975. The cannon fatigue test was completed in February 1975 and the ammunition safety test was completed in July 1975. All phases of DT/OT II testing of the M198 were initiated in FY 1975. An Army systems Acquisition Review Council III (ASARC III) convened on 14 October 1976 and approved the XM198 for type classification standard and to enter production. Environmental testing was initiated in fourth quarter FY 1976 with one prototype shipped to Australia for tropic testing. Ammunition compatibility testing with the M198 howitzer was initiated on the M692 anti-personnel mine projectile and the M483A1 improved conventional munition projectile.

2. FY 1978 Program: Ammunition compatibility testing will be continued and DT III testing of production M198 howitzers will be initiated. Development of the high explosive (HE) XM795 Projectile will be continued. Funds originally programed for the XM761 improved smoke projectile effort will be reprogramed to support advanced development of a redesigned smoke projectile. Compatibility testing of the M454 nuclear projectile in the M198 howitzer will be initiated.

3. FY 1979 Planned Program: Development of the XM211 Propelling Charge will be restarted and the charge configuration will be finalized. XM201 Charge development will be resumed to incorporate a cool burning single base propellant which should provide improved tube wear. Development of the XM795 HE Projectile will continue and developer/operational test II will begin. The redesigned smoke projectile will enter ED (Engineering Development) with manufacture of components and initiation of testing. Compatibility testing of M692 (ADAM) Projectile and the M454 projectile will be completed as will DT III testing of production M198 howitzers. United Kingdom stick propelling charges will be procured and tested against performance and safety requirements in the M198 howitzer with the M549 high explosive rocket assisted projectile and the M483A1 improved conventional munition (ICM) projectile. Funds are increased over FY 1978 to provide for ammunition development and initiation of ED smoke projectile.

Program Element: #6.46.14.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Weapons and Ammunition, 155mm
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: The XM201 and XM211 Propelling Charge programs will be completed and the XM795 HE Projectile development will complete final development testing. Development efforts on the smoke projectile will continue and final development testing will be initiated. The M198 howitzer will complete ammunition compatibility testings.

5. Program to Completion: This is a continuing program.

Program Element: #6.46.14.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Weapons and Ammunition, 155mm
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation: The M198 155mm Howitzer has completed in-house development and is in limited production at Rock Island Arsenal, Illinois. It is managed by the Project Manager, Cannon Artillery Weapons Systems, Dover, New Jersey. The M198 is a towed field artillery howitzer and is air transportable by the CH-47 helicopter. This weapon was developed to provide an increase in range and improved reliability and maintainability over the standard towed M114 and M114A1 towed 155mm Howitzer now in use in the US Army. The M198 will be employed in the general support field artillery battalions of the infantry and air assault divisions and in corps level artillery battalions. Development test and evaluation began in December 1968 with Advanced Development (AD) and Initial Engineering Development (ED) test. These tests essentially equate to the current Development Test (DT) I. AD testing provided a basis for the design and fabrication of three ED prototypes delivered for testing in 1970. Two of these weapons were subjected to firing tests at Aberdeen Proving Ground (APG), Maryland and Yuma Proving Ground (YPG), Arizona. After firing over 10,000 rounds, durability problems were identified. The breech design was changed from a sliding block to an interrupted screw block to improve durability. A third prototype was subjected to a 15,000 round durability firing test at Camp McCoy, Wisconsin in March 1973. The 44th round produced a propelling charge malfunction which damaged the weapon. As a result of this incident, the XM123 Propelling Charge was redesigned. During ammunition safety tests in December 1975, a breech was blown from the XM199 Cannon (barrel and breech assemblies) installed in a facility mount while firing the XM203 Propelling Charge. The charge igniter pad was redesigned resulting in the current M203 designation. DT II was extended through September 1977. These subtests, in final stages, include the Arctic and Tropic Climatic Tests, ammunition safety and verification of firing tables tests. Except for design changes noted ED prototypes are similar to the item to be procured. Several deficiencies were identified during DT II:

a. Tube wear when firing maximum charge has prevented the attainment of the 2500 effective full charge (EFC) round tube life. The user has accepted the attained 1750 EFC round tube life. Investigations to increase the tube life continue. Currently bore plating and propellant additives are being investigated.

b. Because of the increased target size compared to the M114A1 Howitzer, vulnerability to counter fire of the M198 was considered a problem during DT II analysis. A vulnerability shield has been added, which with modifications to the equilibrator have reduced the vulnerability of the weapon to a level lower than the crew in foxholes.

c. Ammunition performance and compatibility problems were also identified in several areas.

(1) The M203 Charge was redesigned to prevent excessive pressures and for compatibility with the M549 Rocket Assisted Projectile. This redesign was a success and the item was Type Classified in December 1976 concurrently with the Howitzer.

(2) Sticking (projectiles remaining in the bore) has been experienced when firing current standard low zone propelling charges and the developmental XM164 low zone propelling charge. The XM164 was designed as a replacement for the current low zone charges. The XM164 is being redesigned as the XM211. Preliminary test results of this program are encouraging and indicate sticking has been eliminated.

(3) The intermediate propelling charge XM201 has produced excessive tube wear. Development efforts have been suspended and various alternatives are now being studied. Existing M4A2 and M119 charges are adequate and have been accepted for the intermediate time period.

(4) The current 155mm nuclear projectile, M454, has not been certified in the M198 Howitzer. Interior dimensions of the M199 Cannon are similar to the M185 Cannon of the M109A1 Howitzer. The M454 is compatible with the M109A1, therefore it is technically compatible in the M198. In view of the impending development of the XM785, the 155mm nuclear projectile, the Army is investigating means to demonstrate and certify the M454 compatibility at the lowest possible cost.

d. The M198 has met all developmental test requirements for other than tube life.

e. The M198 completed final subtests of Development Test (DT II) in September 1977. First Article - Initial Production Test (FA-IPT) and Follow-On-Evaluation (FOE) are now scheduled to be conducted from August 1978 through January 1979. FA-IPT will subject the initial production howitzers to an equivalent 15,000 rounds firing test and 4,800 miles of mobility testing.

2. Operational Test and Evaluation:

a. The Field Artillery Board evaluated human engineering aspects and operational suitability of the XM198 at Fort Sill, Oklahoma, using a single weapon and crew. The consensus of the evaluation was that the XM198, with stated recommended modifications, would be capable of fulfilling its mission, and would meet operational requirements. Specifically, the XM198 demonstrated excellent towing mobility experienced no significant emplacement/displacement problems, and is compatible with personnel skills and aptitudes.

b. The US Army Field Artillery School conducted an informal user evaluation of the Engineering Development (ED) prototype S/N 3. The objective was to evaluate operational performance and the training required to prepare experienced troops to operate the XM198. The School concluded that the crew could readily perform their assigned duties. Successful redesign of the hydraulic pump and actuator assembly was accomplished after problems were identified.

c. Operational Test II (OT II), a battery level, side-by-side comparison test was conducted by US Army Operational Test and Evaluation Agency (OTEA) at Fort Sill, Oklahoma from July to December 1975. Three XM198's and three M114A1 Howitzers were tested concurrently in four phases; new equipment training, Reliability, Availability and Maintainability (RAM) firing exercise, field exercise, and extended range. Test objectives concerning range, precision, 6400 mile capability, ease and simplicity of operation, displacement with helicopter, emplacement/displacement, rapid responsiveness to fire commands, operational rates of fire, training and limited employment, doctrine, and personnel selection procedures were satisfactorily demonstrated. Objectives relating to accuracy of all possible ammunition combinations were not tested because firing tables and some projectile safety certifications were not available, but will be tested in First Article - Initial Production Test (FA-IPT) and Follow-On-Evaluation (FOE). The maintenance burden, towing with various prime movers, and crew protection from blast overpressure are areas requiring further testing. FOE will be conducted from October 1978 through January 1979 at Ft. Bragg, North Carolina, by OTEA.

d. Initial OT II results prior to Army Systems Acquisition Review Committee (ASARC) III indicated that acquisition of the XM198 should be delayed until command and control problems associated with double ear protection and C130 aircraft transportability problems were solved. OTEA also stated that problems with traversing and elevating mechanism and the hydraulic system be corrected prior to FOE. Subsequent to the OT II, solutions to the above problem were successfully demonstrated. Based on these, the OTEA operational test results supported continuation of the acquisition cycle.

3. System Characteristics:

	Objective	Demonstrated Performance
Max Range (km)		
Unboosted	22.0	22.6
Boosted	28.5	30.5
Precision (Boosted)		
Range (% of)	.3	.22
Azimuth (Mils)	1	1
Rate of Fire (rds/min)		
Max (for 3 min)	4-6	4-6
Sustained (30 Min)	2	2
Durability (EFC)		
Carriage	15,000	15,000
Breech Ring	7,500-10,000	15,000

Program Element: #6.46.14.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Weapons and Ammunition, [illegible]
Budget Activity: #4 - Tactical Programs

	Objective	[illegible] Performance
Recoil Mechanism	10,000-15,000	[illegible]
Tube Life (Rds) (XM203, Zone 8)	1,750 1/	[illegible]
Weight (Lbs)	15,000-15,500	[illegible]
Reliability (MRBF)	700-1100	[illegible]
Availability (%)	83	[illegible]

1/ User accepts 1750 rd tube life with XM203, but desires improved tube life through tube wear technology program and investigation of stick propellant.
2/ US Army Operational Test and Evaluation Agency (OTEA) estimate after post OT II fixes and retesting.

AD-A051 976 DEPUTY CHIEF OF STAFF FOR RESEARCH DEVELOPMENT AND AC--ETC F/G 5/1
DESCRIPTIVE SUMMARIES OF THE RESEARCH, DEVELOPMENT, TEST AND EV--ETC(U)
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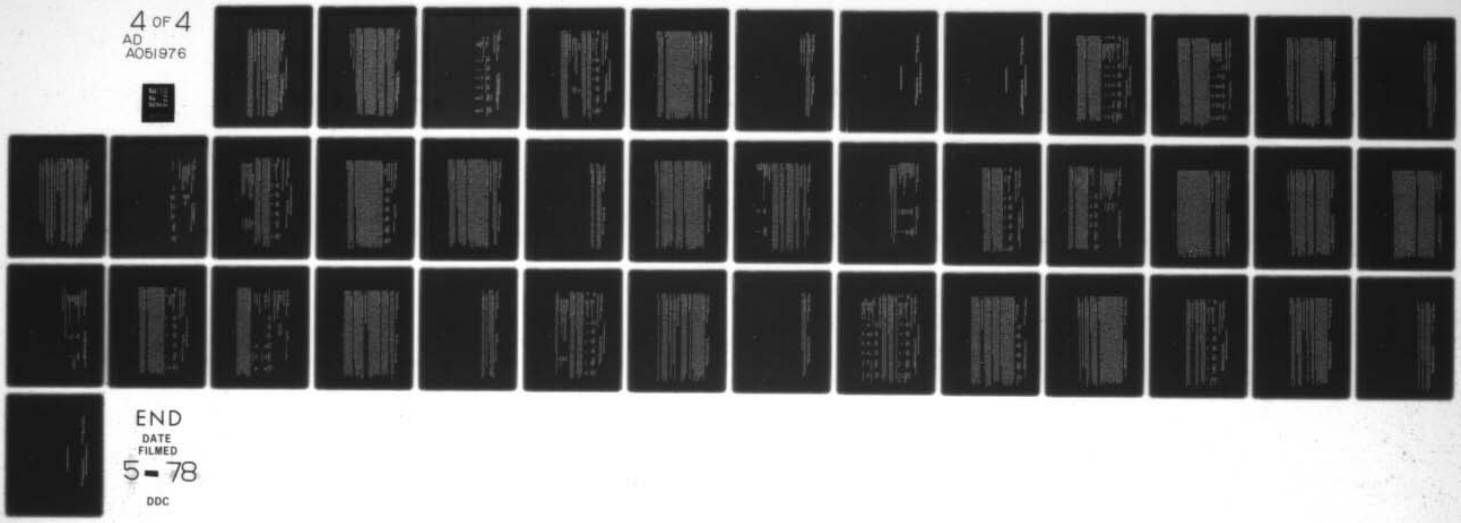

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FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D373 Title: Ammunition, Cannon, 155mm
Program Element: #6.46.14.A Title: Field Artillery Weapons and Ammunition, 155mm
DoD Mission Area: #413 - Fire Support Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: The purpose of this project is to conduct engineering development on ammunition components for 155mm howitzers. The XM211 and XM201 propelling charges will replace the M3, M4, and M119 charges and be in agreement with ballistic parameters contained in a Memorandum of Understanding between the United States and three European allied nations. They will be type classified for use in both the M198 and M109A1 howitzers. The M203 (Zone 8) propelling charge was type classified with the M198 howitzer and is being tested for compatibility with the M109A1 howitzer. The XM795 High Explosive (HE) projectile is being developed as a replacement for the standard M107 projectile. It will be ballistically similar to the cargo optimized family (M483A1, M692/XM718 Mines), and be compatible with the M203 maximum propelling charge to provide the full unassisted range capability of the 155m howitzer system. A new smoke projectile will replace the current smoke projectile and will provide a significantly longer lasting source of screening smoke.

B. RELATED ACTIVITIES: The development of new munitions for 155mm howitzers is a continuation of advanced development efforts funded under Program Element 6.36.28.A, Field Artillery Ammunition Development. Direct liaison is maintained with the US Marine Corps to provide close coordination of development programs.

C. WORK PERFORMED BY: Project Manager for Cannon Artillery Weapon Systems, US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; ARRADCOM, Edgewood, MD; and Army Materiel Systems Analysis Agency, Aberdeen, MD.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Engineering development was initiated for a new family (XM164 low zones, XM201 intermediate zones, XM203 maximum zone) of 155mm propelling charges for the 155mm howitzer XM198 and M109A1. Development was completed on the M549 rocket assisted projectile (RAP). The XM164 propelling charge produced low zone stickers (where the projectile did not leave the tube when fired) and was redesigned to eliminate stickers. It was redesignated as the XM211 charge. Development

of the M203 propelling charge was completed and it was type classified. The XM201 propelling charge was certified with the M109A1 howitzer but was not type classified due to excessive tube wear. The XM708 high explosive (HE) range optimized projectile development was terminated, and advanced development of the XM795 HE cargo optimized projectile was initiated. Metal parts for initial development tests were manufactured and fragmentation range match tests initiated. The XM761 smoke projectile exhibited instability in flight, and reentered advanced development which will address alternate approaches to payload design. Initial prototypes were manufactured and testing initiated.

2. FY 1978 Program: Development of the XM795 HE projectile will be continued. Metal parts will be manufactured, loading procedures will be developed, and engineering development projectiles will be filled. Funds programed for engineering development on the XM761 smoke projectile were reprograming to accomplish advanced development. Initial developer and operational tests will be conducted and the Validation In-Process Review (VAL-IPR) will be held in the 4th Quarter. A decision will be made as to which payload configuration will go forward into engineering development scheduled for initiation in FY 1979.

3. FY 1979 Planned Program: Continue engineering development of the XM211 propelling charge and finalize the charge configuration. Resume development of the XM201 propelling charge incorporating a cool burning M1 or M6 single base propellant. Continue development of the XM795 high explosive projectile. Release contract authority to manufacture XM795 metal parts assemblies and load complete rounds (2438) for Development/Operational Test II. Conduct engineering development testing (including transonic precision at Nicolet), and begin Development/Operational tests II. Complete fracture mechanics studies, and initiate producibility engineering planning. Convene special XM795 in-process review (IPR) on explosive fill and conduct metallographic verification of *non-destructive testing* techniques. Components of the redesigned smoke projectile will be fabricated. Rough handling tests will be completed by Aberdeen Proving Ground. Desert and Air Transportability, and Tropic and Storage Tests will be performed at Dugway Proving Ground (DPG). Yuma Proving Ground will conduct Ballistic Similitude Tests.

4. FY 1980 Planned Program: Conduct developer operational tests and conduct Development Acceptance IPR's for type classification of the XM211 and XM201 propelling charges. Continue engineering development of the smoke projectile which will require increased funding above the FY 1979 level. Fabrication of projectiles and smoke submissiles for development/operational II testing initiated in FY 1979 will be completed in FY 1980 and DPG will conduct acceptance and development/operational II tests. Conduct safety tests, cold weather tests, and ballistic match tests on the XM795 HE projectile.

5. Program to Completion: This is a continuing program.

6. Major Milestones: Not Applicable.

Project: #D373 Title: Ammunition, Cannon, 155mm
Program Element: #6.46.14.A Title: Field Artillery Weapons and Ammunition, 155mm
DoD Mission Area: #413 - Fire Support Budget Activity: #4 - Tactical Programs

7. Resources ($ in thousands):

		FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Cost
RDTE:	Funds	2291	1996	8170	8412	Continuing	Not Applicable
	Quantities	(Not feasible to list due to number of diverse items)					
Ammunition, Procurement, Army:							
	Funds	6100	0	20300	73200	488900	588500
	Quantities						
	XM201	0	0	0	360	2100	2460
	XM211	0	0	0	85	1951	2036
	M203	46	0	117	117	348	628

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.15.A
DoD Mission Area: #412 - Close Combat

Title: Tank Thermal Sight
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	8298	2451	1046	0	0	30499
DE25	Tank Thermal Sight	8298	2451	1046	0	0	30499

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Development of a thermal sight for the M60A3 tank and a family of modules for use in other combat vehicles. Thermal sights use advanced far-infrared technology to image heat emitted from objects. They are completely passive, penetrate smoke and some haze, operate in any light level, and are difficult to countermeasure.

C. BASIS FOR FY 1979 RDTE REQUEST: Continuation of engineering development (ED) and Production Engineering Planning (PEP) support, primarily in the area of preparing finalized engineering drawings and production technical data package (TDP) suitable for competitive procurement. Some contractor support of Development Test (DT) II is also required.

Milestones	Date
Complete Development Test (DT)/Operational Test (OT) II	Feb 78
Development Acceptance In-Process Review (DEVA IPR)	Mar 78
DT/OT III	Aug 78-Mar 79
Production Validation IPR	May 79

D. OTHER APPROPRIATION FUNDS: Not Applicable

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop a thermal sight for use in the current and future main battle tanks. The sight will be mounted entirely inside the tank turret, will be integrated fully into the tank's fire control system, and will provide the tank crew an improved capability of detecting, identifying and engaging targets at night when there is no ambient light and during the day where the target is obscured by weather, smoke, or dust. The sight will be entirely passive; therefore, it will not be subject to detection by the enemy by means of normal vision devices.

Program Element: #6.46.15.A
DoD Mission Area: #412 - Close Combat

Title: Tank Thermal Sight
Budget Activity: #4 - Tactical Programs

F. RELATED ACTIVITIES: This program was funded in FY 1973 under Program Element (PE) 6.46.04.A, M60A1 Tank Product Improvement Program. This program is being coordinated with related thermal imaging efforts being conducted under PE 6.37.19.A, Surveillance, Target Acquisition, and Night Observation.

G. WORK PERFORMED BY: The in-house work is being performed by Project Manager for M60 Tanks (Development), Warren, MI; US Army Electronics Command, Night Vision Laboratory, Ft. Belvoir, VA; and US Army Test and Evaluation Command, Aberdeen Proving Ground (APG), MD. Primary contractors are Texas Instruments, Incorporated, Dallas, TX and Chrysler Corporation, Centerline, MI.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: A prototype thermal sight was fabricated by Hughes Aircraft Company and was delivered to the Army in April 1973. This prototype began competitive testing with another thermal sight prototype delivered by Chrysler Corporation/Texas Instruments, Inc. under PE 6.37.19. Testing was completed in September 1973. It was determined that improvement in the areas of sensitivity, resolution, and display were required in each of the thermal sight prototypes. A decision was made not to enter engineering development as originally planned but to upgrade the current effort by continuing advanced development for another year. To this end, a contract was awarded to two contractors in June and July 1974. Each contractor was required to provide two prototypes for testing. In FY 1974 each contractor developed a prototype thermal sight and delivered two systems (one in a vehicle plus one spare) in early July 1975 to undergo Developmental Test I/Operational Test I (DT I/OT I) in FY 1976. After delivery to the Night Vision Laboratory (NVL) for laboratory check-out, the prototype systems were provided to Chrysler Defense Engineering (CDE) for integration into test tanks. This was done at Aberdeen Proving Ground where competitive DT I/OT I was conducted from September-December 1975. Test results were very favorable and a validation In-Process Review (IPR) was conducted on 6 May 1976. An engineering development (ED) contract was awarded to the winning contractor, Texas Instruments, to commence fabrication of 16 thermal sight systems and spare parts for delivery beginning March 1977. The contract included an option to begin Low Rate Initial Production (LRIP) of 300 systems. Producibility, Engineering and Planning (PEP) was initiated in FY 1976. Test bed tanks and their fire control systems were refurbished prior to the integration of prototypes for contractor qualification testing. In November 1976 the Army conducted a Special In-Process Review which reviewed all available data and recommended that the option to the ED contract for 300 production units as LRIP be exercised. A reprogramming action to utilize $23.3 million of funds appropriated for the modification of M60 series tanks was forwarded to the Congress. Final approval was received just after the end of FY 1977. Delivery of ED hardware, contractor qualification testing, laboratory check-out, and integration of hardware into test vehicles were accomplished and the DT II was started as scheduled in July 1977.

2. FY 1978 Program: Upon completion of Developmental Test II/Operational Test II (DT/OT II) testing a Development Acceptance In-Process Review (DEVA-IPR) will be conducted in March 1978 to make a final production decision. Actions will be taken to incorporate engineering changes resulting from DT/OT II into the Technical Data Package (TDP) and units being produced under low rate initial production, to conduct necessary retests, and to move into the final stages of Production Engineering Planning (PEP).

Program Element: #6.46.15.A
DoD Mission Area: #412 - Close Combat

Title: Tank Thermal Sight
Budget Activity: #4 - Tactical Programs

3. FY 1979 Planned Program: Finalization of Production Engineering Planning (PEP) and completion of a Technical Data Package (TDP) based upon results of the Developmental Test III/Operational Test III (DT/OT III) (conducted as part of the M60A3 Tank DT/OT III). Full scale competitive procurement is scheduled for mid FY 1979. This will complete RDTE efforts.

4. FY 1980 Planned Program: Not Applicable.

5. Program to Completion: Not Applicable.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.16.A
DoD Mission Area: #412 - Close Combat

Title: Infantry Fighting Vehicle
Budget Activity: #4 - Tactical Programs

TO BE SUBMITTED UNDER SEPARATE COVER

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.17.A
DoD Mission Area: #412 - Close Combat

Title: Vehicle Rapid Fire Weapon System (BUSHMASTER)
Budget Activity: #4 - Tactical Programs

TO BE SUBMITTED UNDER SEPARATE COVER

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.19.A
Title: Land Mine Warfare
DoD Mission Area: #416 - Land Mine Warfare
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	9080	7781	14886	19799	Continuing	Not Applicable
	Quantities						Not Applicable
D016	Mine Systems	100	4409	3515	12279	Continuing	Not Applicable
D088	Modular Pack Mine System (MOPMS)	0	0	7421	7120	3572	22322
D301	Land Mine Development (NATO)	0	0	300	0	0	300
D407	Antitank Artillery Mine XM718/XM741	2314	280	1550	0	0	18341
D568	Ground Emplaced Mine Scattering System Anti-tank/Antipersonnel Mines	6666	3092	2100	400	0	31589

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides for increased tactical effectiveness and responsiveness of landmines by supporting the development of a Family of Scatterable Mines (FASCAM) which can be dispensed rapidly from helicopter and ground dispensers, cannon artillery and rockets, tactical aircraft, and other means which prove cost effective. The minefield continues to be one of the most effective, efficient, and adaptable obstacles available. The increased pace of modern warfare together with the fluidity and porosity of today's battlefield make the use of labor intensive, hand emplaced, logistically burdensome, conventional landmines less effective than in previous wars. Current mines, which must be emplaced well in advance of the actual tactical need, lack the responsiveness and flexibility necessary for effective employment in rapidly changing tactical situations. Scatterable mines placed with multiple delivery means provide a formidable threat and deterent to mass armor attacks such as can be mounted by the Warsaw Pact. Scatterable mines will be used to delay, canalize, or interdict attacking enemy forces and to deny selected areas to the enemy.

C. BASIS FOR FY 1979 RDTE REQUEST: Funds will support completion of Development Test (DT) III/Operational Test (OT) III on the XM718 artillery (arty) delivered antitank (AT) mine system. Engineering design testing of the Modular Pack Mine System will continue in preparation for DT II/OT II. The GEMSS (Ground Emplaced Mine Scattering System) will be type classified standard and funds will support integrated technical documentation and training (ITDT) and test hardware. Engineering development of a command and control system to assist in the employment of scatterable mines will be initiated. Effort will focus on defining and producing computer software compatible with existing display hardware. Test and evaluate a German AT mine for adoption by US.

Program Element: #6.46.19.A
DoD Mission Area: #416 - Land Mine Warfare

Title: Land Mine Warfare
Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Ammunition Procurement, Army						
Funds (XM718 Arty AT Mines)	0	14000	51700	45400	114800	225900
Quantities (rounds)	0	4000	24000	23000	62000	113000
Funds (GEMSS XM74/XM75 Mines)	0	0	5800	10500	27300	43600
Quantities (mines)	0	0	11000	44000	130000	185000
Other Procurement, Army						
Funds (GEMSS Dispenser)	0	0	1800	12600	16300	30700
Quantities (each)	0	0	6	100	178	284

E. DETAILED BACKGROUND AND DESCRIPTION: The minefield continues to be one of the most effective, efficient, and adaptable obstacles available. Conventional hand emplaced antitank (AT) and antipersonnel (AP) mines are both labor and logistically intensive and hence employment cannot keep pace with related battlefield activities. To overcome identified deficiencies, the Army for several years has pursued development of a Family of Scatterable Mines (FASCAM). FASCAM consists of smaller mines with improved lethality, target sensing and descrimination, and response times packaged for delivery by multiple means. The first generation scatterable mine, the M56 helicopter delivered AT mine, has been fielded in US Army, Europe. Production has commenced on the second generation M692 artillery delivered AP mine. The companion XM718 artillery delivered AT mine will be type classified standard for use and production will commence during FY 1978. The Ground Emplaced Mine Scattering System with both AT and AP mines is scheduled to complete development and enter production in FY 1979. The Modular Pack Mine System and the USAF GATOR air-delivered system are well into development and will complete the second generation of mass scatterable mines. Scatterable mine systems utilize extensive component commonality during manufacture. The option to emplace minefields when and where desired in a matter of minutes provides the tactical commander with a unique capability which will impact on both friendly and enemy tactics.

F. RELATED ACTIVITIES: This program follows from advanced development (AD) Program Element (PE) 6.36.06.A, Landmine Warfare, where components and mine hardware concepts are devised. Principal system technical development responsibility is assigned to the US Army Armament Research and Development Command (ARRADCOM), Dover, NJ, under the management of the co-located Project Manager (PM) for Selected Ammunition, who maintains control of all phases of mine systems development, initial procurement, and logistical and field support. Closely related to this PE is the joint-Service development of air delivered scatterable mines (GATOR). The scope of this development is controlled by an approved joint development plan. The Army is developing both AP and AT mines for the GATOR systems using FASCAM components under the Air Force as lead-Service. Joint-Service mine requirements are coordinated through the DOD Armaments/Munitions Requirements and Development Committee and the Joint Technical Coordination Group for Bombs, Mines, and Clusters.

Program Element: #6.46.19.A
DoD Mission Area: #416 - Land Mine Warfare

Title: Land Mine Warfare
Budget Activity: #4 - Tactical Programs

G. WORK PERFORMED BY: Principal Army Management Agency is the PM for Selected Ammunition, ARRADCOM, Dover, NJ. In-house support is provided by the US Army Mobility Equipment Research and Development Command, Fort Belvoir, VA; US Army Test and Evaluation Command and the Army Materiel Systems Analysis Agency, Aberdeen, MD; and Yuma Proving Ground, Yuma, AZ. Principal contractors are: Aerojet Ordnance and Manufacturing Company, Downey, CA; Hughes Aircraft Company, Fullerton, CA; Honeywell Incorporated, Hopkins, MN; RCA Solid State Division, Sommerville, NJ; AAI Corporation, Cockeysville, MD; Chamberlain Corporation, Waterloo, IA; Bulova, Valley Stream, Long Island, NY; and FMC, San Jose, CA.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Scatterable mine development was initiated in the late 1960's with emphasis on the XM56 helicopter delivered antitank mine system and the XM692E1 artillery delivered antipersonnel mine system. During FY 1973, the XM56 and XM692E1 systems entered developmental testing (DT) and the XM718 artillery delivered AT mine system entered engineering development (ED). In FY 1974, the M56 helicopter AT mine system was type classified standard. During FY 1975, the M56 AT mine system went into production; DT II/Operational Testing (OT) II continued on the XM692E1 AP mine system; and engineering design tests (EDT) continued on the XM718 AT mine system. Design and testing of the Ground Emplaced Mine Scattering System (GEMSS) and its associated XM75 AT mines and XM74 AP mines continued with emphasis on system reliability, maintainability, and human factors. The XM58 helicopter dispensed minefield marking system effort was redirected towards a rapid Hand Emplaced Minefield Marking System (HEMMS). Efforts continued on the joint-Service GATOR air delivered mines in coordination with Navy and Air Force. During FY 1976, the M692 artillery delivered AP mine was type classified standard and went into initial production; DT II/OT II was initiated on the XM718 artillery delivered AT mine; DT II/OT II test hardware for the GEMSS was procured; and DT II/OT II on HEMMS continued. In FY 1977, the M56 helicopter AT mine was fielded; initial production continued on the M692 artillery AP mine; DT II/OT II was completed on the XM718 artillery AT mine and initiated on the GEMSS; advanced development on the Modular Pack Mine System (MOPMS) was completed; and the HEMMS was type classified standard for Army use.

2. FY 1978 Program: Conduct DT III/OT III and field the M692 artillery AP mine. Type classify and commence production of the XM718 artillery AT mine. Complete DT II/OT II on the GEMSS with XM74 AP and XM75 AT mines. Initiate ED of the MOPMS. Initiate production of the HEMMS.

3. FY 1979 Planned Program: Initiate full scale production of the M692 artillery AP mine. Conduct DT III/OT III and field the XM718 artillery AT mine. Type classify the GEMSS and initiate production. Continue EDT on the MOPMS. Initiate ED of an integrated command and control system to assist in the employment of scatterable mines. All necessary experimental work will have been performed and the command and control system will be ready for full scale development. Increased funding reflects the **procurement of test quantities for MOPMS. Test and evaluate the German DT-21 AT mine.**

Program Element: #6.46.19.A
DoD Mission Area: #416 - Land Mine Warfare

Title: Land Mine Warfare
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: Initiate full scale production of the XM718 artillery AT mine. Field the GEMSS. Conduct DT II/OT II on MOPMS. Continue ED of an integrated command and control system for the employment of scatterable mines. Initiate ED of a Manually Emplaced Mine System (MEMS), an off-route antitank mine (STORMS), and a river mine. All necessary experimental work will have been performed and these proposed systems will be ready for full scale development.

5. Program to Completion: This is a continuing program.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Project: #D088 Title: Modular Pack Mine System
Program Element: #6.46.19.A Title: Land Mine Warfare
DoD Mission Area: #416 - Land Mine Warfare Budget Activity: #4 - Tactical Programs

A. DETAILED BACKGROUND AND DESCRIPTION: The Modular Pack Mine System (MOPMS) is being developed to provide a rapid means of emplacing tactical, point, or protective minefields and to close lanes and gaps in existing minefields. MOPMS consists of a two-man portable pack which serves as the shipping, storage, and dispensing container. A remote command dispense capability will be provided to permit areas to remain free of mines until tactically appropriate. The pack can be recovered if the mines are not dispensed. MOPMS utilizes the baseline family of scatterable mines (FASCAM) components, thereby accelerating the development at a significantly reduced risk.

B. RELATED ACTIVITIES: This project follows from advanced development Program Element 6.36.06.A, Land Mine Warfare, where components and the concept were devised. Principal system technical development responsibility is assigned to the US Army Armament Research and Development Command (ARRADCOM), Dover, NJ, under the management of the co-located Project Manager for Selected Ammunition. MOPMS is being developed under the family concept and utilizes a high degree of component commonality with other FASCAM systems.

C. WORK PERFORMED BY: Principal Army Management Agency is the Project Manager for Selected Ammunition, ARRADCOM, Dover, NJ. In-house support is provided by the US Army Test and Evaluation Command and the Army Materiel Systems Analysis Agency, Aberdeen, MD. Principal contractors are: Aerojet Ordnance and Manufacturing Company, Downey, CA; Hughes Aircraft Company, Fullerton, CA; and Honeywell Incorporated, Hopkins, MN.

D. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: MOPMS system concept was demonstrated in advanced development.

2. FY 1978 Program: Conduct Validation In-process Review and initiate engineering development. Procure initial prototype hardware and conduct engineer design tests. Build and test command dispense/destruct manportable receiver/transmitter.

3. FY 1979 Planned Program: Finalize design and conduct final engineer design tests. Procure long lead-time hardware components for Developmental Testing II/Operational Testing II (DT II/OT II). Increased funding reflects procurement of DT II/OT II hardware.

4. FY 1980 Planned Program: Procure DT II/OT II hardware and initiate DT II/OT II testing.

5. Program to Completion: Complete DT II/OT II and type classify standard for Army use.

Project: #D088 — Title: Modular Pack Mine System

Program Element: #6.46.19.A — Title: Land Mine Warfare

DoD Mission Area: #416 - Land Mine Warfare — Budget Activity: #4 - Tactical Programs

6. Major Milestones:

	Date
Validation In-process Review	1QFY78
Developmental Testing II	4QFY80 - 3QFY81
Operational Testing II	2QFY81 - 3QFY81
Developmental Acceptance In-process Review and Type Classify Standard	4QFY81

7. Resources ($ in thousands):

	FY 1977	FY 1978	FY 1979	FY 1980	Additional to Completion	Total Estimated Costs
RDTE,A Funds	0	4409*	7421	7120	2372	21322

*Funded in Project D016 in FY 1978 only.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.20.A
Title: Tank Systems
DoD Mission Area: #412 - Close Combat
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	98698	117645	78376	31578	2513	581442
	Quantities						13
DG20	XM1	98698	117645	78376	31578	2513	581442

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The XM1 is a four man, highly mobile, fully tracked vehicle with significantly improved survivability provided by improved ballistic protection and compartmentalization. The XM1 will mount a large caliber main gun and two or more complementary armament systems with improved fire control and shoot-on-the-move capabilities. Higher cross-country speeds and faster acceleration provided by a 1500 horsepower turbine engine will make the XM1 tank a more difficult target for opposing ground and air forces. The XM1 is required to counter potential enemy armor threats of the 1980's and 1990's. It will replace the M60 series of tanks and become the primary offensive weapon of the Army's combined arms team.

C. BASIS FOR FY 1979 RDTE REQUEST: Chrysler Corporation will continue its work on the Full Scale Engineering Development/ Producibility Engineering and Planning (FSED/PEP) program. Continued development of the armor configuration and compartmentalization techniques and engine durability testing will be accomplished during this period. Kit and training device development will also be continued during this period. Configuration and standardization management will also be accomplished.

Major Milestones	Date
Complete Development Test/Operational Test (DT/OT) II	July 1979
Defense Systems Acquisition Review Council (DSARC) III	February/March 1979
Award Low Rate Initial Production (LRIP) Contract	May 1979
Delivery of first LRIP Tank	February 1980
Conduct DT III/OT III	March/December 1980
Initial Operational Capability (Tank Company)	
Decision to start full production (DSARC IIIA)	February 1981
European Operational Capability (Tank Battalion)	

Program Element: #6.46.20.A
DoD Mission Area: #412 - Close Combat

Title: Tank Systems
Budget Activity: #4 - Tactical Programs

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

Weapons and Tracked Combat Vehicles Procurement, Army	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimate Costs
Funds	21200	157000	418600	782200	8319500	9698500
Quantities	0	0	110	569	6379	7058

E. DETAILED BACKGROUND AND DESCRIPTION: Congress terminated the Main Battle Tank (XM803) program in FY 1972 as unnecessarily complex, excessively sophisticated and too expensive, and directed initiation of a new tank prototype program. To determine the requirements and characteristics of a new tank, the Army formed a task force to prepare a requirements document. The objective of this program is to counter the quantitatively superior Soviet tank forces by producing a qualitatively superior tank for use as the primary weapons systems in a highly mobile, sustainable, combined arms force. The XM1 will be superior in the areas of survivability, firepower and mobility and hence will provide a dramatic increase in combat capability. The ballistic protection offered by special armor coupled with its inherent agility makes the XM1 significantly more survivable than the M60 tanks. Silhouette will be reduced and compartmentalization stressed to reduce vulnerability to anti-tank fire. The main gun will be a stabilized large caliber gun (105-120mm). The 1500 HP engine with matching transmission in conjunction with the high performance suspension system provides superior cross-country mobility. The program was approved on 18 January 1973 and contracts awarded to General Motors and Chrysler on 28 June 1973 for the competitive Validation Phase of the XM1 program. Competitive evaluation of the two prototypes was completed on schedule (July 1976); however, the Defense Systems Acquisition Review Council (DSARC) decision on the selection of a single Full Scale Engineering Development (FSED) contractor was delayed 120 days until a resolicitation, considering a standardized version of the XM1, could be developed. Testing of the Leopard 2, American Version (AV) tank in accordance with the Dec 74 United States/Federal Republic of Germany (US/FRG) harmonization Memorandum of Understanding (MOU) was initiated on 10 Sep 76 and completed in mid December 1976. The DSARC met on 10 and 11 November 1976 and selected Chrysler Corporation for the fabrication and delivery of eleven pilot vehicles to be used during Development Test/Operational Test (DT/OT) II. The Full Scale Engineering Development (FSED) contract was awarded on 12 Nov 1976. In January 1977, an Addition to the Addendum to the MOU was signed which limited technical evaluation of the Leopard 2 (AV) to consideration of selective subsystems/components for standardization/interoperability.

F. RELATED ACTIVITIES: There is no other program being conducted by other services that meets the XM1 requirements. The Marine Corps is closely monitoring the XM1 development in relation to their requirement for a battle tank in a high intensity environment for subsequent operations ashore. Related and nonduplicatory Army activities being conducted are as follows: Program Element (PE) 6.36.16.A, Tank Gun Cooperative Development; PE 6.46.02-DG21, Tank Ammunition (XM774); and PE 6.46.15 - DE25, Tank Thermal Sight.

Program Element: #6.46.20.A
DoD Mission Area: #412 - Close Combat

Title: Tank Systems
Budget Activity: #4 - Tactical Programs

G. WORK PERFORMED BY: Prime Contractor is: Chrysler Corporation, Detroit, Michigan; In-house work is being accomplished by the US Army Tank Automotive Research and Development Command, Warren, Michigan; the US Army Armament Research and Development Command, Dover, New Jersey; and the Ballistics Research Laboratory, Aberdeen Proving Ground, Maryland.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: A Parametric Design/Cost Effectiveness Study to determine the design characteristics and possible alternatives for the XM1 was accomplished. Both Validation Phase Contractors completed trade-off analyses and design studies and selected the optimum vehicle configuration. Cost and specification studies were updated. Fabrication and assembly of the prototype vehicles, ballistic hull and turrets, and retrofit of test rigs for government competitive test and evaluation were accomplished. In-house efforts to develop and evaluate manufacturing techniques for hulls and turrets and feasibility studies to determine types and quantities of training devices required were conducted. Foreign technology evaluations continued with the establishment of a program for the test and evaluation of a modified German prototype, the Leopard 2, American Version (AV), as an alternative for the XM1 requirement. As part of the United States/Federal Republic of Germany agreement, a jointly funded cost/producibility study was initiated with FMC Corporation. The Full Scale Engineering Development phase began on 12 November 1976 following contract award to Chrysler Corporation. Fabrication of eleven pilot vehicles and six armor test sections for government test and evaluation was initiated. Contractors conducted design studies to meet system specifications in configuration management, integrated logistics support and human engineering. Testing and evaluation of the Leopard 2 (AV) tank were completed. In-house development and evaluation of special armor configurations were continued. Extended durability testing of the turbine engine was initiated. A cost and technical evaluation study was conducted to ascertain the level to which standardization/interoperability of subsystems/components between US and German main battle tanks could be achieved.

2. FY 1978 Program: Fabrication of eleven pilot vehicles and refurbishment of the prototype vehicle and automative test rig will be completed and delivered along with special kits and maintenance support packages. Development Test (DT) II will be conducted during the period February 1978 through July 1979. Operational Test (OT) II will be conducted during the period May through December 1978. Other test programs include prototype qualification tests and engineering design testing. Armor development effort; extended turbine engine durability testing; development of compartmentalization techniques; development work on auxiliary power units, dozer and mine roller kits; and development work on training devices will be conducted. Initiation of planning for Development Test (DT) III will also begin.

3. FY 1979 Planned Program: Development Test/Operational Test (DT/OT) II will be completed. Redesign and testing as required to correct deficiencies noted in DT II/OT II will be conducted. Low Rate Initial Production (LRIP) contract will be awarded in May 1979 following Defense Systems Acquisition Review Council (DSARC) decision to continue the program. The decreased funding requirements in FY 1979 reflect a reduction in hardware costs required for Full Scale Engineering Development and the transition to the LRIP phase of development.

Program Element: #6.46.20.A
DoD Mission Area: #412 - Close Combat

Title: Tank Systems
Budget Activity: #4 - Tactical Programs

4. FY 1980 Planned Program: The Full Scale Engineering Development/Producibility Engineering and Planning (FSED/PEP) contract, as well as development of training devices, armor and compartmentilization techniques, will be completed. The first of the Low Rate Initial Production (LRIP) tanks will be delivered in February 1980 just prior to initiation of DT III and OT III.

5. Program to Completion: Delivery of the 110 LRIP vehicles is expected to be completed in January 1981. DT III/OT III will be completed in December 1980. The decision to enter full scale production will be made at DSARC IIIA, scheduled for February 1981.

Program Element: #6.46.20.A
DoD Mission Area: #412 - Close Combat

Title: Tank Systems
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation: Both US contractors, Chrysler and General Motors, completed their design, construction and testing within cost and schedule thresholds. A Source Selection Evaluation Board (SSEB) convened on 1 March 1976 and submitted their findings to the Source Selection Advisory Council on 4 June 1976. The final selection of the winner and award of a Full Scale Engineering Development (FSED) contract was scheduled to occur in late July 1976, following the 20 July 1976 Defense Systems Acquisition Review Council (DSARC) II. However, the validation phase was extended 120 days as a result of the Secretary of Defense decision to consider incorporation of standardized components as outlined in the 28 July 1976 Addendum to the Memorandum of Understanding (MOU) with the Federal Republic of Germany. On 12 Nov 1976, the Source Selection Authority (SSA) announced that Chrysler Corporation was selected as the winning US contractor to continue development of the XM1 tank. The award of the FSED contract to Chrysler was made the same date for the fabrication of eleven pilot vehicles. The FSED contract includes options for follow-on procurement of 462 vehicles in FY 79-80. A German Leopard 2 American Version (AV) prototype was also to be evaluated as a competitor for the XM1 requirement. However, in the January 1977 Addition to the Addendum to the MOU, the U.S. and Germany agreed not to pursue competition on a total tank basis, but, rather to limit interoperability/standardization efforts to subsystems/components only. Development testing will be accomplished at three critical times in the development cycle to determine the degree to which XM1 tank system meets performance specifications.

a. Phase I of Development Test (DT) I was conducted by the US Army Test and Evaluation Command (TECOM) at Aberdeen Proving Ground, MD, during the period 1 Feb-30 Apr 76 to resolve critical issues and provide data for the selection of one contractor and the decision to enter FSED. Testing of US prototypes was completed on schedule with both vehicles having successfully demonstrated the ability of meeting or exceeding all XM1 requirements. Phase II, testing of the Leopard 2 AV, began on 10 Sep 76 and was completed in mid-Dec 76. The Leopard 2 AV did not meet all XM1 requirements. The performance of each candidate was evaluated against the performance of the baseline vehicle, the M60A1 AOS.

b. DT II, utilizing the eleven FSED pilot vehicles, will be conducted during the period Feb 78-Jul 79 by TECOM at Aberdeen Proving Ground, MD, Yuma Proving Ground, AZ, White Sands Missile Range, NM, Fort Greeley, AK, and Woodbridge, VA, to resolve the issues critical to the decision to enter Low Rate Initial Production (LRIP). The FSED vehicle differs from the prototype vehicle tested during the Validation Phase in that it incorporates provisions for standardization of selected components and/or systems between the XM1 and Leopard 2 in accordance with the Addendum to the United States/Federal Republic of Germany Memorandum of Understanding, in addition to changes as a result of lessons learned during Development Test/Operational Test (DT/OT) I. The standardization effort has as one of its major objectives commonality of logistical support in the area of consumables, such as fuel and ammunition, and in those other areas requiring substantial logistical support, such as the gun, track, engine, transmission and fire control.

c. DT III is scheduled to be conducted during the period Mar-Oct 80 by TECOM at Aberdeen Proving Ground, MD, to verify production changes resulting from DT/OT II deficiencies and to support a decision to enter full scale production and development of the XM1 tank system.

d. The U.S. Army Materiel Systems Analysis Activity (AMSAA) will provide an independent evaluation of test results to the appropriate decision making body prior to each of the major decision milestones.

2. Operational Test and Evaluation:

a. Three Operational Tests (OT) are being conducted to assess the operational effectiveness and operational suitability of the XM1 tank system. The US Army Operational Test and Evaluation Agency (OTEA) will provide an independent evaluation to the appropriate decision body after each test and prior to the major decision milestones.

b. Phase I of OT I was conducted by OTEA at Aberdeen Proving Ground, MD, during the period 15-30 Apr 76. This test was a combined Development Test/Operational Test (DT/OT) I using one prototype vehicle and one automotive test rig from each contractor, and employed six typical user tank crews. Both candidates met the operational effectiveness required at this stage of development, and nothing was noted during OT I which would preclude entry into engineering development. The Leopard 2 American Version (AV) prototype was tested in December 1976 at Aberdeen Proving Ground, MD, in Phase II by OTEA against the same test criteria.

c. OT II is scheduled to be conducted by OTEA at Fort Bliss, TX, during the period May-Dec 78. Platoon live fire and tank company team field exercises under simulated tactical conditions will be conducted using five prototype vehicles and typical user tank crews. Reliability, availability, and maintainability (RAM) data will be collected.

d. OT III is scheduled to be conducted by the US Army Training and Doctrine Command (TRADOC) Combined Arms Test Activity (TCATA) at Fort Hood, TX, during the period Jun-Dec 80. This will be a battalion level test utilizing troops from Fort Hood armored units. This test will evaluate all transition training; formal military school training; logistical requirements; and validation of doctrinal, tactical, and operational concepts. Reliability, availability, and maintainability (RAM) data also will be collected.

3. System Characteristics:

Operational/Technical Characteristics	Objective	Demonstrated Performance
Acceleration (hard surface 0 degree slope, 0 to 20 mph) (sec)	6-9	6.2
Speed (mph)		
10% slope	20-25	24
60% slope	3-5	5.2
Maximum	40-50	45

Program Element: #6.46.20.A
DoD Mission Area: #412 - Close Combat

Title: Tank Systems
Budget Activity: #4 - Tactical Programs

Operational/Technical Characteristics	Objective	Demonstrated Performance
Cruising range (miles)	275-325	280 1/
Horsepower/Weight (ton)	26-30	26:1
Height (inches)	90-95	93.5 2/
Width (inches)	120-144	143.8 2/
Stowed ammunition (main gun rounds)	45-55	55
Reliability (Mean Miles Between Failure - MMBF)	320-360	3/
Durability (miles)	4000-6000	4/
Availability (inherent)	86-92%	4/
Maintenance ratio (maintenance/ operational)	0.66-1.25	4/

1/ Calculated based on fuel quantity proposed for Full Scale Engineering Development (FSED) vehicle.
2/ Entries are projected measurements for FSED vehicle. Selected Acquisition Report (SAR) entries are Validation Phase prototype measurements.
3/ Eighty-five percent of goal to be demonstrated by end of Development Test/Operational Test (DT/OT) II.
4/ To be demonstrated by end of DT/OT III.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.21.A
DoD Mission Area: #413 - Fire Support

Title: COPPERHEAD (Cannon Launched Guided Projectile)
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	38080	35999	12983	5231	0	137876
	Quantities						430
D073	COPPERHEAD	38080	35999	12983	5231	0	137876

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The COPPERHEAD is designed to attack both stationary and moving hard targets such as tanks with a high probability of achieving first round kills. The projectile is fired from a conventional 155mm howitzer. A forward observer is prepared to illuminate the target using a laser designator. During the last several seconds of the COPPERHEAD's flight, he illuminates the target. The projectile acquires and homes on the laser energy reflected from the target. This projectile will satisfy the need for field artillery units to possess the capability to effectively attack armored targets of the numerically superior Warsaw Pact Forces at ranges beyond the capability of direct fire anti-tank weapons. The high single shot kill probability coupled with the ability to attack both stationary and moving targets will significantly improve the Army's anti-tank capability within the existing force structure.

C. BASIS FOR FY 1979 RDTE REQUEST: Operational Test II will be completed in November 1978 and the Prototype Qualification Tests-Government (PQT-G) will be completed by April 1979. The engineering development (ED) contractor will deliver the last reliability, availability, maintainability, and durability report, the final technical report and the final contract report in FY 1979. Development Test Reports and Operational Test Reports will be prepared. Test data will be incorporated into the Cost and Operational Effectiveness Analysis (COEA) leading to the program review for a Low Rate Initial Production decision by the Defense Systems Acquisition Review Council (DSARC).

Program Element: #6.46.21.A
DoD Mission Area: #413 - Fire Support

Title: COPPERHEAD (Cannon Launched Guided Projectile)
Budget Activity: #4 - Tactical Programs

Major Milestones	Date
a. Initiated Advanced Development	February 1972
b. Initiated Engineering Development	July 1975
c. Initiate Development Test II (Prototype Qualification Tests-Government (PQT-G))	March 1978
d. Initiate Operational Test II	September 1978
e. Defense Systems Acquisition Review Council (DSARC III)	March 1979
f. Initial Operational Capability (IOC)	

D. OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Procurement Ammunition, Army						
Funds	0	21800	55800	275100		
Quantities	0	0	3000	22000		

E. DETAILED BACKGROUND AND DESCRIPTION: A requirement exists to enhance the indirect fire capability of field artillery cannon units by providing projectiles that, by use of a ballistic trajectory coupled with terminal guidance, will acquire and home on stationary and moving, hard point targets. The projectile under development, the COPPERHEAD, will satisfy that requirement. The COPPERHEAD concept involves the firing at hard, point targets from cannon artillery as directed by a ground or air observer. During the final portion of the trajectory, the observer illuminates the target with a narrow beam laser. The COPPERHEAD then acquires the reflected laser energy and guides to the target by homing on the reflected energy. The COPPERHEAD is a 155mm guided projectile which utilizes semi-active laser homing and proportional navigation guidance. It is designed to have a range of 16 to 24 kilometers and carries a shaped charge warhead that can penetrate of homogeneous armor. The COPPERHEAD will complement rather than replace available and planned projectiles in field artillery cannon units.

F. RELATED ACTIVITIES: The Army provided $2.3 million through FY 1974 for support of Naval Weapons Systems Command in the development of an 8-inch pursuit guided projectile. The Navy furnished $722 thousand in FY 1975 for a 5-inch/155mm commonality evaluation which included testing of 12 Advanced Development (AD) 5-inch guided projectiles saboted to 155mm.

Program Element: #6.46.21.A
DoD Mission Area: #413 - Fire Support

Title: COPPERHEAD (Cannon Launched Guided Projectile)
Budget Activity: #4 - Tactical Programs

An extensive effort has been undertaken to insure maximum component commonality between the Army 155mm projectile and the Navy 5-inch projectile in order to avoid duplication of effort and to achieve maximum possible savings. To facilitate the achievement of this objective, these development programs are jointly managed with the Army established as the responsible Service.

G. WORK PERFORMED BY: US Army Armaments Research and Development Command, Dover, New Jersey; US Army Missile Research and Development Command, Huntsville, Alabama; Project Manager, Cannon Artillery Weapons Systems, Dover, New Jersey; Martin Marietta Corporation, Orlando, Florida; Harry Diamond Laboratories, Adelphi, Maryland; US Army Test and Evaluation Command, Aberdeen, Maryland.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: The COPPERHEAD program was initiated with systems studies followed by a competitive advanced development (AD) effort which consisted of a technology demonstration with evaluation of competitive designs and hardware performance. Engineering development (ED) was initiated in July 1975 with a single contractor. Modifications to the design of the AD prototype were initiated during ED in order to enhance performance and/or reduce cost. These modifications were completed and proved during the first two years of ED. Congressional underfunding of the program for FY 1976 and FY 197T resulted in the initiation of ED at less than the planned level of effort and resulted in a schedule slip of approximately six months. In an effort to realize maximum cost advantages the Army was directed in February 1977 to assume the responsibility for the development of the Navy's 5-inch and 8-inch semi-active laser guided projectiles and to maximize component commonality among these projectiles. A Special Defense Systems Acquisition Review Council (DSARC) was conducted in August 1977 which reviewed the Army's plans for implementing commonality and approved the entry into Engineering Development of the 5-inch and unpowered 8-inch guided projectiles. The COPPERHEAD program began in 1971 with $1.6 million emergency funds to conduct in-house systems studies. Semi-active laser homing was selected for use during the initial phase of the program because it was the most technically advanced. In February 1972, contracts were signed with Texas Instruments and Martin Marietta to conduct a two-phase competitive prototype demonstration. Phase I of the demonstration was completed in September 1973 with each contractor demonstrating the capability of projectile components to survive the high acceleration forces of the cannon launch environment. Phase II was initiated in September 1973. Each contractor fabricated and delivered to the Army three fully functional prototype projectiles with telemetry for testing. Tests were completed in June 1974. In-house fuze and warhead design tests were on-going. In January 1975, a Special Commonality Defense Systems Acquisition Review Council (DSARC) directed the Army to continue the Advanced Development (AD) program. Each contractor delivered the last nine initial design projectiles for test and evaluation. Sixteen of these 18 prototype projectiles and six of the 12 Navy 5-inch/155mm prototype projectiles were tested and evaluated. DSARC II was conducted in June 1975 and approval to enter ED was received. The ED contract was awarded to the Martin Marietta Corporation in July 1975. Warhead and fuze development will be accomplished by the ED contractor, thereby giving him complete design responsibility. The FY 1976 and FY 197T funding was reduced by over 31 percent (from $24.8 million to $17.0 million) necessitating a complete program restructure which resulted in a program slip of six months and the

initiation of engineering development (ED) at a lower level of effort than initially anticipated. During FY 1976 and FY 197T, design changes to the warhead, fuze, roll-rate sensor and seeker gyro were tested. The final two advanced development (AD) prototypes were successfully fired. The first was fired at a tank illuminated by a designator mounted in a remotely piloted vehicle (RPV) and the second was fired at a moving tank illuminated by a helicopter-mounted designator during darkness. The majority of component testing was completed and subsystem development testing was continued. Producibility Engineering and Planning (PEP) was initiated in December 1976 under Congressionally imposed dollar and time constraints. The PEP constraints were lifted in April 1977. During FY 1977 subsystem testing was completed and the first series of contractor test firings were conducted at White Sands Missile Range. Contractor firings were initiated in March 1977. The first four of these firings failed to achieve target hits due to isolated component failures and calculation of inadequate guidance commands. These deficiencies were corrected and three target hits were achieved during the next five firings on stationary and moving targets.

2. FY 1978 Program: PEP and the contractor baseline firings will be completed during this period. Additionally, 50% of the prototype qualification tests will be completed. Operational Tests (OT II), which includes the firing of 80 projectiles, will be initiated in September 1978. Initiation of Procurement of Ammunition, Army is planned with the award of an Initial Production Facilities contract in January 1978. This effort will provide for the procurement of long lead, special production machinery which is design independent. Efforts to validate the Technical Data Package will be initiated.

3. FY 1979 Planned Program: Prototype Qualification Tests will be completed as will Operational Tests. Test reports will be prepared and the *Cost and Operational Effectiveness Analysis* will be completed. The Defense Systems Acquisition Review Council will review the program for a Low Rate Initial Production decision. Initial Production Facilitization will be completed through procurement of special tooling required to adapt the production facility for fabrication of the final design. A low rate production contract will be awarded in order to produce projectiles for production validation testing and fielding to implement the Congressional guidance contained in PL 95-79 and PL 95-184. The reduction in Research, Development, Test and Evaluation (RDTE) funding between FY 1978 and FY 1979 reflects nearing the completion of the development program.

4. FY 1980 Planned Program: RDTE funding in FY 1980 is required to support the conduct of Development Test (DT) III and to complete the validation of the Technical Data Package by the Naval Avionics Facility at Indianapolis, Indiana and to support the conduct of Operational Tests III. The FY 1980 effort will complete the development program.

5. Program to Completion: Not Applicable.

Program Element: #6.46.21.A
DoD Mission Area: #413 - Fire Support

Title: COPPERHEAD (Cannon Launched Guided Projectile)
Budget Activity: #4 - Tactical Programs

I. Test and Evaluation Data:

1. Development Test and Evaluation: The development contractor is the Martin Marietta Corporation, Orlando, FL. A competitive feasibility demonstration of the Martin Marietta and Texas Instruments advanced development (AD) versions of the COPPERHEAD was completed in April 1975. Targets included panels and both stationary and moving tanks at ranges from 4 to 16 kilometers. The Texas Instruments version achieved one hit out of twelve rounds fired. The Martin Marietta version achieved 8 hits out of 12 rounds fired including two hits on moving tanks, a hit on a stationary tank that had been designated from a remotely piloted vehicle, and a hit on a moving tank designated by the Airborne Target Acquisition and Fire Control System (ATAFCS). Contractor and Prototype Qualification Tests for the engineering development version which began in March 1977 are being conducted primarily by the US Army Test and Evaluation Command (TECOM) at White Sands Missile Range (WSMR). Major subtests include basic performance, environmental qualification, battlefield environment, cold weather performance and range performance and reliability. Nuclear effects, nuclear-biological-chemical decontamination, air transportability and electromagnetic radiation effects will also be tested and firing table data determined. Development Test III (DT III) will be conducted by TECOM at WSMR beginning in December 1979 to verify that the low rate initial production projectiles meet system specifications when manufactured in accordance with production processes.

2. Operational Test and Evaluation: Operational Test I (OT I) was conducted at White Sands Missile Range during 25 March - 30 April 1974. Firings were not included as part of OT I as prototype projectiles were unavailable. Test results indicated that a Forward Observer (FO) section equipped with the Ground Laser Locator Designator (GLLD) could successfully complete an artillery fire mission. OT II will be conducted by the US Army Operational Test and Evaluation Agency (OTEA), independent of DT II, utilizing prototype hardware and typical user troops. The test is to be conducted during the period September - November 1978 at Fort Carson, Colorado. OT II will consist of two subtests and will utilize production representative hardware. The nonfire subtest phase will be conducted under conditions of day, night using night sight, and night using illumination rounds. Acquisition, tracking, engagement, training, and command-control-communications (CCC) will be addressed. During the live fire subtest phase, eighty COPPERHEAD rounds with full guidance and control will be fired against single and multiple moving target arrays. Ten will have live warheads. Conventional artillery missions will be interspersed with COPPERHEAD missions. This phase will add to the data base collected in the first phase. OTEA will provide its independent evaluation to the Army System Acquisition Review Council (ASARC) prior to entry into low rate initial production. Operational Test III is scheduled to be conducted by OTEA independent of Development Test III utilizing low rate initial production hardware and typical user troops. OT III will be conducted in two phases. Phase I will be a nonfiring exercise while Phase II will be a live firing exercise. Operational testing will be completed before a full production decision is made. OTEA will provide its independent evaluation to ASARC/DSARC IIIa. The results of Operational Testing, coupled with the Developmental Testing, will be utilized to thoroughly evaluate the reliability and maintainability of the projectile.

Program Element: #6.46.21.A
DoD Mission Area: #413 - Fire Support

Title: COPPERHEAD (Cannon Launched Guided Projectile)
Budget Activity: #4 - Tactical Programs

3. System Characteristics:

Operational/Technical Characteristics	Objective	Demonstrated
Weight (pounds)	150	137
Length (inches)	54	54
Accuracy (CEP-ft)1/		(during Advanced Development)
Range (km)		
Maximum	16-24	16
Minimum	1.5-3.0	4
Lethality (Probability of a kill given a hit)		*
Reliability	.96	*

* To be demonstrated during development and operational testing (DT/OT II).

1/ CEP - Circular Error Probable

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.23.A
DoD Mission Area: #412 - Close Combat

Title: VIPER
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	12406	6515	6283	0	0	25204
	Quantities						
	Training Rounds						2700
	Tactical Rounds						2400
D072	VIPER	12406	6515	6283	0	0	25204

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is to develop a low-cost, lightweight, shoulder-fired antitank weapon to replace the inadequate M72A2 light antitank weapon (LAW). VIPER system is a short-range, portable, unguided, rocket weapon which consists of a tactical weapon and a training device. The tactical weapon consists of a free-flight in-tube burning rocket, packaged/sealed in an expendable launcher that serves as the tactical storage container. The training device utilizes the tactical launcher and a practice rocket similar to the tactical rocket. The launcher contains the sighting system, firing mechanism, safety interlocks, and closures, shoulder stop and carrying sling. The tactical rocket consists of a propulsion unit, a precision warhead unit, and a dual-safety and arming device. Viper reaches twice as far and hits a third harder than its predecessor, the M72A2 LAW. The VIPER obtains very high thrust for a few milliseconds due to largest burning surface area possible within other system constraints and the use of a high burning rate propellant. Increased range and kill probability due to a better warhead and considerably higher hit probability which stems from twice the velocity and a flatter trajectory than the M72A2 LAW. An operational requirement exists for this VIPER system to replace the current M72A2 light anti-tank weapon (LAW), by providing for a greater hit probability, greater lethality, longer effective range, and increased reliability of the fuzing system.

C. BASIS FOR FY 1979 RDTE REQUEST: The funds will be utilized to complete the VIPER test program, i.e., complete Prototype Qualification Test - Contractor (PQT-C); and perform Prototype Qualification Test-Government (PQT-G); and Operational Testing II (OT-II). Effort will be expended during this time frame to complete the Producibility Engineering and Planning (PEP) effort and to finalize the technical data Package. The development acceptance in-process review will be held in 4Qtr FY 1979, and the system type classified standard.

Program Element: #6.46.23.A
DoD Mission Area: #412 - Close Combat

Title: VIPER
Budget Activity: #4 - Tactical Programs

Significant Milestones

(1)	Design Freeze	2nd Qtr. FY 1978
(2)	DEVA IPR	4th Qtr. FY 1979
(3)	Initial Production Award	1st Qtr. FY 1980
(4)	Initial Operational Capability (IOC)	

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

Procurement Ammunition, Army	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Funds (VIPER)	-	-	0	27900	*50100	78000
Quantity (000) (VIPER)	-	-	0	156	330	486
					*Thru FY 1983	
Rocket Training RD (PRACTICE)						
Funds (Thousands)	-	-	0	16100	*37500	53600
Quantity (000)	-	-	0	885	2625	3510
					*Thru FY 1983	

E. DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop a low-cost, lightweight, shoulder-fired anti-tank weapon to replace the M72A2 LAW (Light Antitank/Assault Weapon). A replacement for the M72A2 LAW has been under consideration for several years. A substantial effort has been focused on product improving the current LAW, investigating and testing possible foreign operational and developmental candidates, and developing a strong technology base from which state-of-the-art solutions could be evaluated. After a long and comprehensive review by the user and developer, the requirement for a high performance LAW-type system was reaffirmed. Basically, the requirement described a low-cost, lightweight and effective weapon which could be proliferated on the battlefield as a last-ditch measure to stop enemy armor. The current M72A2 LAW was unacceptable. A product improved LAW, limited by rocket motor and launcher case dimensions, could not be upgraded sufficiently to overcome the serious deficiencies cited for the current LAW. Foreign systems were found to be either too big, too heavy, or too costly to meet the users operational concept and requirement. Having narrowed the replacement to the products of a technology program started

earlier, prototypes were manufactured and tested. A high performance light antitank weapon (LAW), type system with slightly larger dimensions, was selected over other candidates as providing the best mix of physical and performance characteristics. This selected concept was definitized in user requirements and will be developed in this program.

F. RELATED ACTIVITIES: Exploratory developments in Program Element (P.E.) 6.26.18.A, Ballistics Technology; P.E. 6.26.17.A, Small Caliber and Fire Control Technology; P.E. 6.23.03.A, Missile Technology; and the US Marine developmental multishot light antitank weapon are related to the VIPER program. In addition, under Headquarters US Army Materiel Development and Readiness Command projects 5772181 and 5782181, a facility will be provided to manufacture carborane, an ingredient within the rocket propellant system; also to provide necessary equipment for VIPER metal parts, and load, assembly, pack operations.

G. WORK PERFORMED BY: Development support activities are being conducted at Army Missile Research and Development Command (MIRADCOM), Huntsville, AL; US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, MD; Harry Diamond Laboratories, Adelphi, MD; Watervliet Arsenal, Watervliet, NY; Human Engineering Laboratory, Aberdeen, MD; and Anniston Army Depot, Anniston, AL. Three prime contractors showed interest in developing the VIPER: Northrop, Anaheim, CA; General Dynamics, Pomona, CA; and Day and Zimmerman, Texarkana, TX. General Dynamics was awarded the contract to provide necessary design, material, labor, equipment and facilities for the engineering development phase of the VIPER system. Subcontractors are: Atlantic Research Corporation, Gainsville, VA; Brunswick Corporation, Lincoln, NB; and Bulova Watch, Garden City, NY. Additionally, the Iowa Army Ammunition Plant, Burlington, IA is loading and assembling the warhead and assembling the complete system.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: In FY-76, VIPER was approved as a new start in Engineering Development (ED). Request for proposals for VIPER ED was issued to industry. Three firms responded and General Dynamics was awarded a contract on 27 Feb 76 for a 43-month ED effort. The in-house developed technology was transferred to the contractor early in the contract. The contractor evaluated alternative design approaches, materials, and fabrication techniques for the various components of the system. Engineering design testing was initiated early in FY-77; however, technical problems were encountered which prevented completion of the engineering design test as planned. Problems included dispersion, warhead dudding, and defective latch in launcher. The warhead dudding problem was resolved and solutions to the other problems are at hand.

2. FY 1978 Program: Final resolution of the problems encountered in development and testing will be accomplished early in FY-78. Engineering design tests are projected to be complete during 3rd Quarter. Hardware will be fabricated for Prototype Qualification Test - Contractor (PQT-C), Prototype Qualification Test - Government (PQT-G) and Operational Test II (OT-II). PQT-C testing will be initiated in 3rd Quarter. Additionally, Producibility Engineering and Planning effort will continue through FY-78. A contract will be awarded for production equipment to support VIPER hardware production. Approximately two-thirds of the FY-78 funding will be applied to the contractor effort with the remaining going to in-house Government support.

Program Element: #6.46.23.A
DoD Mission Area: #412 - Close Combat

Title: VIPER
Budget Activity: #4 - Tactical Programs

3. FY 1979 Planned Program: Prototype Qualification Test - Contractor (PQT-C) and Prototype Qualification Test - Government (PQT-G) will be completed. Hardware fabrication for Operational Test II (OT II) and conducting of the OT II will be completed. The Development Acceptance In-Process Review (DEVA IPR) will be held and the system type classified "standard". Producibility Engineering and Planning (PEP) effort for production planning will continue.

4. FY 1980 Planned Program: VIPER system to include tactical and training rounds will enter into production.

5. Program to Completion: Procurement actions coincidental with RDTE will be initiated. Subsequently, a second production source for VIPER system will be qualified. Training necessary to introduce the system into the hands of troops will be conducted.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.26.A
DoD Mission Area: #413 - Fire Support

Title: Forward Observer Vehicle (FOV)
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5999	807	3700	300	6500	24572
	Quantities						
DG23	Improved TOW Vehicle (ITV)	5999	807	0	0	0	14072
DF23	Forward Observer Vehicle (FOV)	0	0	3700	300	6500	10500

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program includes the ITV project which will complete engineering development and type classification in FY 1978, and will enter the procurement program. The FOV project will provide to the forward observer an M113A1 carrier equipped with the necessary communications, position navigation equipment, and Ground Laser Locater Designator (GLLD) integration into the elevated module developed in the ITV program so as to protect the forward observer from fragmenting munitions and small arms fire.

C. BASIS FOR FY 1979 RDTE REQUEST: The FOV project represents a new start in FY 1979. The request supports the engineering development to integrate the communications equipment required by the forward observer to support the Fire Integration Support Team (FIST) concept, position navigation equipment to include a north seeker module, and the GLLD integration into the elevated module developed under the ITV program.

Major Milestones	Date
Communications Integration Engineering Development Complete	Jan 80
Start Position Navigation and North Seeker Initial Engineering	Feb 80
Start GLLD Under Armor Integration	Jun 80
System Operational Test (OT)/Development Test (DT) II	Jan 81- Jun 81
Production Decision	Jul 81

D. OTHER APPROPRIATION FUNDS: Procurement funds to purchase the FOV kit have not been identified principally because the cost of the kit is currently unknown. Military construction costs are not anticipated.

Program Element: #6.46.26.A
DoD Mission Area: #413 - Fire Support

Title: Forward Observer Vehicle (FOV)
Budget Activity: #4 - Tactical Programs

E. DETAILED BACKGROUND AND DESCRIPTION: The field artillery forward observer (FO) party needs a system to integrate an interface observation designation and location of target functions. The system will support maneuver units in both mounted and dismounted operation. The FO's most severe operational deficiencies exist in armor, mechanized infantry, and armored cavalry units. The FO is the weakest element in the field artillery system because of deficiencies in position and target location accuracy and responsiveness. A fully integrated vehicular mounted system will provide greatly increased effectiveness on the modern battlefield as a result of significant savings in the volume of fire required to achieve the desired effect. The forward observer vehicle kit will be a modular system for interfacing position location, observation, target locating, and target designating components. The system concept will be based on internal configuration within an M113A1 carrier that permits the FO party to utilize the equipment or equipment modules with the vehicle in motion, stopped, or dismounted.

F. RELATED ACTIVITIES: This developmental program is a logical derivative of the elevated module developed in the Improved TOW Vehicle (ITV) program.

G. WORK PERFORMED BY: The overall in-house program responsibility lies with the US Army Tank-Automotive Research and Development Command (TARADCOM), Warren, MI; with assistance from three other agencies: the US Army Electronics Research and Development Command, Adelphi, MD; the US Army Engineering Test Laboratories, Fort Belvoir, VA; and the US Army Missile Research and Development Command (MIRADCOM), Huntsville, AL. The majority of the work will be contracted to private businesses yet to be identified.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: This program in FY 1977 supported exclusively the development of the ITV during the final phases of engineering development, testing and evaluation, and final design modification changes.

2. FY 1978 Program: Complete development of the ITV program, specifically producibility engineering and planning; and finalize Development Test II and integrated logistics support planning.

3. FY 1979 Planned Program: These funds will permit the start of development engineering of the FOV by acquiring materiel and parts for eight prototypes, complete fabrication of eight prototypes (2 prototypes which will be built for Development Test (DT)/Operational Test (OT) II testing. Additionally, this budget request supports the Project Manager and an eight-person staff, system definitions study, and provides technical services of an engineering, maintenance, purchasing, and quality assurance nature.

4. FY 1980 Planned Program: These funds support completion of the integration of the communication system into the M113A1 carrier.

Program Element: #6.46.26.A
DoD Mission Area: #413 - Fire Support

Title: Forward Observer Vehicle (FOV)
Budget Activity: #4 - Tactical Programs

5. Program to Completion: Program to completion will place the Ground Laser Locator Designator (GLLD) under armor, provide an integrated logistics support planning, and integrate the position navigation locating system and north seeking modules. Complete system testing will also be conducted during the FY 1981 period.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.27.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Weapons and Ammunition, 8-Inch
Budget Activity: #4 - Tactical Programs

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4942 1/	1748	687	2581	Continuing	Not Applicable
	Quantities						Not Applicable
D389	8-Inch Howitzer, Self-Propelled, M110A1E1	1066	1423	687	0	0	15876
D666	Ammunition, Cannon, 8-Inch	3876	325	0	2581	Continuing	Not Applicable

1/ Includes Project D666, Ammunition, Cannon, 8-Inch, which was previously carried in Program Element 6.46.02.A, Weapons and Ammunition.

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of this program is to develop an improved 8-Inch Self Propelled (SP) Howitzer Weapon System by providing a new cannon with muzzle brake, improved 8-Inch Rocket Assisted Projectile XM650 and new propelling charge M188E1. When completed, the program will provide a range improvement that will surpass all but one of the possible currently fielded threat cannon artillery systems.

C. BASIS FOR FY 1979 RDTE REQUEST: To provide for completion of M426 (8-Inch Chemical Round) and M509 (8-Inch Improved Conventional Munitions (ICM) Dual Purpose (DP) Round) compatibility testing and qualification (Safety Tests, Range Table Tests, Fuze Tests, Functional Tests) in the M110A1E1 System. To refurbish three remaining test howitzers for return to inventory.

D. OTHER APPROPRIATION FUNDS: ($ in thousands)

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Weapons and Tracked Combat Vehicles)						
M110A2 howitzers	0	109300	0	0	To be determined	Not Applicable
(Quantities)	0	(209)	0	0		
Howitzer modification kits	16800	9600	16000	8200	17700	117300
(Quantities)	(841)	(841)	(841)	(841)	(1046)	(6933)
Procurement (Procurement Ammunition, Army)						
M188A1 propellant	0	31100	25600	26700	Continuing	Not Applicable
(Quantities in thousands)	0	(165)	(114)	(114)		

Program Element: #6.46.27.A
DoD Mission Area: #413 - Fire Support

Title: Field Artillery Weapons and Ammunition, 8-Inch
Budget Activity: #4 - Tactical Programs

	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
M650 projectile	0	4400	4900	4700	Continuing	Not Applicable
(Quantities in thousands)	0	(6)	(6)	(6)		

E. DETAILED BACKGROUND AND DESCRIPTION: The purpose of this program is to develop an improved 8-Inch Self Propelled (SP) Howitzer Weapons System which will increase the range capability of the present 8-Inch System with standard unassisted projectiles and developmental unassisted and rocket assisted projectiles. The program also provides for continued development of an extended range propelling charge M188E1 for the M110A1 Howitzer. The M110A1 Howitzer and M188 charge (Zone 8) were type classified standard in FY 1976. The M188E1 (Zone 9 or top zone) development will add an additional powder increment to provide the required maximum system range capability. The XM650 projectile combines a rocket motor and aerodynamic shape to extend the range beyond the present limit. The improved fragmentation warhead and high explosive filler increase the lethality. The XM650 projectile is ballistically similar to the XM753 nuclear projectile. The M110A1E1 has a new long cannon and muzzle brake. Type classification of the muzzle brake, zone 9 and XM650 is scheduled for Mar 78. At that time the M110A1E1 will become the standard M110A2. It is planned to convert all fleet M110 8-inch howitzers and M107 guns to the final M110A2 configuration.

F. RELATED ACTIVITIES: The XM736 projectile (Program Element (PE) 6.46.10, Lethal Chemical Munitions Project DF94), XM753 projectile (PE 6.46.03.A, Nuclear Projectile and M422 Modifications Project D663) and XM711 projectile (PE 6.36.28.A, Field Artillery Ammunition Development Project D007) are directly related to upgrading of the 8-Inch Self-Propelled (SP) Howitzer System. There is continuing coordination with the Navy and Marine Corps to avoid any duplication of effort and to maintain as much compatibility as possible. This is especially true with respect to projectiles.

G. WORK PERFORMED BY: In-house efforts are being executed by Product Manager for M110E2 Weapon System, US Army Armament Research & Development Command, (ARRADCOM) at Rock Island, IL; Dover, NJ; and Watervliet, NY; Aberdeen Proving Ground, Aberdeen, MD; Yuma Proving Ground, Yuma, AZ; Dugway Proving Ground, Dugway, UT; and Jefferson Proving Ground, Madison, IN. No contractor is involved in FY 1979 with Project D389 8-Inch Howitzer, M110A1E1. Contractors performing work under Project D666, Ammunition, Cannon, 8-Inch, are Norris Industries, Vernon, CA; Ferrulmatic Inc., Peterson, NJ; and Haber Inc., Canoga Park, CA.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 and Prior Accomplishments: Feasibility testing of the XM188 propelling charge was conducted in FY 1968 and 1969 with development beginning in FY 1971. Initiation of the effort to improve the 8-Inch Self Propelled Howitzer began in 1969. Initial testing was completed in the early 1970's and the bulk of Development Testing II (DT II) and Operational Testing II (OT II) of the M110E2 Howitzer was conducted during 1974 (testing included fatigue tests, armament tests, ammunition safety tests, firing tables, operational testing and service testing). During Development Test II it was determined that zone 9 of the M188E2 propelling charge exceeded the total momentum transfer limits of the M110E2 Howitzer; therefore, additional zone 9 testing was

delayed pending resolution of this momentum problem. Advance Development (AD) of an 8-Inch, high-explosive, rocket assisted projectile began in FY 1970. The program was realigned in FY 1971 and lengthened by a year. The XM650 projectile Developmental Testing (DT) II phase began during FY 197T. DT and Operational Testing (OT) II of the M110E2 and zone 8 was completed in July 1975. Also in 1975, a low efficiency muzzle brake was selected as the solution to the M110E2 momentum problem. The development of the muzzle brake was scheduled concurrent with development of the top zone (Zone 9) of the 8-Inch propelling charge (M188E1) and XM650 High Explosive (HE) Rocket Assisted Projectile (RAP) to attain the full maximum range capability required of the Improved 8-Inch Weapon System. A Development Acceptance In-Process Review (DEVA IPR) for the M110E2 and zone 8 of the XM188 propelling charge was held on 16 December 1975. The improved M110E2 8-Inch Self Propelled (SP) Howitzer (Zone 8 capability) was type classified Standard as the M110A1, and the XM188 was type classified Standard as the M188 zone 8 Propelling Charge. Type Classification was finalized on 29 March 1976. Development of a zone 9 charge continued through FY 197T. Muzzle brake prototypes, required for future testing were ordered. The muzzle brake confirmatory test and durability test were completed. Final structural analysis on the muzzle brake was completed. M426 8-Inch Chemical simulant filled projectiles required for FY 78 testing, were manufactured. Testing of the M110A1E1 (M110A1 with muzzle brake), M188E1 propelling charge (Zone 9) and standard M106 High Explosive (HE) projectile was initiated. The M404 8-Inch Improved Conventional Munition (ICM) Antipersonnel (AP) projectile range tables and ammunition safety test with the M110A1E1 was initiated. Producibility Engineering and Planning (PEP) of the XM650 projectile was completed and also the production Technical Data Package (TDP). The XM650 Development Testing II (DT II) and Operational Testing II (OT II) projectiles were fabricated and testing initiated. A safety and reliability assessment of the M188E1 charge was completed.

2. FY 1978 Program: M426, 8-Inch Chemical, Projectile and M509, 8-Inch Improved Conventional Munition (ICM) Dual Purpose (DP), projectile compatibility testing (safety tests, range table tests, fuze tests and functional tests) with the M110A1E1 will be conducted. Development Test II/Operational Test II (DT/OT II) of the XM650 projectile, M188E1 propelling charge and the M110A1E1 howitzer will be completed and all items will be type classified during FY 1978. FY 78 funding requirements decrease due to near completion in FY 77 of XM650 and M188E1 efforts.

3. FY 1979 Planned Program: Three Howitzers used for all test activities will be refurbished and turned back into the supply system. M426 and M509 Projectiles will be qualified for use with the M110A1E1 howitzer. The bulk of efforts associated with the M110A1E1 will be completed prior to FY 1979, thereby, decreasing overall FY 1979 funding requirements.

4. FY 1980 Planned Program: The XM711 high explosive projectile will enter engineering development.

5. Program to Completion: The 8-Inch Self Propelled Howitzer program will be completed in FY 1979; however, the 8-Inch ammunition efforts will continue.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.28.A
DoD Mission Area: #413 - Fire Support

Title: Indirect Fire Training Munitions
Budget Activity: #4 - Tactical Program

A. RESOURCES (PROJECT LISTING): ($ in thousands)

Project Number	Title	FY 1977 Actual	FY 1978 Estimate	FY 1979 Estimate	FY 1980 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	0	2501	246	979	3726
	Quantities						Not Applicable
D250	Indirect Fire Training Munition	0	0	2501	246	979	3726

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports engineering development of low cost indirect fire training munitions for howitzers and mortars. The training rounds are full caliber projectiles which use pyrotechnic fuze spotting charges to provide realistic training to weapons crewmen and observers. The use of these munitions will permit significant savings in the annual costs of training ammunition.

C. BASIS FOR FY 1979 RDTE REQUEST: To conduct development test and operational test II (DT/OT II) of the 155mm projectile, initiate DT/OT II of the 81mm mortar round, initiate engineering development of the 60mm mortar and 105mm howitzer rounds, and procure projectiles for DT/OT II.

D. OTHER APPROPRIATION FUNDS: Not Applicable.

E. DETAILED BACKGROUND AND DESCRIPTION: This program supports development of a new family of artillery and mortar training projectiles which will reduce the cost of ammunition for training purposes and improve the methods of training artillery and mortar crews. Exploratory development efforts show that low cost training projectiles can be developed that will provide gunner

and forward observer training at a cost only half that of present high explosive (HE) projectiles. One of these concepts is a plastic jacketed mortar projectile filled with concrete. This projectile will provide the same exterior ballistics as the HE round and will upon impact produce a signature similar to the HE projectile. The 155mm and 105mm artillery projectiles will utilize thick walled, inert metal shells, which will be ballistically matched to the current high explosive projectile. The munitions will be fired using standard propelling charges which will provide realistic fire direction gunnery crewmen training and howitzer crewmen training. The conventional fuze will be replaced with a pyrotechnic spotting charge that provides a realistic flash, smoke and noise to train observer personnel. The mortar rounds will use the standard fins and propelling charges used with HE rounds. The fuze will be the same as for the artillery rounds. Cost savings will be derived from reduced shell costs, fuze costs and packaging costs. Estimated annual savings are in excess of 20 million dollars.

F. RELATED ACTIVITIES: This program element is the normal engineering development supporting program element 6.36.28.A, Field Artillery ammunition development. During FY 1977 and FY 1978 advanced development of the artillery and mortar training projectiles was conducted in program element 6.36.28.A.

G. WORK PERFORMED BY: US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; Aberdeen, MD. Contractors performing work in this area will be selected at a later date.

H. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1977 Prior Accomplishments: Advanced development of the 155mm projectile, XM804 and 81mm cartridge XM798 was initiated. Projectile and process design evaluation of the 155mm projectile was evaluated. Fuze and spotting signatures were evaluated, low cost packaging design was conducted, and 100 each XM798 cartridges were fabricated and tested for cartridge integrity. Initial mortar firings have demonstrated cartridge integrity and correct fuze functioning.

2. FY 1978 Program: Advanced development of the 155mm projectile will be completed with the ballistic firing of 300 rounds. 350 81mm cartridges will be fired and fuze suitability and spotting charge signature characterization will be completed. Development of the 105mm artillery training cartridge and the 60mm mortar cartridge will be initiated during the technology derived from the FY 1977 program.

Program Element: #6.46.28.A Title: Indirect Fire Training Munitions
DoD Mission Element: #413 - Fire Support Budget Activity: #4 - Tactical Program

3. FY 1979 Planned Program: Sufficient quantities of training projectiles will be fabricated for engineering development testing, safety testing, and the conduct of development test and operational test II (DT/OT II) testing. Developments acceptance in-process reviews (DEVA IPR) will be conducted for the 155mm projectile and 81mm mortar round. The items will be Type Classified and provide the Army a low cost training munition to reduce annual ammunition training costs.

4. FY 1980 Planned Program: Complete DT/OT II testing, conduct DEVA IPR and type classify the 105mm howitzer and 60mm mortar rounds. Initiate engineering development of 8-inch training projectile if required.

5. Program to Completion: Complete the 8-inch training projectile effort, conduct DT/OT II testing and type classify the projectile.

FY 1979 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #6.46.29.A
DoD Mission Area: #412 - Close Combat

Title: Cavalry Fighting Vehicle
Budget Activity: #4 - Tactical Programs

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