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DA PAM 5-6-1

Supporting Data FY 1991
Amended Budget Estimate

Submitted to Congress — January 1990

Descriptive Summaries Of The

DTIC
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MAR 14 1990
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RESEARCH DEVELOPMENT TEST AND EVALUATION Army Appropriation

"READINESS THROUGH MODERNIZATION"

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DEPARTMENT OF THE ARMY OFFICE OF THE ASSISTANT SECRETARY OF ARMY (FINANCIAL MANAGEMENT)
INVESTMENT DIVISION, RDTE BRANCH

*This pamphlet supersedes DA PAM 5-6-1, January 1989.

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FY 1991 AMENDED RDT&E
PROGRAM ELEMENT DESCRIPTIVE SUMMARIES
INTRODUCTION AND EXPLANATION OF CONTENTS

1. **General.** This section has been prepared for the purpose of providing information concerning the US Army Research, Development, Test and Evaluation program. The Descriptive Summaries provide narrative information on all RDT&E,A program elements and projects.

2. **Relationship of Amended FY 1991 Budget Structure to the FY 1990 Budget Approved by Congress.** This paragraph provides a list of program elements restructured, transitioned, or established to provide specific program identification.

A. Program Element Restructures

OLD PE/PROJECT	TITLE	NEW PE/PROJECT
0602120A/A035	TRACTOR FIELD	0602123A/AC14
0603314A/A431	TRACTOR CAGE	0603322A/AB60
0603270A/D025	TRACTOR NAIL	0603271A/DC15
0603270A/A042	Electronic Warfare Technology	0602270A/A442
0603270A/A904	Electronic Warfare Technology	0602270A/A906
0203739A/D245	FAAD, C2 ED	0604741A/D126
OPA	Close Combat Tactical Trainer	0604715A/D574

B. Developmental Transitions of Major Programs

OLD PE/PROJECT	**TITLE**	**NEW PE/PROJECT**
0603619A/D005	Landmine Warfare	0604619A/D088
0603619A/D606	Landmine Warfare/Barrier — ED	0604808A/D415
0603804A/DK39	Logistics and Engineer Equipment — ED	0604804A/DL39
0603804A/D428	Logistics and Engineer Equipment — ED	0604804A/D429
0603612A/096	Advanced Antitank Weapon System — Heavy to Engineering Development (FY91)	0604819A/DE07
0603745A/D406	Joint Tactical Fusion Program	0604321A/DB20

C. Establishment of New Program Elements

TITLE	NEW PE/PROJECT
Electronic Warfare Technology	0602270A/A442, A906
TRACTOR NAIL	0603271A/DC15
TRACTOR CAGE	0603322A/AB60
TRACTOR FIELD	0602123A/AC14
Armed Army Helicopter Improvement Program (AHIP)	0604220A/D518
Classified Program	0604812A/DB59

3. The following program elements are **Classified/Special Access** Programs and are submitted off line through OSD. Details will be furnished upon request.

0602122A

0602123A

0602788A

0603009A

0603012A

0603013A

0603271A

0603322A

0102814A

0603639A

0603754A

0603808A

0604754A

0604812A

0604813A

0604815A

0604817A

0203806A

0203808A

0301359A

4. **Classification.** Classified information is identified by use of brackets [ ]. The abbreviation OADR used in the classification block throughout this document means Originating Agency Determination Required.

5. A Test and Evaluation Section is provided for all major weapon systems (identified by asterisks in the Table of Contents).

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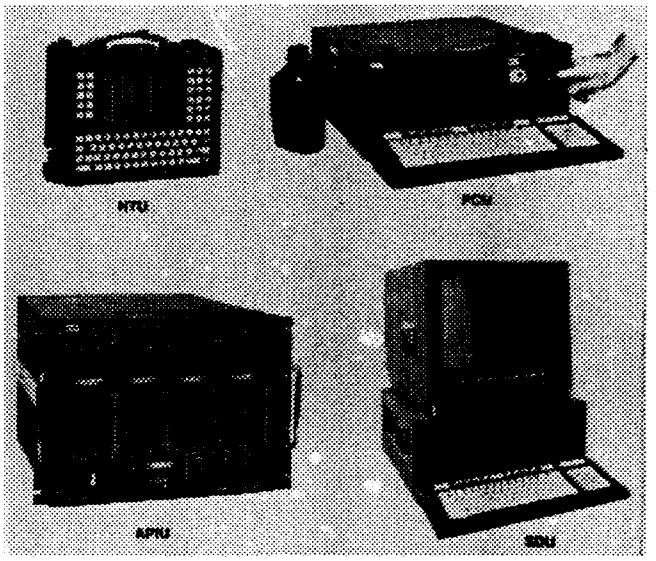
FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203726A**
PE Title: **Advanced Field Artillery Tactical Data System**
Project Number: **D322**
Budget Activity: **#4**
Project Title: **Advanced Field Artillery Tactical Data System**



POPULAR NAME: **AFATDS**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		ASARC II 7/89 DAB 9/89			ASARC III 3Q 93
Engineering Milestones		Concept Eval Pln SW Dev 1/89	SDR 1/90 SRR 4/90	CDR 5/91	FUE 2Q 93
T&E Milestones		Concept Eval Test 4/89		SST 7/92 FDTE 9/92	IOT&E 3Q 93 FOT&E 3Q 94
Contract Milestones			FSD Contract Award 3/90	V2 OPT 5/91	V3 Start 3Q 93
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		3000	11971	24532	Cont
Support Contract		12352	14698	15706	Cont
In-House Support		1670	2409	3110	Cont
GFE/ Other			2922	2416	
Total		17022	32000	45764	Cont

Program Element: **#0203726A** Project Number: **D322**
PE Title: **Advanced Field Artillery Tactical Data System** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Advanced Field Artillery Tactical Data System (AFATDS) will broaden and modernize the US Army fire support command, control and communications (C^3) system. As a battle management system, AFATDS will provide automated fire support in the Army Tactical Command and Control System (ATCCS) architecture in support of close, rear and deep operations, nuclear, non-nuclear and chemical fire planning and the coordination of/and the employment of all service/combined fire support assets to complement the commander's scheme of maneuver. AFATDS will accomplish this by providing fully automated support for planning, coordination and control of all fire support assets (mortars, close air support, naval gunfire, attack helicopters, offensive electronic warfare, field artillery cannons, rockets and guided missiles) in the execution of close support counterfire, interdiction and suppression of enemy air defense and deep operations. AFATDS will automatically implement detailed commander's guidance in the automation of operational planning, movement control, targeting, target value analysis and fire support planning. AFATDS is composed of a common suite of hardware and software (ATCCS Common Hardware/Software (CHS)) employed in varying configurations at different operational facilities (or nodes) interconnected by tactical communications in the form of a software-driven, automated network. Both hardware and software will be capable of being tailored to perform the fire support command, control and coordination requirements at any level of command. This will permit variable command and control relationships and full fire support functionality at all echelons of field artillery and maneuver, from corps to battery or company in support of all levels of conflict. The Marine Corps will utilize AFATDS for their FIREFLEX System. The Marine Corps unique requirements will be added to the Army system.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Complete formal qualification test
- **(U)** Complete concept evaluation (CE)
- **(U)** Complete Milestone II review Army Systems Acquisition Review Council (ASARC)
- **(U)** Defense Acquisition Board (DAB)
- **(U)** Initiate Marine Corps requirements analysis/system definition for AFATDS participation

(U) FY 1990 Planned Program:

- **(U)** Award full-scale development (FSD) contract
- **(U)** Start system integration using Army Tactical Command and Control System (ATCCS)
- **(U)** Conduct system requirements review for version I software

(U) FY 1991 Planned Program:

- **(U)** Demonstrate a segment of AFATDS concept exploration software running on ATCCS Common Hardware/Software (CHS)
- **(U)** Complete preliminary and detailed design of AFATDS version 1 software
- **(U)** Conduct critical design review (CDR) of each computer software configuration item (CSCI), and after successful completion of each CDR, initiate coding for each CSCI

D. (U) WORK PERFORMED BY: The support contract was awarded to ARC Professional Service Group, Shrewsbury, NJ in August 1986. The system design and concept evaluation contract for the AFATDS software was awarded to Magnavox Government and Industrial Electronics Company, Ft. Wayne, IN in May 1984. The in-house developing agency is the US Army Communications Electronics Command (CECOM), Ft. Monmouth, NJ.

Program Element: **#0203726A** Project Number: **D322**
PE Title: **Advanced Field Artillery Tactical Data System** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** ASARC II approved the stretchout of the FSD program from 37 to 47 months to facilitate software porting and reduce overall program risk.
3. **(U) COST CHANGES:** The increase in the length of the FSD program required RDTE increases in FY91 and beyond and corresponding decreases in the AFATDS procurement funding.

F. (U) PROGRAM DOCUMENTATION:

Mission Element Need Statement		03/81
Letter of Agreement		12/84
System specification		12/88
Draft Required Operational Capability (ROC)		05/87
Operational & Organizational Plan	(Updated)	05/87

G. (U) RELATED ACTIVITIES: USMC FIREFLEX Program. PM CHS Common Hardware/Software and SICPS Program. Forward Entry Device (FED). PE #0604779A (Joint Interoperability of Tactical Command & Control Systems (JINTACCS)). PE #0604818A (Army Tactical C3I Systems Engineering). The Advanced Field Artillery Tactical Data System (AFATDS) is part of the overall Army Tactical Command and Control System (ATCCS) which is managed by the Program Executive Office Command and Control Systems (PEO-CCS). No unnecessary duplication exists.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

J. (U) TEST AND EVALUATION DATA:

Test and Evaluation Activity (Past 12 Months)

Event	Planned Date	Actual Date	Remarks
Concept Evaluation	3Q89	3Q89	Completed on schedule

Test and Evaluation Activity (Next 12 Months)

Event	Planned Date	Remarks
None		

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203735A**

PE Title: **Combat Vehicle Improvement Programs** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

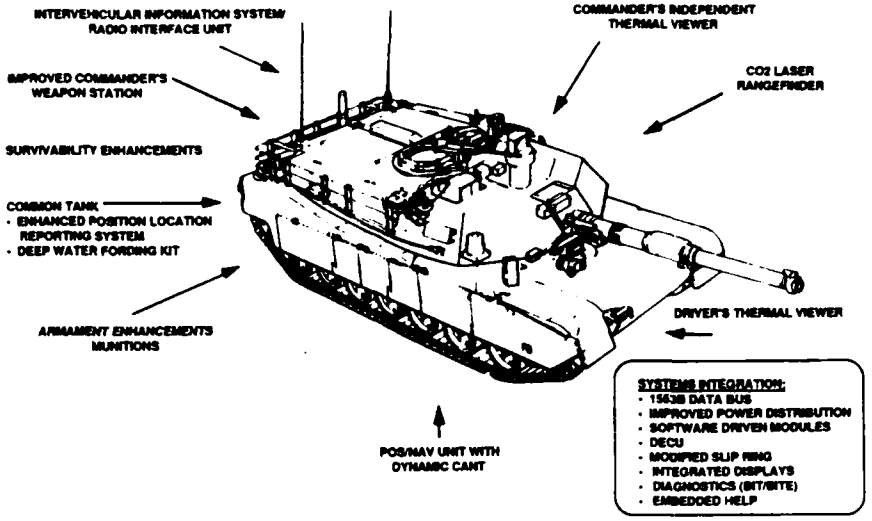
Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D280 Recovery Vehicle Improvement Program	1868	- 0 -	- 0 -	- 0 -	
D330 M1A1 Block Improvement Program	103803	52681	90697	Cont	Cont
D332 M2/M3 Fighting Vehicle Improvement Program	20950	9544	7054	Cont	Cont
D342 105mm Armor-Piercing Cartridge Product Improv Program	9502	- 0 -	- 0 -	- 0 -	
PE TOTAL	136123	62225	97751		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The technological advances in the USSR's armored force modernization efforts require a dedicated and timely Army evolutionary improvement program to improve or maintain combat capabilities of its Abrams tank fleet and its Bradley M2/M3 Fighting Vehicles in relation to future threat armored forces. This program element provides survivability and fightability enhancements for the combat vehicle fleet. The objective of the Abrams tank and M2/M3 Fighting Vehicle Block Improvement Programs is to enhance combat survivability and increase effectiveness by incorporating design changes and improvements into the current production vehicles. The objective of the Recovery Vehicle Improvement Program was to improve the Recovery Vehicle by providing a system with the tractive power, winching and lifting capabilities required to support effectively the Abrams series tank. The 105mm Armor-Piercing Cartridge Product Improvement Program was designed to provide an improved anti-tank capability to Abrams and M60 series tanks equipped with 105mm cannons by means of an improved XM 900E1 kinetic energy round, with type classification in FY 1989.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203735A** Project Number: **D330**
PE Title: **Combat Vehicle Improvement Programs** Budget Activity: **#4**
Project Title: **M1A1 Block Improvement Program**

BLOCK II IMPROVEMENT ELEMENTS



POPULAR NAME: **Abrams Tank**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		FSD Cont 12/88 PDC ICWS 5/89; M1A2 PDR 6/89; CDR 9/89	HFM MDR 2Q90 Block III MSI 3Q90	Block III MSII 4Q91	M1A2 MS IIIA 2Q92
Engineering Milestones		ICWS Drawing package complete 12/88	M1A2 Manufacturing TDP 2Q90; CO_2 LRF/GPS; Qual 11/89-4/90	CITV, POS/NAV, RIU Qualification 4Q90-1Q92	M1A2 TDP 10/92 Block III FSD
T&E Milestones		CO2 LRF PPT-G 8-12/89, ICWS OA 12/88		M1A2 PPT-C 4-9/91, M1A2 PPT-G 7-9/91,	M1A2 PPT-C M1A2 PPT-G M1A2 UT
Contract Milestones		FSD maj subcnt awards 1Q89	Long-lead prod award 2Q90	M1A1 Prod cont award 4Q91	M1A2 cont MOD 2Q92
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		93003	39181	65797	Cont
Support Contract		- 0 -	- 0 -	- 0 -	- 0 -
In-House Support		7500	9700	14600	Cont
GFE/ Other		3300	3800	10300	Cont
Total		103803	52681	90697	Cont

* Acronyms are listed at the top of the next page.

Program Element: **#0203735A** Project Number: **D330**
PE Title: **Combat Vehicle Improvement Programs** Budget Activity: **#4**

Acronyms:

PDC —	Production Decision Conference
ICWS —	Improved Commander's Weapon Station
CO2 LRF —	Carbon Dioxide Laser Range Finder
POS/NAV —	Position/Navigation
PDR —	Preliminary Design Review
CDR —	Critical Design Review
CITV —	Commander's Independent Thermal Viewer
TDP —	Technical Data Package
FSD —	Full Scale Development
PRR —	Production Readiness Review
IPR —	In-Process Review
ASD —	Abrams System Development
RIU —	Radio Interface Unit
SEA —	Systems Engineering Analysis
SRR —	Systems Requirement Review
SDR —	Systems Design Review
PQT —	Product Quality Test
PPT —	Production Prove Out Test
GPS —	Gunner's Primary Sight
OA —	Operational Assessment
UT —	User Test
CCATTD —	Common Chassis Advance Technology Transition Demonstrator
CATTB —	Component Advanced Technology Test Bed
ATACS —	Advanced Tank Cannon System
HFM —	Heavy Force Modernization
MDR —	Milestone Decision Review
OT —	Operational Test
MBT —	Main Battle Tank

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Abrams Main Battle Tank incorporates significant advances in crew protection, firepower, and mobility and was designed with growth potential in mind. The Abrams Block Improvement Program (BIP) provides for timely initiation of evolutionary improvements which anticipate threat changes and capitalize on technological opportunities. The BIP introduces time-phased product improvements to the production line in groups called "Blocks" to minimize production costs while providing effective configuration control. The FY1985 block improvements resulted in the M1A1 Abrams Tank which incorporates the 120mm gun system, a hybrid nuclear, biological and chemical (NBC) overpressure system, upgraded armor, and suspension/final-drive upgrade. The FY 1989-1992 Block Improvement (Block II) includes Crew Survivability Enhancements, Commander's Independent Thermal Viewer, Improved Commander's Weapons Station, Carbon Dioxide Laser Rangefinder (LRF), Position/Navigation System, and improvements that will generate operations and support (O&S) cost reductions. This BIP will significantly enhance the Abram's survivability, fightability and overall effectiveness on the battlefield. The common chassis ATTD with Block III Tank system design analysis and full scale development (FY92-FY96) of Block III will lead to enhanced capabilities beyond the year 2000.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Completed evaluation of ICWS and obtained production decision
- **(U)** Continued design/development of Block II core tank architecture and awarded major component sub-contracts
- **(U)** Awarded FSD contract
- **(U)** Received CO2 LRF prototypes and began development and qualification testing

Program Element: **#0203735A** Project Number: **D330**
PE Title: **Combat Vehicle Improvement Programs** Budget Activity: **#4**

(U) FY 1990 Planned Program:

- (U) Complete evaluation of CO2 LRF and obtain production decision
- (U) Complete manufacturing TDP and award long-lead production contract
- (U) Initiate CCATTD & Block III Tank system design analysis

(U) FY 1991 Planned Program:

- (U) Begin development and qualification testing of the M1A2 tank
- (U) Award production contract for M1A1 tanks
- (U) Complete competitive technical data package for M1A2 procurement

(U) Program Plan to Completion:

- (U) Block III FSD
- (U) Integration of Advanced Tank Cannon System
- (U) Completion of M1A2 drawing package
- (U) Complete evaluation of the M1A2 and obtain low-rate initial production decision
- (U) This is a continuing program

D. (U) WORK PERFORMED BY: In-house efforts accomplished by Tank Automotive Command, Warren, MI. Primary contractor is Land Systems Division, General Dynamics Corporation, Sterling Heights, MI. Block III is a subset of CCATTD supporting HFM-Heavy Variant. In house performed by multiple AMC MSCs. Contractors to be determined.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Areas of commonality/standardization include components, test methodology, software, configuration management, drawings and specifications. This effort is directed to reduce costs and facilitate logistics requirements in the M1A2.
2. **(U) SCHEDULE CHANGES:** FSD contract award delayed 4 months due to Congressional hold on release of CITV RFP pending leader/follower procurement strategy analysis. Further slip caused by termination of program following FY91 procurement buy.
3. **(U) COST CHANGES:** Due to need for two additional prototypes for testing and component standardization effort, the standardization effort will be an ultimate cost saver and aid to configuration management.

F. (U) PROGRAM DOCUMENTATION:

Abrams Block II Program Approval-HQDA In-Process Review	2/85
Preliminary Design Review	12/85
Critical Design Review—ICWS	3/87
System Requirements Review	3/88
System Design Review	6/88
Chief of Staff Army Decision Review	9/88
Defense Acquisition Board	12/88
Preliminary Design Review	4/89
Defense Acquisition Board	8/89
Critical Design Review	9/89

G. (U) RELATED ACTIVITIES:

- PE #0602601A (Combat Vehicle and Automotive Technology)
- PE #0603005A (Combat Vehicle and Automotive Advanced Technology)

Program Element: **#0203735A** Project Number: **D330**
PE Title: **Combat Vehicle Improvement Programs** Budget Activity: **#4**

- PE #0604630A (Advanced Tank Cannon System)
- There is no unnecessary duplication of effort within the Army or Department of Defense

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
1. PROCUREMENT Weapons & Tracked Combat Vehicles (M1A1) incl Adv. Proc. SSN G82917 M1A1 Tank	1332291	1373074	992324
2. MILITARY CONSTRUCTION Not Applicable			
3. HFM CCATTD RDTE Dollars (several PE/ Projects)		50300	113000

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:

A. US/UK Agreement concerning Armor Technology, 18 September 1979. Project is active with biannual meetings. The funding, schedules, program structure are classified.

B. US/GE Agreement concerning the harmonization of Abrams and Leopard 2 MBT to include the 120mm smoothbore gun and ammo; Addendum 3 adds emerging technologies to the areas of cooperation.

C. US/GE Combat Vehicle Command and Control (CVC2) MOU, 12 Sep 88, to define symbology, development a bilateral concept, conduct joint simulation experiments, maximize interoperability and possibly develop common hardware.

D. US/UK/FR/GE MOU concerning harmonization of Future Tank Main Armament (FTMA) will implement the 30 Sep 88 FTMA Harmonization Arrangement for a program to further define the FTMA parameters by initiating a cooperative FTMA demonstration phase (Phase I) and prepare a transition plan to Development - Phase II.

E. New agreements with NATO countries are being staffed for ATACS Gun and Ammo harmonization.

J. (U) TEST AND EVALUATION DATA: Data contained in Procurement Descriptive Summary.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203735A** Project Number: **D332**
PE Title: **Combat Vehicle Improvement Programs** Budget Activity: **#4**
Project Title: **M2/M3 Fighting Vehicle Improvement Program**

POPULAR NAME: **BRADLEY**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		Inc 600HP in Prod — 5/89			
Engineering Milestones		600 HP Tech Data Pack 11/88	Design Review Armor Upgrade 1/90	Final Design Review Armor Upgrade 1/91	
T&E Milestones		600 HP Engine IPT 6/89			
Contract Milestones		Incorp 600hp Engine 11/88 Armor Upgrade FSD AWD 8/89			
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		13567	8853	6100	Cont
Support Contract					
In-House Support		1977	691	954	Cont
GFE/ Other		5406	- 0 -	- 0 -	
Total		20950	9544	7054	Cont

Program Element: **#0203735A** Project Number: **D332**
PE Title: **Combat Vehicle Improvement Programs** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The technological advances of Soviet modernization efforts require an evolutionary improvement program to maintain the combat advantage of the Bradley Fighting Vehicles (M2-Infantry Fighting Vehicle and M3-Cavalry Fighting Vehicle). In the combined arms task force, the Bradley is the primary companion to the Abrams Main Battle Tank. This project will enhance the combat effectiveness of the Bradley through a series of product improvements. The current development program includes the following: continued survivability improvement efforts, optical improvements, biological and chemical protection, nuclear hardening and improved lethality.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- **(U)** Continued survivability improvement efforts
- **(U)** Incorporated 600hp engine into production

(U) FY 1990 Planned Program:
- **(U)** Continue survivability improvement efforts

(U) FY 1991 Planned Program:
- **(U)** Continue survivability improvement efforts
- **(U)** This is a continuing program

D. (U) WORK PERFORMED BY: Prime Contractor: FMC Corporation, San Jose, CA. In-house developing Organization: Project Manager for BFVS, Warren, MI; U.S. Army Tank-Automotive Command, Warren, MI; U.S. Army Ballistic Research Lab, Aberdeen Proving Ground, MD; U.S. Army Armament, Research, Development and Engineering Center, Dover, NJ.; U.S. Army Missile Command Redstone Arsenal, AL.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None.
2. **(U) SCHEDULE CHANGES:** None.
3. **(U) COST CHANGES:** Program restructured to support higher priority heavy force modernization project.

F. (U) PROGRAM DOCUMENTATION:

M2A2/M3A2 Program Approval-Army Acquisition Executive Memorandum, subject: Bradley Fighting Vehicle System (BFVS)	9/87
Decision Coordinating Paper for M2A1E1/M3A1E1 High Survivability BFVS	10/87
Test and Evaluation Master Plan (TEMP) for BFVS	9/88

G. (U) RELATED ACTIVITIES:
PE #0604802A (Weapons and Munitions-Engineering Development). Within this PE is Project D031 for 25mm Ammo Development. This effort is managed by the U.S. Army Armament, Research, Development and Engineering Center and consists of the M910 and XM919 rounds. There is no unnecessary duplication of effort within the Army or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate

Program Element: **#0203735A** Project Number: **D332**
PE Title: **Combat Vehicle Improvement Programs** Budget Activity: **#4**

1. PROCUREMENT
   Appropriation 2033 — Weapons and
   Tracked Combat Vehicles, SSNs GA7000

Bradley Fighting Vehicle	653450	540117	657360
	641	600	600
GZ2400 (Modification)	35600	31848	146135

2. MILITARY CONSTRUCTION
   Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) TEST AND EVALUATION DATA: Data contained in Procurement Descriptive Summary.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203740A**
PE Title: **Maneuver Control System** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D184	Maneuver Control Automated Data Processor Equipment				
	560	- 0 -	- 0 -		
D484	Maneuver Control System				
	11345	7295	25541	Cont	Cont
PE TOTAL	11905	7295	25541		

* Funding for Project D184 transferred to Project D484 starting in FY 1990.

B. (U) BRIEF DESCRIPTION OF ELEMENT: Maneuver Control is one of the five battlefield functional areas (BFA) of the Army Tactical Command and Control System (ATCCS). The Maneuver Control System (MCS) is the force level commander's information system and integrates the maneuver function with the command and control (C2) systems of the other four functional areas (Fire Support, Air Defense, Intelligence/Electronic Warfare and Combat Service Support). MCS serves the commander and staff at corps, division, brigade, and maneuver battalion, and provides automated assistance in the coordination of plans, dissemination of orders and guidance, and the monitoring and supervision of operations. MCS is a network of stand-alone computer devices with no central node whose loss could cause system failure. It is a hybrid system consisting of both fully militarized and ruggedized commercial Non-Development Item (NDI) equipment linked together by standard tactical Army communications systems. Software is written in the DOD standard language Ada. Since the initial MCS was introduced in Europe in 1981, this program has been, and will continue to be, an evolutionary development. The MCS capability continues to expand in pre-planned, time-phased steps toward the objective system in the mid 1990's. The recent insertion of an NDI Tactical Computer Processor (TCP) version of the full-militarized Tactical Computer Terminal (TCT) enables the integrated MCS system to capitalize on state-of the-art ruggedized commercial equipment and reduce life cycle costs. Commencement of the transition to Common Hardware and Software (CHS) began in FY 1989 with the initiation of the porting of Segment 11 software as well as the initiation of the integration of CHS into both the Standardized Integrated Command Post System as well as the existing command and control unit vehicles.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D184 — Maneuver Control ADPE: This project satisfies Army needs for intelligent terminals for automated field and data processing systems, capable of being used in a variety of support packages. This provides Integrated Logistic Support (ILS) for general equipment, both fully militarized and non-development items. Segment 10 provides implementation of command and control functionality on MCS NDI Equipment. It incorporates utilization of a commercial operating system (UNIX), a commercial data base management system (INFORMIX), and includes commercial integrated business packages (IBPs). It provides new functionality on decision graphics, replication of data bases at Corps, Divisions and Brigades, and supports interfaces with MSE and SINCGARS communications equipment.

(U) FY 1989 Accomplishments:

- **(U)** Completed MCS Segment 10 User Guides
- **(U)** Completed TCT Segment 10 User Guides

Program Element: **#0203740A**

PE Title: **Maneuver Control System** Budget Activity: **#4**

(U) FY 1990 Planned Program: Included in D484

(U) FY 1991 Planned Program: Included in D484

(U) Work Performed By: Project Manager, Operations Tactical Data Systems (OPTADS), Project Executive Office — Command and Control Systems (PEOCCS), Fort Monmouth, NJ; Ford Aerospace Corporation, Colorado Springs, CO is the prime contractor for Software Development. TRW, Inc., Carson, CA is the prime contractor for System Engineering and Integration. The Singer Company, Librascope Division, Glendale, CA is the Tactical Computer Terminal (TCT) production contractor. Ford Aerospace Corporation, Colorado Springs, CO is the Tactical Computer Processor (TCP) production contractor.

(U) Related Activities:
The Maneuver Control System (MCS) is part of the overall Army Tactical Command and Control System (ATCCS) which is managed by the Program Executive Office, Command and Control Systems (PEO-CCS) who ensures that no unnecessary duplication exists.

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
PROCUREMENT:			
Other Procurement, Army BA9300	9636	13914	- 0 -
MILITARY CONSTRUCTION			
Not Applicable.			

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203740A**
PE Title: **Maneuver Control System**
Project Title: **Maneuver Control System**

Project Number: **#D484**
Budget Activity: **#4**

NO PICTURE AVAILABLE

POPULAR NAME: **Maneuver Control System**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		FUE-NDI (TCP/AC) April 89			ASARC III (CHS) 3QFY92
Engineering Milestones		S10 Software Release Oct 88		S11 Software Release Nov 90	
T&E Milestones		Field Validation (TCT/TCP/AC) Aug 89	International Interop Demo May 90	FOT&E (CHS) Jan 92	
Contract Milestones		System Engr Option Award Aug 89	System Engr Option Award Aug 90	System Engr Option Award Aug 91	
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		9450	5219	23040	Cont
Support Contract		300	325	370	Cont
In-House Support		1595	1751	2131	Cont
GFE/ Other					
Total		11345	7295	25541	Cont

Program Element: **#0203740A** Project Number: **#D484**
PE Title: **Maneuver Control System** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Maneuver Control System (MCS) satisfies an urgent need for more efficient command and control of tactical operations on the battlefield. By using a mix of fully-militarized equipment and ruggedized non-development items (NDI), MCS provides commanders and staffs, at Corps through Battalion, more accurate, up-to-date information for quicker decisions and more effective utilization of firepower and maneuver resources. The MCS data base provides decision support information and functional tools in both text and map graphics form. The system also automates the preparation and distribution of operations orders and reports to facilitate the initiation and execution of the commander's decision. Reports received through MCS automatically update the data base ensuring that current tactical information is available whenever and wherever it is needed. Since the initial MCS was introduced in Europe in 1981, this program has been, and will continue to be, an evolutionary development. The MCS capability continues to expand in pre-planned, time-phased steps toward the objective system in the mid 1990s. The recent insertion of an NDI Tactical Computer Processor (TCP) to augment the full-militarized Tactical Computer Terminal (TCT) enables the integrated MCS system to capitalize on state-of-the-art ruggedized commercial equipment and reduce life cycle costs. Commencement of the transition to Common Hardware and Software (CHS) will begin in FY 1989 with the initiation of the porting of Segment 11 software as well as the initiation of the integration of CHS into both the Standardized Integrated Command Post System and the existing Command and Control Unit Vehicle.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Continued System Engineering/Integration for MCS
- **(U)** Began efforts for integration of common hardware into MCS
- **(U)** Began porting of software for use with common hardware
- **(U)** Continued preparations for interoperability demonstration with international systems

(U) FY 1990 Planned Program:

- **(U)** Continue System Engineering/Integration for MCS
- **(U)** Continue integration of common hardware into MCS
- **(U)** Continue porting of software for use on common hardware
- **(U)** Conduct interoperability demonstrations with International Systems (British French, German)

(U) FY 1991 Planned Program:

- **(U)** Continue System Engineering/Integration for MCS
- **(U)** Continue integration of common hardware into MCS
- **(U)** Complete software porting for common hardware
- **(U)** Prepare for operational testing using common hardware for production decision
- **(U)** Develop Common Software Architecture Modules that will be handed off to other Battlefield Functional Areas (BFA) which will preclude costly duplicate development efforts
- **(U)** Conduct segment 11 system software acceptance testing
- **(U)** Conduct common hardware/software software verification tests

D. (U) WORK PERFORMED BY: Project Manager, Operations Tactical Data Systems (OPTADS), Project Executive Office, Command and Control Systems (PEO-CCS), Fort Monmouth, NJ. Ford Aerospace Corporation (FAC), Colorado Springs, CO is the Prime Contractor for Software Development and Tactical Computer Processor (TCP) Production. The Singer Company, Librascope Division, Glendale, CA is the Tactical Computer Terminal (TCT) Production Contractor. TRW, Inc., Carson, CA is the Prime Contractor for System Engineering and Integration.

Program Element: **#0203740A** Project Number: **#D484**
PE Title: **Maneuver Control System** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not Applicable.
2. **(U) SCHEDULE CHANGES:** Not Applicable.
3. **(U) COST CHANGES:** Not Applicable.

F. (U) PROGRAM DOCUMENTATION:

Required Operational Capability (ROC)	7/82
Updated ROC	6/88
Decision Coordinating Paper (DCP)	5/83
Test and Evaluation Master Plan (TEMP) Service approved	7 /88

G. (U) RELATED ACTIVITIES: The Maneuver Control System (MCS) is part of the overall Army Tactical Command and Control System (ATCCS) which is managed by the Program Executive Office, Command and Control Systems (PEO-CCS) who ensures that no unnecessary duplication exists.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Other Procurement, Army			
Maneuver Control System BA9300	9636	13914	- 0 -

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: There are Memoranda of Agreement with United Kingdom, Federal Republic of Germany, and France.

J. (U) TEST AND EVALUATION DATA:

Test and Evaluation Activity (Past 12 Months)

Event	Planned Date	Actual Date	Remarks
First Article Test (FAT) on NDI Equipment	6/88	6/88	
Manuever Control Evaluation (MCE) at Ft. Lewis, WA	8/88	8/88	
Army Tactical Command and Control System (ATCCS) Experimentation Site	8/88	8/88	on-going
Field Validation (FV)	8/89	8/89	For materiel release

Test and Evaluation Activity (Next 12 Months)

Event	Planned Date	Remarks
Quadrilateral Interoperability Demonstration	5/90	Demo with British, French and German Systems

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203743A**
PE Title: **155mm Self-Propelled Howitzer Improvements**
Project Number: **#D008**
Budget Activity: **#4**
Project Title: **155mm Self-Propelled Howitzer Improvement Program**

POPULAR NAME: **HIP**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			Settle AAS term MS IIIA (TC-LP) 12/89		MS III TC-STD 2Q92
Engineering Milestones		Prototype 8 delivered 12/88	Design/Fabr Ballistic Covers; Complete Software Dev		Integrate Ballistic Covers into production
T&E Milestones		PQT Comp 1/89 TT 12/88-2/90 OT 6/89-7/89	Live Fire Test of Ballistic Covers	Complete Live Fire Tests	
Contract Milestones		FSD Definitized 10/88; LLI Awd 6/89; LLI 2nd Awd 8/89; LP Awd 12/89	Award Engineering Spt Contract		
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		19000	7000	5000	(0)
Support Contract		1000			
In-House Support		8440	3493	3809	(0)
GFE/ Other					
Total		28440	10493	8809	(0)

Program Element: **#0203743A** Project Number: **#D008**

PE Title: **155mm Self-Propelled Howitzer Improvements** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Specific system deficiencies addressed in the Howitzer Improvement Program include survivability; reliability, availability and maintainability (RAM); responsiveness; and terminal effects. The principal survivability enhancements are an automatic fire control system; on-board navigation-direction system; remotely operated travel lock; and night vision, permitting semiautonomous operations, and nuclear, biological, and chemical protection, and yielding a 200% increase in survivability. Other survivability features include Kevlar ballistic liners, selected application of steel armor, hydraulic component compartmentation, line fuzing and critical component and ammunition relocation. Given a hit, these features reduce the probability of a kill by 50%. Major addition of built-in test, on board diagnostics/prognostics and plug-in test equipment have raised predicted operational availability from .40 to .55. Responsiveness is improved with the Automatic Fire Control System (HFCS) controlling gun drive servos which allow firing from the move in 60 seconds, firing while emplaced in 30 seconds and displacement in 60 seconds. Terminal effects are improved by increasing maximum range from 22km to 30km through modifications to the government furnished equipment (GFE) cannon and gun mount to allow safe firing of the M203A1 propelling charge. Further upgrades will be the application of sideskirts providing ballistic protection for the track area and application of ballistic covers for the cannon recoil system. In FY 1990 and FY 1991 threat materiel acquisition/exploition has been programed in PE #0605709A/DC28 and will be executed upon authorization/appropriation.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Completed logistics, maintenance support, provisioning and production planning
- **(U)** Initiated technical test (TT)
- **(U)** Conducted operational testing (OT) from June 1989 through July 1989

(U) FY 1990 Planned Program:

- **(U)** Complete TT (February 90)
- **(U)** Present RDTE results including independent evaluation to Milestone IIIA (Low Rate Production) decision authorities in U.S. and Israel
- **(U)** Design/fabricate corrective actions to deficiencies identified during scheduled technical tests and independent operational test and evaluation, to include engineer design testing of corrections
- **(U)** Milestone IIIA, Type Classification — Low Rate Production
- **(U)** Engineer/fabricate protective sideskirts and ballistic covers to correct vulnerabilities in track area and recoil systems
- **(U)** Live fire testing of modifications resulting from deficiencies identified during ballistic hull and turret tests. Live fire tests have been directed by Deputy Under Secretary of the Army — Operations Research
- **(U)** Completion of software development of HIP Automatic Fire Control System (AFCS) baseline, frozen during early FSD, to ensure compatibility with emerging Advanced Field Artillery Tactical Data System (AFATDS) and Battery Computer System (BCS) software upgrades and resolution of FSD firing table corrections.

(U) FY 1991 Planned Program:

- **(U)** Upgrade integrated logistics support (ILS) documentation to reflect corrective actions
- **(U)** Design and test Test Program Sets (TPS)
- **(U)** Complete live fire testing.
- **(U)** Planned program completed

Program Element: **#0203743A** Project Number: **#D008**
PE Title: **155mm Self-Propelled Howitzer Improvements** Budget Activity: **#4**

D. (U) WORK PERFORMED BY: In-house efforts will be accomplished by Project Manager, Howitzer Improvement Program, Dover, NJ, who does System Management. Watervliet Arsenal, Watervliet, NY does the cannon design and production. Letterkenny Army Depot, Chambersburg, PA, does the hull and chassis modifications. Major contractors are BMY, York, PA, who is the system integrator. Honeywell, Minneapolis, MN, does fire control system work. General Electric, New Bedford, MA works on test equipment. ECC, Orlando, FL, works on training devices.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None
2. **(U) SCHEDULE CHANGES:** TT/OT starts were delayed from 4Q FY 1988 to 1Q FY 1989 due to design and software changes. Milestone IIIA slipped from Sep 89 to Feb 90.
3. **(U) COST CHANGES:** The FY91 RDTE increase results from planned software upgrade.

F. (U) PROGRAM DOCUMENTATION:

Program Decision Memorandum	11/84
US-Israeli Memorandum of Understanding	10/85
System Manpower and Personnel Integration Management Plan	10/86
Required Operational Capability	5/88
Test and Evaluation Master Plan (Update)	1/89
Computer Resource Management Plan (Update)	3/89
Integrated Logistic Support Plan (Update)	7/89

G. (U) RELATED ACTIVITIES:

- PE #0203726A (Advanced Field Artillery Tactical Data System)
- PE #0602783A (Computer and Software Technology)
- PE #0603005A (Combat Vehicle and Automotive Advanced Technology)
- The Howitzer Improvement Program is a Joint-US-Israeli Defense Force program. Israeli participation is funded through Foreign Military Sales Credits.
- There is no unnecessary duplication of effort within the Army or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: ($ *in Thousands*)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
1. PROCUREMENT			
WTCV, Army	27827	75477	206827
GA0400 Howitzer, MED SP 155MM M109			

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: International RDTE program with the government of Israel, Memorandum of Understanding dated 9 October 1985.

J. (U) TEST AND EVALUATION DATA: HIP System level testing was initiated in FY 1988 and continued into FY 1989 to determine ability to meet technical and operational criteria in support of Milestone IIIA. Live fire vulnerability testing of HIP system was performed to assess effectiveness of design in FY 1988. Live fire testing in FY 1990 further evaluates system survivability.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203744A**

PE Title: **Aircraft Modifications/Product Improvement Programs** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D193 UH-60 Product Improvement Program	21857	- 0 -	- 0 -	- 0 -	21857
D423 AH-64 Product Improvement Program	51738	66464	60457	46187	253000
PE TOTAL	73595	66464	60457	46187	274857

B. (U) BRIEF DESCRIPTION OF ELEMENT: Funds in this program element (PE) will be used for development and testing modifications to existing Army aircraft required to improve system performance, respond to threat changes, increase reliability/maintainability/survivability, improve safety, and extend operational life. Project D423 is being used to continue the upgrade of AH-64 helicopters that was initiated by Congress as part of the FY88 Appropriation Act. A portion of project D423 is SECRET (not releasable to foreign nationals). Classification is in accordance with DOD Directive S-5200, 17(M2), dated January 1965, access controlled by the Assistant Secretary of the Army for Research, Development, and Acquisition. The unclassified portion of project D423 is the AH-64 integration program.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D193 — UH-60 Product Improvement Program

(U) FY 1989 Accomplishments:

- **(U)** Program for improved UH-60 Black Hawk was terminated

(U) Work Performed By: Not Applicable.

(U) Related Activities: Not Applicable.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203744A** Project Number: **D423**

PE Title: **Aircraft Modifications/Product Improvement Programs** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: AH-64 Product Improvement Program

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
APACHE	51738	66464	60457	46187	253000

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: As the Army's first line heavy Attack Helicopter, the AH-64A is integrated in maneuver and fire plans of the combined arms team and has the primary mission of killing tanks and other armored vehicles. Firepower, speed, agility, and cross country mobility of the AH-64 provide a versatility of the combined arms team not otherwise available. Secondary missions include air-to-air combat, reconnaissance, security, and economy of force operations. System capabilities are expanded by application of improvements, substantially increasing current capabilities of AH-64A to withstand the projected threat from 1995 to 2005 in close, deep, and rear operations. These improvements enhance target killing capability (including significant capabilities against threat helicopters), increase operational capability of the crew, and improve reliability. Improvements will include multiple system and architecture features consistent with the integrated system being developed for the Special Operation Forces aircraft, improved fire control, application of air-to-air capabilities, reduced pilot workload, better hover control, increased reliability, availability, maintainability, and survivability. The improvements are being designed to facilitate integration of the LONGBOW Weapons System, which will further increase battle capabilities of the APACHE. The LONGBOW Streamlined Acquisition Program will lead to production incorporation in FY1992 and fielding in FY1994. Other improvements will be the late 1990's incorporation of portions of the mission equipment package developed for the LHX. A portion of this project is classified in accordance with DOD Directive S-5200, 17 (M2), dated January 1965, with access controlled by the Assistant Secretary of the Army for Research, Development, and Acquisition.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Conducted system design review, 1-2 Feb 89
- **(U)** Completed concept definition phase
- **(U)** Initiated full-scale engineering development (FSED)
- **(U)** Combined Army Systems Acquisition Review Council (ASARC) with LONGBOW for approval of LONGBOW APACHE FSED

(U) FY 1990 Planned Program:

- **(U)** Combine ASARC for LONGBOW development/production proveout and approval of long-lead items procurement
- **(U)** Conduct preliminary design review
- **(U)** Continue FSED

(U) FY 1991 Planned Program:

- **(U)** 1st LONGBOW fire control radar to aircraft for integration
- **(U)** Conduct flight testing
- **(U)** Conduct critical design review

Program Element: **#0203744A** Project Number: **D423**
PE Title: **Aircraft Modifications/Product Improvement Programs** Budget Activity: **#4**

(U) Program Plan to Completion:

- **(U)** Technical testing
- **(U)** Force development test and experimentation
- **(U)** Initial operational test and evaluation
- **(U)** Final operational test and evaluation
- **(U)** Complete development/production proveout
- **(U)** Begin production
- **(U)** Fielding

D. (U) WORK PERFORMED BY: McDonnell Douglas Helicopter Corporation, Mesa, Arizona.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY: Name changes, more definition

1. **(U) TECHNICAL CHANGES:** Not Applicable.
2. **(U) SCHEDULE CHANGES:** Not Applicable.
3. **(U) COST CHANGES:** Not Applicable.

F. (U) PROGRAM DOCUMENTATION: AAH-MN of 7 Sep 1977.

G. (U) RELATED ACTIVITIES: Related aircraft programs include the Optical Improvement Program, the Special Operations Forces (SOF) Integrated Avionics Subsystems, the Light Helicopter (LHX) mission equipment package development, aircraft survivability equipment development, LONGBOW Weapons System and the Advanced Tactical Aircraft (A-12) US Navy. The programs will maximize commonality and complement each other without duplicating effort. The addition of the LONGBOW to the AH-64 will greatly enhance target killing capability and survivability.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
Concept definition contract award	08/88
Critical design review	05/91
Complete operational testing	10/93

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203752A (TIARA)**

PE Title: **Aircraft Engine Component Improvement Program (CIP)** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D106 Aircraft Component Improvement Program	7883	5738	7055	Cont	Cont

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Engine Component Improvement Program (CIP) corrects service revealed problems. CIP investigates, analyzes, develops, tests and qualifies engine components to improve flight safety, reliability, maintainability and durability, to reduce life cycle costs and to improve readiness. In addition, CIP provides redesign, test and qualification of effort. CIP is included in the RDTE vice procurement appropriations in accordance with Congressional direction.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) FY 1989 Accomplishments:

- **(U)** Qualified a cost reduced cast air diffuser for T700 with rectangular throat
- **(U)** Continued development of T700 turbine hardware to eliminate silverplate contamination
- **(U)** Purchased long-lead castings for FY 90 T55 CIP effort to qualify engine component redesigns to eliminate magnesium-thorium alloy
- **(U)** Redesigned T53 gearbox to pin bearing outer races to preclude race spinning chips and Army Oil Analysis Program (AOAP) removals
- **(U)** Completed design work and structural analysis of redesigned components to eliminate magnesium-thorium alloy in T53 engines
- **(U)** Developed a new combustor design for T700 to reduce gas temperature variance and increase hot section durability

(U) FY 1990 Planned Program:

- **(U)** T700 Engine
  - Develop improved compressor rub coatings
  - Develop an improved life particle separator blower bearing
  - Qualify combustor improvements to reduce gas temperature variance
  - Develop fuel pump improvements to preclude hot day/hot fuel caused flameouts
  - Develop an improved number 4 bearing and support
  - Develop and qualify compressor rotor inertial damper
- **(U)** T53 Engine
  - Qualify redesigned inlet housing developed in FY89
  - Qualify hot section components developed in FY89
- **(U)** T55 Engine
  - Perform structural analysis and evaluation of components redesigned in new alloys to eliminate magnesium
  - Develop machined hardware from castings purchased in FY89
  - Develop Number 3 bearing lubrication changes to improve bearing durability
- **(U)** T62T Auxiliary Power Unit

Program Element: **#0203752A (TIARA)**

PE Title: **Aircraft Engine Component Improvement Program (CIP)** Budget Activity: **#4**

- Develop improved life turbine wheel
- Develop reliability improvements for Electronic Sequence Unit

- **(U)** GTCP36 Auxiliary Power Unit (APU)
  - Develop extended life power take-off (PTO) clutch
  - Develop and qualify improved planetary gear design to eliminate cracks/failures
- **(U)** T63/T703 Engine
  - Develop program to develop and qualify a compressor rotor design in a corrosion resistant material

(U) FY 1991 Planned Program:

- **(U)** T700 Engine
  - Develop Improved compressor material
  - Qualify improved rub coatings developed in FY90
  - Develop a STAGE 1 bucket in a new material for improved durability
  - Spin pit evaluation
  - Conduct engine/component life analysis and testing
  - Develop an improved fuel pump spline design
- **(U)** T55 Engine
  - Qualify the improved number 3 main bearing
  - Develop a machined combustor liner for increased durability and hot section life
  - Qualify components re-alloyed to eliminate magnesium-thorium
- **(U)** T53 Engine
  - Develop and qualify improved gearbox seals
  - Complete qualification of hot section parts designed in new material
  - Qualify alternate sources
- **(U)** T62T Auxiliary Power Unit (APU)
  - Complete qualification testing of improved turbine wheel and reliability improvements to the electronic sequence unit
  - Develop repair techniques for high dollar hardware
- **(U)** GTCP36 Auxiliary Power Unit (APU)
  - Qualify improved life power take-off (PTO) clutch
  - Develop repairs for high dollar hardware
- **(U)** T63/T703 Engine
  - Develop an extended life turbine wheel
  - Complete qualification of compressor developed in FY89/FY90

Program Element: **#0203752A (TIARA)**

PE Title: **Aircraft Engine Component Improvement Program (CIP)** Budget Activity: **#4**

(U) Work Performed By:

ENGINE	CONTRACTOR
T700	General Electric, Lynn, Massachusetts
T55 & T53	Textron Lycoming, Stratford, Connecticut
T63 & T703	Allison Div. General Motors, Indianapolis, Ind.
T62	Sundstrand Turbomach, San Diego, California
GTCP36	Garrett, Auxiliary Power Division, Phoenix, Arizona

DEVELOPING ORGANIZATION: US Army Aviation Systems Command, St. Louis, Missouri

(U) Related Activities: The Aircraft Engine Component Improvement Program (CIP) is authorized for all three military Services by DOD Manual 71101-M. When more than one Service utilizes the same engine, funds from all using Services are consolidated into one program. This program is managed by the lead Service having the largest inventory. Funding levels are negotiated at an annual tri-service coordination meeting and are based on the size of each Service's inventory.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203801A**

PE Title: **Missile/Air Defense Product Improvement Program** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D036 PATRIOT Product Improvement Program	22604	37260	23662	Cont	Cont
D683 Air Defense System — Heavy P3I	- 0 -	- 0 -	9021	Cont	Cont
D690 HAWK Product Improvement Program	10756	11351	8134	Cont	Cont
PE TOTAL	33360	48611	40817		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The advances of Soviet modernization efforts require an evolutionary improvement program to maintain the effectiveness of the ground based anti-air and tactical missile defense systems. This program develops improvements to PATRIOT, HAWK, and Line of Sight-Forward-Heavy. In FY 1990 and FY 1991 threat materiel acquisition/exploition has been programed in Program Element #0605709A/DC28 and will be executed upon authorization/appropriation.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D690 — HAWK Product Improvement Program (PIP): HAWK is a surface-to-air guided missile designed to defend against low-flying aircraft. The project consists of several developments as needed, to keep HAWK current with the evolving threat by increasing capabilities, incorporation of new technologies and enhancement of operational capabilities and accomplishments of new missions. Developments include improvements to the missile necessary to improve missile performance in escalating electromagnetic countermeasures (ECM) environments. Development of field maintenance equipment upgrades is required to support fielded phase III product improvement program (PIP) and will provide the first significant HAWK maintenance equipment upgrade since the system was fielded in 1960. Field Maintenance Equipment is a phased program which will first reconfigure support equipment to eliminate many vehicles and shelters and then develop test program sets (TPS) which will eliminate obsolete repair consoles, which do not support fielded Phase III equipment and provide compatability with Army standard intermediate forward test equipment (IFTE). With the IFTE, HAWK maintenance will be greatly streamlined, resulting in significant reductions in maintenance time and manpower. Development of mobility modifications is necessary to provide for a manpower and equipment reduction, provide greater tactical mobility and improve tactical survivability.

(U) FY 1989 Accomplishments:

- **(U)** Completed fuze arm development
- **(U)** Continued field maintenance equipment development
- **(U)** Continued mobility enhancement development

(U) FY 1990 Planned Program:

- **(U)** Continue field maintenance equipment development
- **(U)** Continue mobility enhancement development

Program Element: **#0203801A**

PE Title: **Missile/Air Defense Product Improvement Program** Budget Activity: **#4**

(U) FY 1991 Planned Program:

- **(U)** Continue field maintenance equipment development
- **(U)** Continue mobility enhancement development
- **(U)** Perform system assessment analyses
- **(U)** Evaluate emerging technology for inclusion into HAWK

(U) Work Performed By: HAWK prime contractor is Raytheon Company, West Andover, MA. Other contractors supporting HAWK are Westinghouse Electric Corp., Baltimore, MD; Instrumentation Control Systems Division, Kissimmee, FL; Northrup Corp., Anaheim, CA; and Aerojet, Sacramento, CA; Harris Corp., Winter Park, FL; Program Executive Officer, Air Defense, US Army Missile Command, and other government support.

(U) Related Activities: The US Marine Corps is actively participating in the HAWK Improvement Program. There is no duplication of effort within the Army or the Department of Defense on this program as program coordination is accomplished by exchange of technical reports and joint attendance at scientific meetings and program reviews.

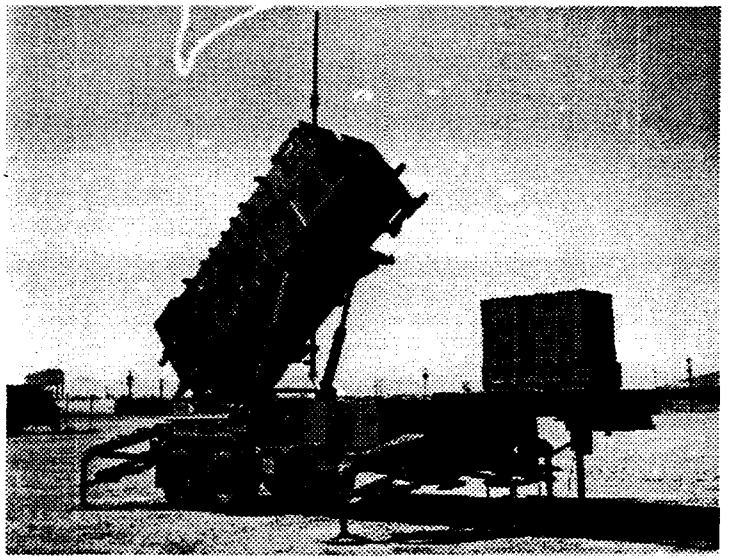
(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
MISSILE APPROPRIATION			
Budget Activity 2. Other Missile Support (CA0275)	5040	983	4850
Budget Activity 2. HAWK (MIM-23-B)	- 0 -	13358	- 0 -
Budget Activity 5. HAWK Modifications (C35200)	27092	28378	43615

(U) International Cooperative Agreements: A memorandum of agreement was signed 19 June 1987 between the U.S. and the Netherlands concerning joint research and development of modifications to the HAWK missile system for the enhancement of mobility.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203801A**
Project Number: **#D036**
PE Title: **Missile/Air Defense Product Improvement Programs**
Budget Activity: **#4**
Project Title: **PATRIOT Product Improvement Program**



POPULAR NAME: **PATRIOT**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones					
Engineering Milestones					
T&E Milestones					
Contract Milestones					
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		16261	29011	19233	Cont
Support Contract		2858	3875	2348	Cont
In-House Support		2375	2748	1747	Cont
GFE/ Other		1110	1626	334	Cont
Total		22604	37260	23662	Cont

Program Element: **#0203801A** Project Number: **#D036**

PE Title: **Missile/Air Defense Product Improvement Programs** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: PATRIOT is an advanced medium-to-high altitude surface-to-air guided missile air defense system with a high single-shot kill probability, capable of operating in an intense electronic countermeasures (ECM) environment and able to conduct multiple, simultaneous engagements against high-performance aircraft and tactical missiles likely to be encountered during the 1990's and beyond. This PE keeps PATRIOT current with the evolving threat by increasing capabilities during and after deployment, upgrading basic PATRIOT technology as technological breakthroughs occur, enhancing operational capabilities, and accommodating new missions. This effort is based upon a preplanned product improvement (P3I) required operational capability (ROC) to overcome operational deficiencies and to upgrade capabilities. Additionally, because European nations have selected or are considering PATRIOT as their future surface-to-air missile system, development efforts are continuing in support of NATO rationalization, standardization and interoperability.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project D036 — PATRIOT Product Improvement Program.

(U) FY 1989 Accomplishments:

- (U) Conducted production confirmatory tests for Stand-Off-Jammer Counter
- (U) Completed retrofit of radar enhancement phase I
- (U) Continued development of out-of-sector launch software
- (U) Performed engineering tests for the pulse doppler waveform search/track capability
- (U) Completed development of enhancement of missile guidance software
- (U) Initiated development of radar enhancement phase II
- (U) Initiated development of weapons control computer (WCC) upgrade
- (U) Initiated development of anti-radiation missile (ARM) decoy

(U) FY 1990 Planned Program:

- (U) Complete out-of-sector launch software development
- (U) Continue development of radar enhancements phase II
- (U) Continue development of the WCC upgrades
- (U) Continue development of ARM decoy
- (U) Initiate development of radar enhancements phase III
- (U) Initiate development of Communications Upgrades

(U) FY 1991 Planned Program:

- (U) Field Post Deployment Build 3 (PBD 3) software modifications; modifications include the pulse doppler waveform search/track capability, out-of-sector launch capability and missile guidance enhancements
- (U) Complete development of ARM decoy
- (U) Complete development of radar enhancements phase II
- (U) Complete development of WCC upgrade
- (U) Continue development of radar enhancements phase III
- (U) Continue development of communications upgrades
- (U) Initiate development of remote launch capability
- (U) Initiate analysis of signature reduction techniques
- (U) Initiate analysis of positive target identification techniques

Program Element: **#0203801A** Project Number: **#D036**

PE Title: **Missile/Air Defense Product Improvement Programs** Budget Activity: **#4**

(U) Program Plan to Completion:

- **(U)** Continue PATRIOT product improvements
- **(U)** Continue analysis of threat as it responds to PATRIOT product improvements

D. (U) WORK PERFORMED BY: The prime contractor for PATRIOT is Raytheon Company, Bedford, MA, with Martin Marietta Corp. Orlando, FL, as missile subcontractor. Teledyne Brown, Huntsville, AL, is the software verification and validation contractor. In-house work to be performed by US PEO Air Defense and U.S. Army Missile Command, Redstone Arsenal, Al, and U.S. Army Air Defense School, Ft. Bliss, TX.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None
2. **(U) SCHEDULE CHANGES:** Development of communications upgrades has been accelerated due to reordering of army priorities.
3. **(U) COST CHANGES:** None

F. (U) PROGRAM DOCUMENTATION:

Decision Coordinating Paper - 8/80

G. (U) RELATED ACTIVITIES: PATRIOT ATM Upgrade project under Program Element #0603302A, Joint Tactical Missile Defense.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
1. MISSILE PROCUREMENT ARMY			
Budget Activity 2 — PATRIOT (C49100)	816635	896645	883152
Budget Activity 5 — PATRIOT Modifications (C50700)	43685	19177	20856

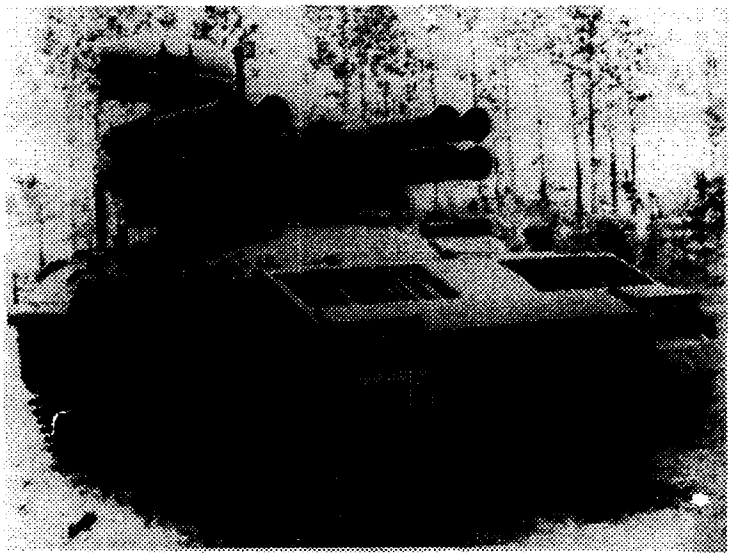
I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Under the cooperative agreements with NATO countries (Federal Republic of Germany, Netherlands and Italy), product improvements are available to those countries.

J. (U) TEST AND EVALUATION DATA: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203801A**
PE Title: **Missile/Air Defense Product Improvement Program**
Project Title: **Air Defense System — Heavy P3I**

Project Number: **#D683**
Budget Activity: **#4**



POPULAR NAME: **LOS-F-H**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			MDR IIIA 3Q90	MDR IIIB 2/91	FUE 3Q93
Engineering Milestones				Start Block I Design 1Q91	
T&E Milestones					
Contract Milestones				Award RDTE contract 1Q91	
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract				8000	TBD
Support Contract					
In-House Support				1021	TBD
GFE/ Other					
Total		- 0 -	- 0 -	9021	TBD

Program Element: **#0203801A** Project Number: **#D683**
PE Title: **Missile/Air Defense Product Improvement Program** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The LOS-F-H component of the FAADS was procured using a Non-Development Item (NDI) acquisition strategy. An essential phase of this NDI acquisition strategy is the pre-planned product improvement (P3I) program. LOS-F-H P3I will upgrade ADATS to the objective LOS-F-H configuration, and grow ADATS capabilities to meet threat requirements and responses of the late 1990's and beyond. Projected improvements include: a commander's viewer, an automated C2I interface/integrated weapon display/mission planner, passive target acquisition and recognition (NCTR) capabilities, NBC protection upgrades, increased armor protection for crew and missile survivability, reduced battlefield signature, enhanced electro-optical countermeasures, and missile improvements (increased range and fire and target seeker). ADATS P3I program will ensure that the combined arms team retains freedom of maneuver despite advances in threat air platforms and munitions. New start product improvement program in FY 1991.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project D683 — Missile/Air Defense Product Improvement:

(U) FY 1989 Accomplishments: Not applicable.

(U) FY 1990 Planned Program: Not applicable.

(U) FY 1991 Planned Program:
- (U) Evaluate ADATS shortfalls, if any, discovered during operational test phase
- (U) Conduct P3I integration, engineering and test planning
- (U) Initiate product improvement design

(U) Program Plan to Completion:
- (U) Complete design of product improvement and initiate prototype development
- (U) Initiate testing of selected product improvements
- (U) Continue evaluation of emerging technology to determine applicability to the LOS-F-H weapon
- (U) Monitor threat and countermeasures developments

D. (U) WORK PERFORMED BY: In-house efforts accomplished by Program Executive Officer for Air Defense Systems, Program Manager-Line of Sight-Forward-Heavy and U.S. Army Missile Command, Redstone Arsenal, AL. Prime contractor for LOS-F-H is Martin Marietta Corporation, Orlando, FL.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** Not applicable.

Program Element: **#0203801A** Project Number: **#D683**

PE Title: **Missile/Air Defense Product Improvement Program** Budget Activity: **#4**

F. (U) PROGRAM DOCUMENTATION:

Required Operational Characteristics document	3/87
Test and Evaluation Master Plan	8/88

G. (U) RELATED ACTIVITIES: Not applicable.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
1. PROCUREMENT:			
Missile Procurement Army			
AD SYS HVY H01700	85522	167176	235584

2. (U) MILITARY CONSTRUCTION: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: The Canadian Army is procuring 36 Low Level Air Defense System (LLADS) versions of ADATS mounted on a M113A3 chassis. An Annex for ADATS to the existing Master Data Exchange Agreement for the mutual development of weapon systems between the US and Canada was approved in Oct 88. This annex provides for exchange of scientific and technical data in test and evaluation, integrated logistics support, system integration and quality control and P^3I programs. No cost sharing or joint funding is required.

J. (U) TEST AND EVALUATION DATA: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203802A**

PE Title: **Other Missile Product Improvement Programs**

Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D045 HELLFIRE Product Improvement Program	14938	28609	30454	Cont	Cont
D336 TOW Product Improvement Program	24584	50784	42866	Cont	Cont
PE TOTAL	39522	79393	73320		

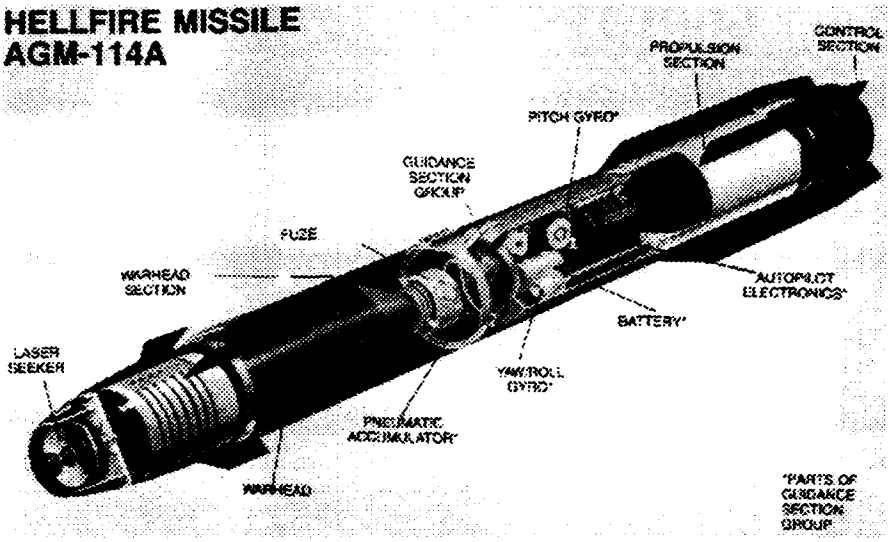
B. (U) BRIEF DESCRIPTION OF ELEMENT: The advances of Soviet modernization efforts require an evolutionary improvement program to maintain the effectiveness of the HELLFIRE, and TOW 2 systems. HELLFIRE improvements consist of the electro-optical countermeasure (EOCM) hardened laser seeker, digital autopilot, increased lethality warhead and improved rocket motor. TOW improvements required to maintain the capability to defeat the evolving Soviet armor and countermeasure threat include continued warhead improvements, TOW 2B development, an optical and nightsight improvement effort, a track link improvement effort, development of a TOW warhead retrofit program, and development of the TOW sight improvement. The TOW sight improvement incorporates an advanced countermeasure hardened acquisition and fire control which will extend the target acquisition range on both the clean and dirty battlefield and enhance fire control effectiveness. In FY 1990 and FY 1991 threat materiel acquisition/exploition has been programed in PE #0605709A/DC28 and will be executed upon authorization/appropriation.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203802A**
PE Title: **Other Missile Product Improvement Programs**
Project Title: **HELLFIRE Product Improvement Program**

Project Number: **#D045**
Budget Activity: **#4**



POPULAR NAME: **HELLFIRE**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones					
Engineering Milestones		Cont Imp Warhead DAP Dev; Initiate Optimized Missile Study Prog (OM) 3/89	Complete Interim Warhead DAP Dev; Complete OM Study Prog; Initiate OM Dev	Continue OM Development	Complete OM Dev, 4Q92 Initiate Insensitive Motor 1Q93; Complete Insensitive Motor , 1Q95.
T&E Milestones		None	None	None	None
Contract Milestones		Initiate OM study; Fund Warhead/ DAP Contract.	Fund Last Incr Imp Warhead/ DAP; Fund 1st Incr OM Dev 3Q90.	Fund 2nd Incr OM Dev.	Complete OM Dev 4Q92. Insen Mtr Contract 1Q93; Complete 1Q95.
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		11142	24008	25772	105273 (25257)
Support Contract		845	788	1038	4286 (1161)
In-House Support		2186	2927	2779	18009 (9006)
GFE/ Other		765	886	865	3884 (891)
Total		14938	28609	30454	131452 (36315)

Program Element: **#0203802A** Project Number: **#D045**

PE Title: **Other Missile Product Improvement Programs** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The improved lethality HELLFIRE initiative will provide the HELLFIRE missile with improved capability to counter advanced heavily armored vehicles at long range and with greater lethality than current Army air-to-ground, antitank weapons. The interim warhead program is necessary for a short-term immediate fix to meet current threat. It consists of a front charge in tandem with the main charge; the purpose of the front charge is to counter reactive armor. This improved interim warhead will be cut into production in FY 90. The optimized missile (OM) includes a combined digital autopilot/improved laser seeker, and a more robust warhead. The optimized missile program began in FY 89. This program provides a seeker/autopilot configuration that will optimize production cost impact, provides a seeker that is hardened against the counter measures threat, and replaces the interim warhead with an optimum robust warhead which will defeat the developing Soviet threat through the 1990s. Recent threat assessments indicate that both an enhanced robust warhead and improved seeker/digital autopilot will be required to maintain HELLFIRE as an effective system through the 1990s.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Continued development of interim warhead digital autopilot (DAP) program
- **(U)** Initiated OM study program

(U) FY 1990 Planned Program:

- **(U)** Complete development and cut interim warhead into production
- **(U)** Initiate OM development program
- **(U)** Complete OM study program

(U) FY 1991 Planned Program:

- **(U)** Continue OM development program

(U) Program Plan to Completion:

- **(U)** Complete OM development and cut into production
- **(U)** Initiate/complete improved motor
- **(U)** This is a continuing program

D. (U) WORK PERFORMED BY: The major contractor for the improved warhead is Rockwell International Corporation, Missiles Systems Division, Duluth GA. Efforts for the optimized missile and the improved motor development program will be competed between Rockwell International Corporation, Duluth GA and Martin Marietta Corporation, Orlando, FL. In-house effort will be accomplished by Research Development and Engineering Center, US Army Missile Command at Redstone Arsenal, AL. The HELLFIRE Project Office reports to the Program Executive Officer (PEO) for Fire Support.

Program Element: **#0203802A** Project Number: **#D045**

PE Title: **Other Missile Product Improvement Programs** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** To meet threat requirements, the interim improved warhead will require an increase in missile length of 7 inches and increased weight of 7 pounds. The optimized missile will decrease the length by approximately 7 inches and 7 pounds to bring length and weight back to current configuration requirements.
2. **(U) SCHEDULE CHANGES:** The improved warhead development began in FY 1988 rather than FY 1987 as originally scheduled. The seeker development was delayed in order to have an independent (non-government) Blue Ribbon panel assess the Army technical plan. This reviewing body recommended the Army technical plan be implemented. This implementation began in FY 89 with the initiation of the optimized missile study program. Production cut-in is scheduled for 4Q92.
3. **(U) COST CHANGES:** Due to increased threat requirements, additional funding for the robust warhead and optimized missile program is required.

F. (U) PROGRAM DOCUMENTATION:

Justification and Approval (J&A) Approved (Designated Acquisition Program & electro-optical countermeasure (EOCM)	06/85
Justification and Approval (J&A) Approved (Improved Warhead, Interim)	02/88
Justification and Approval (J&A) Planned (HELLFIRE Optimized Missile System)	09/89

G. (U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Army or other Services/Agencies within the Department of Defense. This is assured by continuous coordination with other Services/Agencies.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
1. PROCUREMENT Missile Procurement Army Budget Activity 2 — Laser HELLFIRE System	204602	98879	123279

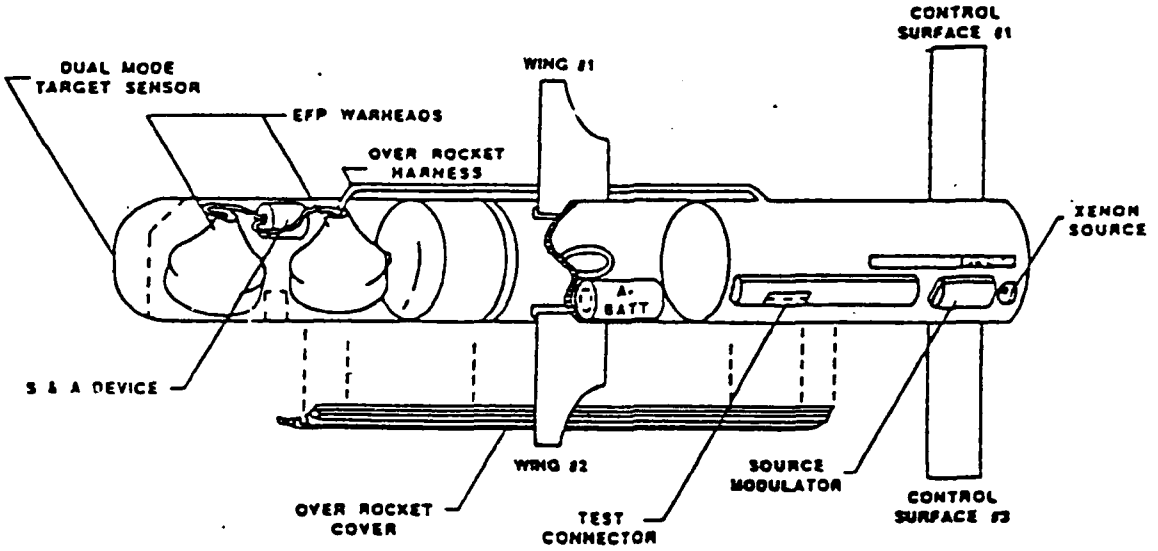
I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable

J. (U) TEST AND EVALUATION DATA: Not applicable

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0203802A**
PE Title: **Other Missile Product Improvement Programs**
Project Title: **TOW Product Improvement Program**

Project Number: **#D336**
Budget Activity: **#4**



POPULAR NAME: **TOW 2**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		4/89 Dwn Sel Sens 8/89 CDR Msle Hdw 12/89	9/90 PRR 9/90 TOW 2B Prod.	4/91 Flt Mtr Eval. 1/91 imp Sight ASARC V	2Q FY92 IPR Flight Mtr. AT2B* IPR ECP 2/92
Engineering Milestones		1/89 Whd PDR 5/89 Whd CDR	1/90 Whd IPR 8/90 Prel. Design AT2B* 10/90 Flt Mtr Cont. Sel	6/91 AT2B* Critical Design Review	1Q FY/92 Flt Mtr CDR 4Q FY92 Formal Design Rev (Flt)
T&E Milestones		12/89 PH. II Eng. Flts.	5/90 Complete PH. II Eng. Flts.	10/91 DT for Flight Motor	3Q92 Cmp Qual Test (Flt Mtr)
Contract Milestones		8/89 Long Ld Items (1st INC)	3/90 LLI (2d INC) 9/90 Prod. Cont. 7/90 Flt Mtr Awd	8/91 Improved Sight FSD Contract	
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		19867	42199	30886	Cont
Support Contract					
In-House Support		2953	5435	7358	Cont
GFE/ Other		1764	3150	4622	Cont
Total		24584	50784	42866	Cont

***Alternate TOW 2B**

Program Element: **#0203802A** Project Number: **#D336**

PE Title: **Other Missile Product Improvement Programs** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Provides for the continued development of improvements to the TOW missile system. Improvements are required to maintain the infantry's capability to defeat a continually evolving Soviet armor threat and to allow operation in battlefield obscurants and electro-optical countermeasure (EOCM) environments. Improvements include TOW 2B, an optical and night sight improvement effort, a track link improvement effort and development of a TOW warhead retrofit program.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Continued development of TOW 2B and lethality improvements to TOW
- (U) Initiated & continued TOW 2B target revision to provide a target representative of the anticipated Soviet threat and a revised warhead design to counter that threat
- (U) Awarded contract for Alternate TOW 2B development (6/89)

(U) FY 1990 Planned Program:

- (U) Complete development of TOW 2B
- (U) Continue development of Alternate TOW 2B program
- (U) Initiate conceptual work for TOW improved sight and fire control
- (U) Complete phase A and begin phase B of Alternate TOW 2B
- (U) Initiate development of an improved TOW flight motor

(U) FY 1991 Planned Program:

- (U) Field TOW 2B
- (U) Continue Alternate TOW 2B program
- (U) Continue development of improved TOW flight motor
- (U) Perform warhead threat validation qualification test
- (U) Initiate development of TOW improved sight

(U) Program Plan to Completion:

- (U) This is a continuing program, i.e. TOW improved sight, warhead test qualification and TOW Future

D. (U) WORK PERFORMED BY: Development contractor is Hughes Aircraft Company, Tuscon AZ. Army management of all TOW programs is performed by Project Manager TOW, Program Executive Officer Fire Support, Redstone Arsenal, AL. The development contractor for the TOW improved sight and fire control will be determined through competition in 1Q FY94.

Program Element: **#0203802A** Project Number: **#D336**

PE Title: **Other Missile Product Improvement Programs** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** Funds added in FY 1990/91 provide improvements necessary to meet the threat (Flight motor, alternate TOW 2B warhead, and to fund the TOW improved sight).

F. (U) PROGRAM DOCUMENTATION:

TOW 2B user requirements message	6/85
Product improvement management info rpt	12/86
(PIP 1-86-03-3026) TOW 2B	12/85
(PIP 1-88-03-3027) TOW 2 to TOW 2A retrofit	5/88
TOW 2 retrofit user requirements and messages	7/88

G. (U) RELATED ACTIVITIES:

- Program Element #0602120A (Electronic Survivability and Fuzing Technology)
- Program Element #0602303A (Missile Technology)
- Program Element #0602618A (Ballistics Technology)
- Program Element #0602624A (Weapons and Munitions Technology)
- Profram Element #0603612A (Adv Anti-Tank Weapon System)
- There is no unnecessary duplication of effort within the Army or the Department of Defense

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Missile Procurement Army —			
Budget Activity 2 TOW 2	143082	105404	219465
Budget Activity 5 TOW MODS	33797	27571	45385

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) TEST AND EVALUATION DATA: The TOW 2B test program will be on-going through the development phase on subsystem models through a development test series with missile flights.

1. Warhead Development - Two static shots were fired in Dec 87 and six in Jan 88. Dynamic testing began in Mar 88. Design evaluation testing (DET) is from Aug-Dec 88 with qualification testing Mar-Jun 89. As of 15 Nov 88, 18 sled tests have been conducted at Redstone Arsenal as part of DET. An additional 18 static tests were conducted at contractor facility. Physical configuration audit (PCA) is scheduled for Jan 90. Warhead production is scheduled to begin Jul 90.

2. Sensor Development - Three sensors were studied and developed with telemetry missile flights in Dec 88-Jan 89. The flights were completed in Jan 89. HAC chose Thorn EMI of Great Britian as the sensor source. The Government concurred in this choice. Phase II of engineering flights are to take place 9/89 through 2/90 at Redstone Arsenal, AL.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0207316A**
PE Title: **TACIT RAINBOW**
Project Title: **TACIT RAINBOW**

Project Number: **# DC03**
Budget Activity: **#4**

NO PICTURE AVAILABLE

POPULAR NAME: **GLTR**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			FSD Start 1/90	Continue FSD	MDR IIIA 2QFY 93
Engineering Milestones				PDR/CDR Complete—1/91 Missile Design/ FAB Complete—8/91	
T&E Milestones		Staff Test and Evaluation Master Plan & Live Fire Test and Evaluation—3/89		Flt Readiness Review—6/91 Component Test Complete—6/91 Complete Range Development—5/91	DTE/LFTE Complete — 3QFY 93 PQT Complete — 3QFY 94
Contract Milestones			FSD AWD	Continue FSD	
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract			25769	43000	194769 (152000)
Support Contract			2600	5300	19500 (11600)
In-House Support			8986	14722	59994 (43552)
GFE/ Other			9600	42236	78800 (26200)
Total			46955	105258	353063 (233352)

Program Element: **#0207316A** Project Number: **# DC03**
PE Title: **TACIT RAINBOW** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Ground Launch TACIT RAINBOW (GLTR) missile is a Multiple Launch Rocket System (MLRS) launched, loitering, mini-cruise, modular design missile capable of attacking radar emitters while maximizing sub-system commonality with the U.S. Air Force produced Air Launch TACIT RAINBOW (ALTR) missile. The GLTR missile was to be a joint service munition developed by the U.S. Air Force and the U.S. Army with U.S. Navy participation. The U.S. Air Force was to be the executive service and responsible for the full-scale development and production of the ground launched missile. The U.S. Army was to integrate the missile into MLRS and be responsible for stock, store, and delivery. However, implementation of a recent agreement between the U.S. Air Force and the U.S. Army (joint memo, VCSA/VCSAF, 28 Nov 88) has resulted in the U.S. Air Force withdrawing from the GLTR program with the subsequent transfer of the executive service responsibility for the GLTR missile to the U.S. Army. Under the agreement, the TACIT RAINBOW Program would remain a tri-service program to maximize subsystem commonality and promote technology transfer between the air launch and ground launch systems. Other variants of the GLTR missile are planned since the missile is to be designed using a modular concept and will, therefore, be capable of being utilized as a "bus" for carrying various payloads. The GLTR missile will be configured in a Missile Launch Pod Assembly (M/LPA) and will be an additional munition compatible with the U.S. Army deep attack family of weapon systems. The GLTR missile will utilize the U.S. Army MLRS fire control and fire direction systems for command, control, communications, and intelligence (C3I) and for integration with the Intelligence/Electronic Warfare (I/EW) system to provide targeting data.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- **(U)** Completed weapon system trades studies

(U) FY 1990 Planned Program:
- **(U)** Initiate full-scale development
- **(U)** Initiate producibility engineering planning activities
- **(U)** Assemble prototype hardware

(U) FY 1991 Planned Program:
- **(U)** Continue full-scale development
- **(U)** Complete preliminary and critical design reviews
- **(U)** Complete component testing
- **(U)** Initiate engineering development tests
- **(U)** Construct test facilities
- **(U)** Test data collection and analysis

(U) Program Plan to Completion:
- **(U)** Complete full-scale development
- **(U)** Begin and complete production

D. (U) WORK PERFORMED BY: This program will be managed by the Joint Weapon System Project Manager. The contractor team to perform full-scale development on the Ground Launch Tacit Rainbow is Raytheon, McDonnell Douglas and E-Systems. Raytheon has total system performance responsibility.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None

Program Element: **#0207316A** Project Number: **# DC03**
PE Title: **TACIT RAINBOW** Budget Activity: **#4**

2. **(U) SCHEDULE CHANGES:** Start of full-scale development changed from FY89 to FY90
3. **(U) COST CHANGES:** None

F. (U) PROGRAM DOCUMENTATION:

- **(U)** Acquisition Plan — Jan 88
- **(U)** Joint Services Operational Requirements Document — Dec 88
- **(U)** Joint Test Evaluation Master Plan — Currently being staffed

G. (U) RELATED ACTIVITIES:

- This system is a companion program to the Air Force Air Launch Tacit Rainbow program
- WPNS Sys Trade Study includes Commander-in-Chief input requirements for worldwide useage

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) N/A

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: N/A

J. (U) TEST AND EVALUATION DATA: During Weapon System Trades Studies alternative concepts and designs will be evaluated and the best approach selected for full-scale development. A test planning working group (TPWG) has been formed and is addressing and defining test issues for the development program.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0208010A**

PE Title: **Joint Tactical Communications Program (TRI-TAC)** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D107 TRI-TAC Army Equipment Modifications	13299	- 0 -	6074	Cont	Cont
D114 TRI-TAC Other Service Tasks	421	- 0 -	- 0 -	- 0 -	21724
PE TOTAL	13720	- 0 -	6074		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides for modifications to fielded TRI-TAC equipment to allow them to interoperate with emerging communications systems such as Mobile Subscriber Equipment (MSE) and others developed by other Services and agencies as well as equipment developed by the NATO allies. This program protects against hardware/software obsolescence which would result in a loss of capability and investment. Included is the development and the evolutionary software development for the AN/TTC-39A, AN/TYC-39A and the Communications System Control Element (CSCE). It also includes technical support and preparation of documentation for Non-Developmental Items (NDI) production contract award for procurement of the Family of Antenna Masts.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D107 — TRI-TAC Army Equipment Modifications: This is a skip-year new start in FY 1991.

(U) FY 1989 Accomplishments:

- **(U)** Initiated Product Improvement Program of AN/TYC-39A message switch to provide throughput improvements and perform a concept study of object reuse of the message switch
- **(U)** Continued AN/TTC-39A and AN/TYC-39A switch system improvements for AUTODIN interface, man/machine interface and diagnostics, and interface development to MSE at corps and below
- **(U)** Completed development of the unit level circuit switch interface to the AN/TTC-39A circuit switch
- **(U)** Continued CSCE software evolutionary development, and started production hardware delivery

(U) FY 1990 Planned Program:

- **(U)** None Funded

(U) FY 1991 Planned Program:

- **(U)** Continue CSCE evolutionary software development to accommodate changes made to the AN/TTC-39D and AN/TYC-39A
- **(U)** Continue AN/TTC-39 circuit switch interface to MSE at corps and below for development and improvement

Program Element: **#0208010A**

PE Title: **Joint Tactical Communications Program (TRI-TAC)** Budget Activity: **#4**

(U) Project D114 — TRI-TAC Other Service Tasks

(U) FY 1989 Accomplishments:

- **(U)** Monitored development of TRI TAC equipment in other Services and agencies

(U) FY 1990 Planned Program: None Funded

(U) FY 1991 Planned Program: Merged with D107

(U) Work Performed By: Acquisition (development and production) of TRI-TAC equipment is performed by the tasked Service or agency as assigned by the Secretary of Defense. Current Army contractors are GTE Sylvania, Needham Heights, MA (AN/TTC-39 family of switches); Raytheon Company, Marlboro, MA (Digital Group Multiplexer family). In-house developing organization for TRI-TAC tasks assigned to the Army is the Program Executive Office, Communications Systems, Fort Monmouth, NJ and Project Manager, Multi-Service Communications Systems (MSCS). The Facility Support Element is assigned to the Army Electronics Proving Ground, and is operated and maintained by a support contractor.

(U) Related Activities:

PE #0208010F (Joint Tactical Communications Program (TRI-TAC Air Force Program))
PE #0208010M (Joint Tactical Communications Program (TRI-TAC Marine Corps))
PE #0303401A (Communications Security Equipment).

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Other Procurement, Army BA1010	112778	1991	18180
BB1600	22970	- 0 -	37679

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0303142A**

PE Title: **Satellite Communications Ground Environment**

Budget Activity: **#5**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D253	Defense Satellite Communications System — Defense Communications System (DSCS-DCS) (Phase II)				
	11596	26913	22526	Cont	Cont
D455	Tactical Satellite Objective Terminal (SCOTT)				
	7146	22558	16036	Cont	Cont
D456	Tactical Satellite Communications (TACSATCOM) System				
	5944	6063	9182	Cont	Cont
PE TOTAL	24686	54634	47744		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides funds for the development of tactical and strategic military satellite communications ground terminals and control systems for the Department of Defense. Developments under this program provide rapid, reliable, effective communications to support The Joint Chiefs of Staff (JCS) validated command, control, communications and intelligence (C3I) in support of the President, Commander in Chiefs (CINCS), JCS, and tactical commanders. This program also provides for a combined strategic/tactical Extremely High Frequency (EHF) DSCS program. Also, the SCOTT Program provides an enduring survivable EHF system in a stressed tactical environment via the MILSTAR satellite.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project Project D456 — Tactical Satellite Communications System: The Ground Mobile Forces Satellite Communications (GMFSC) or Tactical Satellite Communications (TACSATCOM) system provides funds for the development of tactical satellite communications terminals and satellite control equipment used with the Department of Defense global super high frequency (SHF) Defense Satellite Communications System (DSCS) and worldwide ultra high frequency (UHF) Fleet Satellite/Air Force Satellite (FLTSAT/AFSAT) system. Development efforts under this program are in support of Joint Chief of Staff (JCS) validated and Office of Secretary Defense (OSD) approved and directed requirements, projects, and programs satisfying unique and vital command, control, communications, and intelligence (C3I) JCS, Commanders in Chiefs (CINCS), and field commanders of the military departments.

(U) FY 1989 Accomplishments:

- **(U)** Completed AN/TSQ-XX development and test requirements
- **(U)** Awarded development contract for the Enhanced Manpack Ultra High Frequency Terminal (EMUT)
- **(U)** Start reconfiguration of AN/TSC-85/93 SHF terminals for improved reliability

(U) FY 1990 Planned Program:

- **(U)** Upgrade the AN/TSQ-XX for an Anti-Jam (AJ) capability, up and down converters, and associated equipment necessary to provide network control for up to 50 TACSATCOM terminals
- **(U)** Continue EMUT development and start Initial Operational Test and Evaluation (IOT&E)

Program Element: **#0303142A**

PE Title: **Satellite Communications Ground Environment**

Budget Activity: **#5**

(U) FY 1991 Planned Program:

- **(U)** Start production of AN/TSQ-XX control terminal
- **(U)** Begin preproduction of reconfigured AN/TSC-93/85 terminals

(U) Work Performed By: In-house efforts will be accomplished by the PM SATCOM, under the management of PEO Communications Systems, Fort Monmouth, New Jersey. Efforts being undertaken by the Air Force, Navy, Marine Corps, and DCA directly relate to Army projects. Major contractors are the Harris Corp., Melbourne, Fl; Magnavox Corp., Torrance, CA., Ft. Wayne, IN., and Ashburn, VA.; Martin Marietta Corp. Orlando, FL; Ford Aerospace Corp., Palo Alto, CA; RCA Corp., Camden, NJ; Stanford Telecommunications Inc., Santa Clara, CA; General Electric Corp., Valley Forge, PA; Applied Physics Laboratories, College Park, MD; and MIT Laboratory, Cambridge, MD.

(U) Related Activities: There is no unnecessary duplication within DOD.

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Procurement (OPA2)	6400	3300	8400

(U) International Cooperative Agreements: Not Applicable

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0303142A** Project Number: **# D253**

PE Title: **Satellite Communications Ground Environment** Budget Activity: **#5**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Defense Satellite Communications System — Defense Communications System (DSCS-DCS)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DSCS/DCS	11596	26013	22526	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project provides funds for the development of strategic satellite communications ground terminals and control systems for the armed services and other Government agencies. Developments under this program provide rapid, reliable, effective communications to support a variety of command and control requirements for strategic commanders, as well as the National Command Authority and the Defense Communications System. Satellite ground terminals and systems are developed in response to validated requirements of the Joint Chiefs of Staff (JCS). This project supports the Strategic Defense Satellite Communications System.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Awarded Development contract on the Generic Principles Trainer
- **(U)** Continued Integrated Test Facility (ITF) upgrades and systems engineering technical assistance (SETA) efforts

(U) FY 1990 Planned Program:

- **(U)** Continue Development contract on the Generic Principles Trainer
- **(U)** Initiate the solicitation phase on the DSCS Family of Training Devices
- **(U)** Competitive solicitation issued on Universal Modem
- **(U)** Full scale engineering development (FSED) contract award on Universal Modem
- **(U)** Continue ITF upgrades and SETA support

(U) FY 1991 Planned Program:

- **(U)** Continue and complete Development Phase on the Generic Principles Trainer
- **(U)** Competitive solicitation issued on the DSCS Family of Training Devices
- **(U)** Continue FSED on the Universal Modem
- **(U)** Continue ITF upgrades and SETA support

D. (U) WORK PERFORMED BY: In-house efforts will be accomplished by the PM Satellite Communications, under the management of PEO Communications Systems, Fort Monmouth, NJ, and the CECOM Center for Space Systems, Ft. Monmouth, NJ. Major contractors are Magnavox, Torrance, CA; Ford Aerospace Corp, Palo Alto, CA; STel, Santa Clara, CA; AAI, Orlando, FL; Johns Hopkins University, Applied Physics Laboratory, Laurel, MD; Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA.

Program Element: **#0303142A** Project Number: **# D253**
PE Title: **Satellite Communications Ground Environment** Budget Activity: **#5**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** An additional technical effort was added. The Universal Modem Program was transferred from the Air Force to the Army 1 Jun 1989.
2. **(U) SCHEDULE CHANGES:** An FY90 full scale engineering development (FSED)/limited rate initial production (LRIP) contract award is planned.
3. **(U) COST CHANGES:** Contract award slip to late FY90 resulted in deferring $10.0 M from FY91.

F. (U) PROGRAM DOCUMENTATION: Defense Communications Agency (DCA) DSCS Program Plan approved annually by Secretary of Defense.

G. (U) RELATED ACTIVITIES: None

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
1. **PROCUREMENT**			
Other Procurement, Army	61000	68500	56000

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
1. DSCS GENERIC PRINCIPLES TRAINER:	
Development Phase	FY89
Integration/Testing	FY91
Production Phase	FY91
Initial Operational Capability (IOC)	FY93
2. FAMILY OF TRAINING DEVICES:	
Development Phase	FY92
Integration/Testing	FY93/94
Production Phase	FY95
IOC	FY97
3. UNIVERSAL MODEM:	
FSED	FY90
Development Test/Operational Test (DT/OT) II	FY93
Low Rate Initial Production (LRIP)	FY94
Production	FY95
IOC	FY96

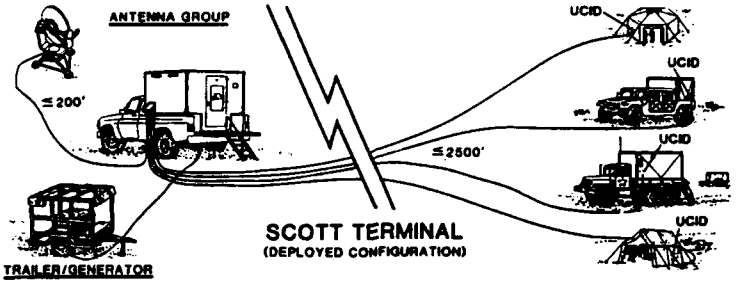
FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0303142A** Project Number: **#D455**

PE Title: **Satellite Communications Ground Environment** Budget Activity: **#5**

Project Title: **Tactical Satellite Objective Terminal (SCOTT)**

SCOTT SYSTEM DESCRIPTION



CHARACTERISTICS	MEAN TIME TO REPAIR	
• 3-MAN CREW	• UNIT	30 MIN
• 5/4 TRUCK W/TRAILER	• INTERMEDIATE	2 HOURS
• 3 KW GENERATOR		
• 30 MINUTE SET-UP TIME		
• UP TO FOUR USERS	RELIABILITY	
• 5.5 FT EHF ANTENNA		
• SECURE VOICE: ANDVT	• MTBOMF	420 HOURS
• DATA: 75/2400 BPS		

POPULAR NAME: **SCOTT**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			DLV 12 FSED Terms	ASARC	
Engineering Milestones		Cont. Med PWR XTR, Initiate TRNG Sim.	Cont. Med PWR XTR. TRNG SIM AWD	Comp. Med PWR XTR, & Trng Sim	Trans Med PWR XTR & Trng Sim to Prod.
T&E Milestones		Joint Interop tests. Cont Tech Test	Complete Tech Test Initiate IOT&E. Joint Interop Test	FAT on FSED Termls Complete IOT&E Joint Interop Test	Continuous Eval Joint Interop Tests.
Contract Milestones		Prod RFP. Phase II Med PWR XTR.	Trng Sim FSED	Awd Production contract.	Awd Production contract for Med PWR XTR & OPT1-4.
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		622	14625	8574	171931 (36941)
Support Contract		3036	3658	4553	77089 (7925)
In-House Support		2973	2736	2845	20122 (5284)
GFE/ Other		515	1539	64	17937 (8644)
Total		7146	22558	16036	287079 (58794)

Program Element: **#0303142A** Project Number: **#D455**

PE Title: **Satellite Communications Ground Environment** Budget Activity: **#5**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The SCOTT, AN/TSC-124, is the MILSTAR terminal for both conventional and nuclear ground forces. SCOTT/MILSTAR is the most survivable planned system for providing satelite communications in a severe electronic warfare, nuclear effects-disturbed, chemical and biological environment. SCOTT provides an extremely robust electronic counter-counter measures (ECCM) system with the following capabilities: very low probability of intercept, virtually jam proof, extremely reliable, extended distance, transportable, and secure tactical communications. SCOTT provides field commanders with survival command and control communications for positive control of our Non-Strategic Nuclear Forces (NSNF), of Theater forces, of special operation forces (SOF), of classified special users and for interoperability with other service MILSTAR terminals. The MILSTAR/SCOTT program was assigned a BRICK—BAT/FAD-I priority by the President.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Continued development of the SCOTT terminal
- (U) Continued technical test
- (U) Began Should Cost effort on production proposal
- (U) Initiated establishment of SCOTT Extremely High Frequency (EHF) Test Facility
- (U) Initiated Reliability Development Growth Test
- (U) Tested the SCOTT terminal successfully against the MILSTAR satellite Enhanced Design Verification Model (EDVM)

(U) FY 1990 Planned Program:

- (U) Continue development of the SCOTT terminal
- (U) Complete technical test (TT)
- (U) Participate in FY89 successful interservice MILSTAR demonstrations
- (U) Initiate Initial Operational Test & Evaluation (IOT&E)
- (U) Award training simulator development contract
- (U) Initiate phase 2 of medium power transmitter development
- (U) Participate in the MILSTAR joint service interoperability testing phase II program
- (U) Complete Reliability Development Growth Testing
- (U) Initiate Development of over-the-air-rekey (OTAR) modification, and network control system (NECOS) protocols

(U) FY 1991 Planned Program:

- (U) Complete Initial Operational Test & Evaluation (IOT&E)
- (U) Prepare the test report and the Independent Evaluation Report (IER)
- (U) Continue training simulator development
- (U) Continue phase 2 of medium power transmitter development
- (U) Initiate First Article Testing (FAT) will be conducted on three (3) terminals built on production tooling and processes
- (U) Initiate Post-Deployment Support Operations
- (U) Resolve any testing problems
- (U) Participate in the MILSTAR joint service interoperability testing program
- (U) Continue development of MILSTAR modifications (over-the-air rekey (OTAR), network control system, Non-Strategic Nuclear Forces (NSNF) protocols, etc.)
- (U) Support continuing evaluation

Program Element: **#0303142A** Project Number: **#D455**
PE Title: **Satellite Communications Ground Environment** Budget Activity: **#5**

- **(U)** Conduct Milestone III review by the Army Systems Acquisition Review Committee
- **(U)** Award production contract

(U) Program Plan to Completion:

- **(U)** Complete training simulator development
- **(U)** Complete development of medium power transmitter and transition into production
- **(U)** Resolve any testing problems
- **(U)** Support continuing evaluation
- **(U)** Continue development of MILSTAR modifications, upgrades, and Enhancements
- **(U)** Establish Post Deployment Software Support Depot
- **(U)** Complete First Article Testing (FAT)

D. (U) WORK PERFORMED BY: In-house efforts will be accomplished by PM SCOTT, under the management of Program Executive Officer (PEO) Communication Systems, with support provided by U.S. Army Communications Electronics Command, Fort Monmouth, NJ. Major contractors are Lincoln Laboratories, Marborough, MA; Magnavox Electronics Systems Company, Ashburn, VA.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** No Change.
2. **(U) SCHEDULE CHANGES:** Delay in delivery of FSED terminals by contractor due to integration problems. IOT&E test slipped from Aug 1989 to Aug 1990.
3. **(U) COST CHANGES:** No Change, Firm Fixed Priced Contract.

F. (U) PROGRAM DOCUMENTATION:

Organization & Operation Plan (O&O).	Approved,	10/82
	Updated	10/88
Cost and Operational Effectiveness Analysis (COEA).	Approved,	8/85
Test and Evaluation Master Plan (TEMP).	Approved,	6/87
Acquisition Plan (AP) Revision 2.	Approved,	10/87
Justification and Authority to Negotiate	Approved,	10/87
MILSTAR Sys Threat Assessment	Approved,	12/87

G. (U) RELATED ACTIVITIES:
Joint MILSTAR Program. Multi-service effort, Air Force airborne, Navy shipboard, Army ground environment. There is no unnecessary duplication of effort within DOD.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
PROCUREMENT (OPA)			
K23700	36500		

Program Element: **#0303142A**
PE Title: **Satellite Communications Ground Environment**

Project Number: **#D455**
Budget Activity: **#5**

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

(U) FY 1989 Accomplishments:

- **(U)** Continued contractor technical testing program
- **(U)** Participated in joint interoperability test with MILSTAR Satellite Enhanced Design Verification Model (EDVM)
- **(U)** Initiated Reliability Development Growth Test (RDGT)
- **(U)** Initiated Electromagnetic Interference (EMI) testing
- **(U)** Completed TEMPEST testing

(U) FY 1990 Planned Program:

- **(U)** Complete technical test
- **(U)** Begin Initial Operational Test & Evaluation (IOT&E)
- **(U)** Participate in successful MILSTAR interoperability test Phase II over Navy Fleet Satellite EHF package (FEP)
- **(U)** Complete Reliability Development Growth Test (RDGT)
- **(U)** Continue development of SCOTT/EFH Test Facility
- **(U)** Conduct Electromagnetic Pulse/Nuclear Reaction (EMP/INR) testing
- **(U)** Complete Electromagnetic Interference (EMI) testing
- **(U)** Complete [illegible]ware Preliminary Qualification and Final Qualification test
- **(U)** Participated in MILCOM 1989 successful interservice MILSTAR demonstrations

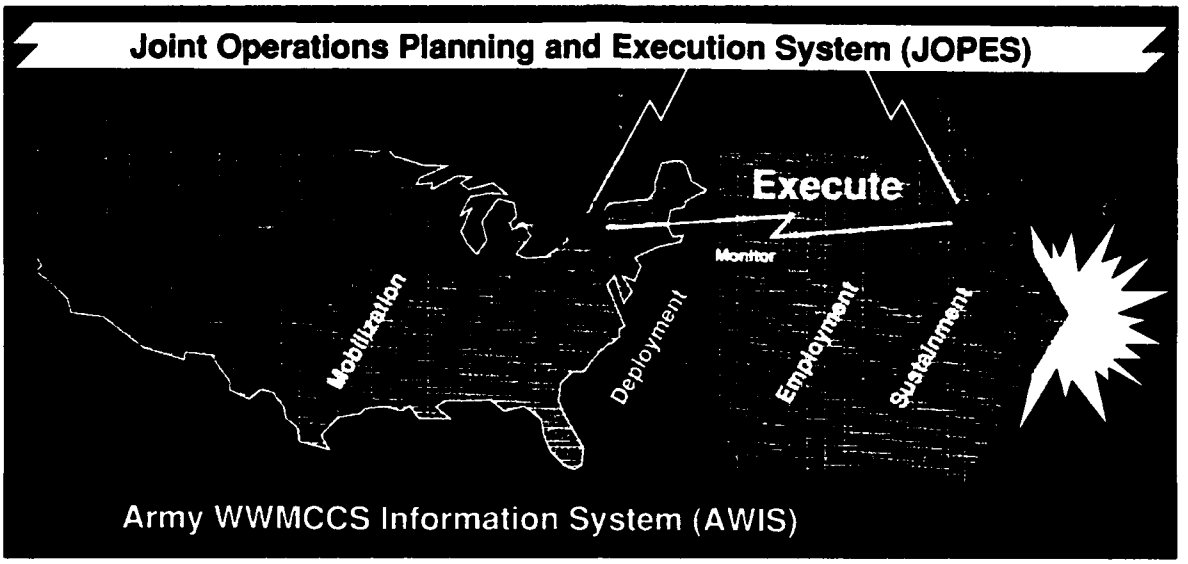
(U) FY 1991 Planned Program:

- **(U)** Complete Initial Operational Test & Evaluation (IOT&E)
- **(U)** Participate in MILSTAR joint service interoperation testing
- **(U)** Conduct First Article Testing (FAT) on three production tooled FSED terminals
- **(U)** Support Continuous Evaluation

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0303152A**
PE Title: **World-Wide Military Command & Control Systems, Information System**
Project Title: **Army WIS Modernization Program**

Project Number: **#DH86**
Budget Activity: **#3**



POPULAR NAME: **AWIS**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones					
Engineering Milestones		ASD Contract Design Review Jan 89. Initiate Segment I Software	ASD Cont Fld USAREUR Trans, FORSCOM MOB/ ODEE. Seg. 1. Init Seg 2.	ASD Contract Development of Segment 2.	ASD Contract Critical Design All Functionality Apr 93
T&E Milestones		ASD Contract OT Apr 89	ASD Contract OT Nov 89	ASD Contract OT Dec 90	ASD Contract OT Sep 92
Contract Milestones		Site Support Option III Apr 89	Site Spt Option IV Apr 90. PM Spt Recompete Jul 90	Site Support Recompete Apr 91	
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		16466	19760	14389	171382* (Cont)
Support Contract		6602	5018	8170	120337* (Cont)
In-House Support		None	None	None	None
GFE/ Other		- 0 -	- 0 -	- 0 -	- 0 -
Total		23068	24778	22559	291719* (Cont)

Program Element: **#0303152A** Project Number: **#DH86**

PE Title: **World-Wide Military Command & Control Systems, Information System** Budget Activity: **#3**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The World-Wide Military Command and Control System (WWMCCS) ADP Modernization (WAM) Program was directed by Congress to provide worldwide data collection and information processing, allowing rapid and reliable exchanges of information to support mobilization, employment, deployment, and sustainment of forces. WAM supports the National Command Authorities, the Joint Staff, Unified and Specified Commanders, and Defense Agencies and Services by providing command and control (C2) information needed for planning and execution of conventional military operations. AWIS is the Army portion of the WAM Program. It will modernize C2 information processing at 19 Army-supported WWMCCS sites. AWIS will also modernize automated information processing and exchange needed for strategic command and control within the Army.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Tested and Installed 1st release of USAREUR Movement Control and Readiness Reporting (MCRR) software
- (U) Tested and Installed 1st release of FORSCOM mobilization and development/employment execution software (MOB/ODEE)
- (U) Developed software segmentation and incremental development plans for segments one through four
- (U) Initiated development of the first segment of common Army strategic C2 software (Unit Status, Logistics, Crisis Operations, Personnel, and Command, Control and Communications (C3) Management)
- (U) Began next phase planning with emphasis on software transition and main frame hardware installation
- (U) Completed FY89 Army site installation planning (SEP 89)
- (U) Performed Independent Verification and Validation (IV&V) of the software development activities and devised an approach for performing IV&V on the prototyping efforts
- (U) Performed maintenance of fielded C2 software

(U) FY 1990 Planned Program:

- (U) Complete fielding of USAREUR transportation strategic C2 software (MCRR release 2.0)
- (U) Complete fielding of FORSCOM mobilization, employment, deployment, and execution strategic C2 software (Releases 2.0, 3.0, and 4.0)
- (U) Preliminary and detailed design and coding of Unit Status, Logistics, Crisis Operations, Personnel, and Command, Control and Communications (C3) Management strategic software (Segment 1)
- (U) Initiate development of the second segment of common Army strategic C2 software (RECON, Weather, Medical, Force Planning, and Military Traffic Management Command (MTMC) Transportation)
- (U) Perform maintenance of fielded C2 software
- (U) Perform IV&V on the software development effort to ensure traceability to the documented requirements

(U) FY 1991 Planned Program:

- (U) Computer Software Configuration Item (CSCI) Integration and test, initial operational test and evaluation (IOT&E) and fielding of Unit Status, Logistics, Crisis Operations, Personnel, C3 Management and Medical strategic C2 software (Segment 1)

Program Element: **#0303152A** Project Number: **#DH86**

PE Title: **World-Wide Military Command & Control Systems, Information System** Budget Activity: **#3**

- **(U)** Continue the development of segment 2 (RECON, Weather, Medical, Force Planning, and MTMC Transportation strategic software)
- **(U)** Provide maintenance of fielded C2 software
- **(U)** Perform IV&V on the software development efforts

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

D. (U) WORK PERFORMED BY: AWIS Software Development Contract: TRW, Fairfax, VA. Program Management Support Contract: TAI, Alexandria, VA. Site Support Contract: TAI, Alexandria, VA. IV&V Contract: EER Systems, McLean, VA.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not Applicable.
2. **(U) SCHEDULE CHANGES:** Not Applicable.
3. **(U) COST CHANGES:** Not Applicable.

F. (U) PROGRAM DOCUMENTATION:

Joint Mission Element Needs Statement (JMENS)	12/81
Material System Requirements Specifications (MSRS)	05/85
WIS Decision Coordinating Paper	07/85
WIS Test & Evaluation Master Plan (TEMP)	07/87
AWIS TEMP	09/87
AWIS Program Master Plan (PMP)	12/87
Life Cycle Documents Architecture Design Contract	05/88
Joint Operational Planning & Execution (JOPES) Required Operational Capability (ROC)	04/88

G. (U) RELATED ACTIVITIES:

- WWMCCS ADP Modernization (WAM) Program
- DCA is Executive Agent and is responsible for Joint standard hardware and software, provides interfaces to Services/agency software and overall hardware and software architecture.
- There is no unnecessary duplication of effort in this program within the Department of Defense

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
OPA2 (BE4100)	15187	27432	20882

I (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

Program Element: **#0303152A** Project Number: **#DH86**
PE Title: **World-Wide Military Command & Control Systems, Information System** Budget Activity: **#3**

J. (U) TEST AND EVALUATION DATA:

Test and Evaluation Activity (Past 12 Months)

Event	Planned Date	Actual Date	Remarks
Test of MCRR 1.0 Software Users Manual (SUM)	5-9 Feb 89	5-7 Feb 89	Tests indicated numerous differences between SUM and actual screens.
Regression Test of MCRR 1.0 SUM		11-12 Feb 89	Fixes Made
MOB/ODEE Release 1.0 preliminary at AWIS Test Facility (ATF)	17 Jul 14 Aug 89	21-24 Aug 89	Numerous tests crashed. Fault analysis done. All but 2 items retested satisfactorily
MOB/ODEE Release 1.0 Demonstration to users at ATF.	8 Sep 89	8 Sep 89	Identified Screen formatting changes.
MOB/ODEE Release 1.0 site integration and test	15-20 Sep 89	25-29 Sep 89	Numerous problems with transition software. Numerous transition S/W and application S/W fixes made. Regression testing completed. All events passed.
	FUTURE EVENTS		
MOB/ODEE Release 2.0 Preliminary Tests at ATF	13-15 Feb. 90		On Schedule
MCRR Release 2.0 Test Readiness Review (TRR).	5 Mar 90		On Schedule
MOB/ODEE Release 2.0 Site Test	5-9 Mar 90		On Schedule
MCRR Release 2.0 Formal Testing	5 Mar-2 Apr 90		On Schedule
MCRR Release 2.0 Software Test Report	1 May 90		On Schedule
UTH User Test	1st Qtr FY 91		On site in Europe

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0303401A** Project Number: **D491**
PE Title: **Communications Security (COMSEC)** Budget Activity: **#5**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Communications Security Equipment Technology

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Totai Program
COMSEC	7530	6920	11323	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program develops Communications Security (COMSEC) equipment and techniques required to combat threat signal intelligence capabilities and to insure our data network integrity. The COMSEC objective is to implement National Security Agency (NSA) developed security technology in Army information systems. The thrust of the program is to insure total security of all Army information systems. NSA is developing a standard set of modules, chips, and algorithms which can be embedded into Army information equipment to accomplish this; for example, the MD-1230 Serial Tone High Frequency (HF) MODEM. The Army COMSEC RDTE program provides the Army funding required to apply these NSA developments to Army information systems in a cost effective, expeditious manner.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** *Continued* Army COMSEC Management and Engineering System (ACMES) developments and Communications and Electronics Command (CECOM) Integrated System Control (ISYSCON) hardware for use in all major Army communications systems
- **(U)** Continued TEMPEST test support to major Army communications systems
- **(U)** Continued to provide evaluation of non-developmental COMSEC products
- **(U)** Continued installation support for NSA developed products and engineering support to Army Program Managers (PMs)

(U) FY 1990 Planned Program:

- **(U)** Continue Proof of Principle of ACMES in support of Mobile Subscriber Equipment (MSE), Single Channel Ground & Airborne Radio System (SINCGARS) and TRI-TAC
- **(U)** Initiate Production Prove-Out of Army unique software to allow use of NSA developed key management hardware in secure Army information systems
- **(U)** Continue to provide evaluation of non-developmental COMSEC products

(U) FY 1991 Planned Program:

- **(U)** Initiate Production Prove-Out program for embedding COMSEC into MD-1230 HF MODEM
- **(U)** Initiate Production Prove-Out of ACMES net planner in support of Major C3 Systems.
- **(U)** Continue development of Army unique software to allow use of NSA developed key management hardware in secure Army information systems
- **(U)** Continue to provide evaluations of non-developmental COMSEC products for Army applications
- **(U)** Continue to provide installation and integration support for NSA developed products to Army PMs

Program Element: **#0303401A** Project Number: **D491**
PE Title: **Communications Security (COMSEC)** Budget Activity: **#5**

D. (U) WORK PERFORMED BY: The primary contractors performing work in this program are: Honeywell Inc., Annapolis MD; ITT, Fort Wayne, IN; Bendix Corp., Towson, MD; Sperry Corp., Reston, VA; Engineering and Professional Services, Tinton Falls, NJ. The primary in-house developing organizations are the US Army Communications-Electronics Command, Fort Monmouth, NJ; US Army Test and Evaluation Command, Aberdeen Proving Ground, MD; Naval Ocean Systems Center, San Diego, CA; and the National Security Agency, Fort Meade, MD.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** A new requirement to provide R&D to incorporate embedded COMSEC in the MD-1230 Modem for the Improved High Frequency Radio (IHFR) and to provide backward compatibility with the ANDVT was added in support of PM SINCGARS.
2. **(U) SCHEDULE CHANGES:** The MD-1230 R&D was added to the schedule.
3. **(U) COST CHANGES:** Funds obtained to perform required MD-1230 R&D.

F. (U) PROGRAM DOCUMENTATION:

O&O Plan for the Automated COMSEC Management and Engineering System (ACMES)	6/87
ROC for ACMES	1/90
ROC for Improved High Frequency Radio (IHFR)	11/81
O&O for IHFR	1/81
TEMP for IHFR Short Term Anti-Jam (STAJ) Modem	4/87

G. (U) RELATED ACTIVITIES:
PE #0203726A (Advanced Field Artillery Tactical Data System)
PE #0604805A (Command, Control, Communications Systems — Engineering Development)
PE #0603713A (Army Data Distribution System (ADDS))
All the above related activities use embedded COMSEC hardware, firmware, and software. There is no unnecessary duplication of effort within the Army or DOD.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
PROCUREMENT			
Other Procurement Army			
TA0400	8214		
TA0500	6215	9988	5300
TA0600		6245	5018
T68000	630		
BZ8950	20704	1482	1779
T54000	7386	11408	11268
T06400	2135		
T99500	5697		
T03200	2135	1200	0
BK5265	200		
BL5264	3258	6035	6388
TOTAL	56574	36358	29753

Program Element: **#0303401A** Project Number: **D491**
PE Title: **Communications Security (COMSEC)** Budget Activity. **#5**

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
Award ACMES Element 1 Proof of Principal	Apr 1989
Complete ACMES Element 1 Proof of Principal	Feb 1991
ACMES MARBO	May 1989
Award ACMES Elements 2&3 Dov Prove-out	May 1990
Complete ACMES Elements 2&3 Dov Prove-out	May 1992
Award MD-1230 Embedded COMSEC	Feb 1991
Complete MD-1230 Embedded COMSEC	Feb 1992

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0601101A**

PE Title: **In-House Laboratory Independent Research** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A91A	In-House Laboratory Independent Research — Army Materiel Command				
	- 0 -	5529	5760	Cont	Cont
A91C	In-House Laboratory Independent Research — Medical Research and Development Command				
	- 0 -	2563	2751	Cont	Cont
A91D	In-House Laboratory Independent Research — Corps of Engineers				
	- 0 -	854	918	Cont	Cont
PE TOTAL	- 0 -	8946	9429		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program allows Army RDT&E activity directors the opportunity to support — at their discretion — innovative, high-payoff research proposed by staff engineers and scientists. Funds are allocated to lab directors by the Assistant Secretary of the Army (Research, Development and Acquisition) and not subject to reallocation by intervening echelons. The amount of the allocation is based on a review of the efforts of the preceding fiscal year by a panel consisting of selected members of the National Research Council's Board of Army Science and Technology. The program serves to foster creativity, strengthen scientific and engineering competence, aid in recruitment and retention of talented scientific and technical personnel, generate scientific recognition, encourage collaboration between Army laboratory and university researchers and influence the performance and cost effectiveness of Army systems. Most projects represent unique opportunities for low dollar investments with potential for high payoff. Successful projects advance into the laboratory core research and development programs. The In-house Laboratory Independent Research (ILIR) program was not funded in FY 1988 or FY 1989. Funding was reinitiated in FY 1990 to exploit the benefits of the ILIR program to support future weapons systems requirements. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A91A — Represents the initial FY 1990 ILIR allocation for the laboratories and Research, Development and Engineering Centers in the Army Materiel Command (AMC).

(U) Project A91C is the initial FY 1990 ILIR allocation for the laboratories in the Medical Research and Development Command.

(U) Project A91D is the initial FY 1990 ILIR allocation for the laboratories in the Corps of Engineers.

(U) FY 1989 Accomplishments:

- **(U)** Not Applicable — The ILIR program was not funded in FY 1989

(U) FY 1990 Planned Program:

- **(U)** ILIR projects are performed at the discretion of the laboratory directors and are not subject to a prior approval. Innovative, potentially high payoff research ideas will be solicited during FY 1990 and the most promising projects will be selected for funding.

Program Element: **#0601101A**

PE Title: **In-House Laboratory Independent Research** Budget Activity: **#1**

(U) FY 1991 Planned Program:

- **(U)** The results of the research performed in FY 1990 will be evaluated by the Board of Army Science and Technology, and the ILIR allocation for FY 1991 for each laboratory will be based on the results of the evaluation. The laboratory directors will select the projects to be funded in FY 1991. This procedure is designed to reward those laboratory Directors who best utilize their ILIR investment

(U) Work Performed By: The work will be performed in-house by the 31 Army Laboratories and Research, Development and Engineering Centers.

(U) Related Activities: The Navy and Air Force have similar programs. Coordination is accomplished and duplication avoided through scientific symposia, literature reviews, exchange of research and technology resumes, Department of Defense topical reviews and reports transmitted by the Defense Technical Information Center. There is no duplication of these programs within the Army or the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A31B Night Vision and Electro-Optics Research	7256	4736	4875	Cont	Cont
A71A Research in Chemical Warfare/Biological Warfare Defense	4796	4683	5029	Cont	Cont
AF22 Research in Vehicular Mobility	770	1747	1775	Cont	Cont
AH40 Signals Warfare Laboratory	681	1051	768	Cont	Cont
AH42 Materials and Mechanics	2949	2812	3021	Cont	Cont
AH43 Research in Ballistics	5409	5072	5111	Cont	Cont
AH44 Sensors Systems Research	2458	2279	2346	Cont	Cont
AH45 Air Mobility	7282	7481	7736	Cont	Cont
AH47 Electronic Device Research	3642	4499	4529	Cont	Cont
AH48 Communications Research	2252	2640	2520	Cont	Cont
AH49 Research in Missiles and High-Energy Lasers	5999	4396	4339	Cont	Cont
AH51 Combat Support	1176	1546	1661	Cont	Cont
AH52 Equipment for the Soldier	3162	3017	3139	Cont	Cont
AH60 Research in Armaments	2390	3114	2934	Cont	Cont
AH61 Research in Close Combat Weaponry	1770	2044	2194	Cont	Cont
AH68 Processes in Pollution Abatement Technology	524	428	566	Cont	Cont
AT22 Soil and Rock Mechanics	2282	1969	2036	Cont	Cont
AT23 Basic Research/Military Construction	982	1030	1132	Cont	Cont
AT24 Snow/ice and Frozen Soil	1460	1464	1503	Cont	Cont
B52C Mapping, Geodesy/Geographic	2746	2428	2996	Cont	Cont
B53A Atmospheric Sciences	4248	5308	5519	Cont	Cont
B74A Human Engineering	2348	3024	2897	Cont	Cont

Program Element: **#0601102A**

PE Title: **Defense Research Sciences** Budget Activity: **#1**

B74F	Personnel Performance and Training					
	4391	3624	3403	Cont	Cont	
BH27	Research in Munitions Science					
	2790	3055	2975	Cont	Cont	
BH57	Scientific Problems with Military Applications					
	58157	55987	57951	Cont	Cont	
BS04	Military Pollutants/Health Hazards					
	698	852	577	Cont	Cont	
BS11	Science Base/Medical Chemical Defense					
	4433	5864	6529	Cont	Cont	
BS12	Science Base/Medical Biological Defense					
	15310	17595	19825	Cont	Cont	
BS13	Science Base/Medical Research Infectious Disease					
	9420	7783	8132	Cont	Cont	
BS14	Science Base/Combat Casualty Care Research					
	2797	2650	2853	Cont	Cont	
BS15	Science Base/System Health Hazards Research					
	5152	7531	7734	Cont	Cont	
BS16	Science Base/Combat Dentistry Research					
	1192	838	1023	Cont	Cont	
PE TOTAL	170897	172643	179490			

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is the US Army core research program to sustain the science and engineering base required to exploit new opportunities in rapidly advancing technological fields. The program supports theoretical and experimental research in the physical, mathematical, biological, environmental, terrestrial and behavioral sciences. This research is focused on the Army's key goals for effectiveness in the Airland Battle environment and the Army 21 concept to provide a lethal, integrated, supportable, highly mobile force with enhanced soldier effectiveness. Research areas are determined and prioritized in order to meet Army needs as stated in mission area analyses and in Army 21, and to exploit scientific opportunities. This core research program is complemented by the inter-disciplinary research performed under the University Research Initiative (URI) program. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A31B — Night Vision and Electro-Optics Research: This program sustains the Army's theoretical and experimental research in night vision and electro-optic technology. The research is focused upon new materials/techniques relative to thermal imaging, lasers, signal processors and tunable filters/power limiters. Emphasis is placed on research in Mercury Cadmium Telluride for high performance, high yield focal plane arrays (FPAs) supporting next generation thermal imaging systems. New tunable laser materials is a critical area that is being addressed for Army countermeasure applications. Additionally, efforts are to be placed upon the research of materials suitable for filters and broad band limiters for Army counter-countermeasure applications. This program includes efforts related to the development of algorithms for automatic target recognizers.

(U) FY 1989 Accomplishments:

- **(U)** Transitioned linear bolometer array to exploratory development (6.2) for munition guidance concept testing
- **(U)** Demonstrated low density optically addressed Infrared (IR) sensor array

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

- (U) Identified new materials for high efficiency diode pumping
- (U) Spectroscopic evaluation of optical fibers
- (U) Developed high efficiency laser diode arrays
- (U) Used low temperature growth technology to grow multilayer structures for new class of advanced IR detector devices
- (U) Established technology for generation of continuous wave laser in 3-5 micron band

(U) FY 1990 Planned Program:

- (U) Examine limits of optical processing to implement corrections for focal plane nonuniformities given the level of performance of optically addressed sensors at that time
- (U) Demonstrate brassboard high pixel count, optically addressed IR array and transition to exploratory development (6.2)
- (U) Focal Plane Array (FPA) fabrication facility on-line using low temperature growth
- (U) Grow vibronic solid state laser crystals
- (U) Evaluation of candidate tunable-laser materials
- (U) Evaluation of materials in laser cavity
- (U) Transition low temperature growth methods to 6.2
- (U) Demonstrate non-destructive array testing
- (U) Grow large-size solid state materials for pumping lasers

(U) FY 1991 Planned Program:

- (U) Examine feasibility of multispectral material response for optical gain and offset correction
- (U) Investigate possibilities of interactive (at sensor-processor level) image processing
- (U) Complete materials evaluation for diode pumping
- (U) Grow large crystals of candidate tunable laser materials
- (U) Evaluate laser characteristics of tunable laser materials
- (U) Transition array testing to the Defense Strategic & Tactical Array Reproducibility (DSTAR) program production line
- (U) Initiate Multi-color, multifunction array design
- (U) Demonstrate feasibility of dry etch process

(U) Project A71A — Research in Chemical/Biological Warfare Defense: The purpose of this project is to obtain, through basic research in chemistry, physics and life sciences. fundamental information in support of: new and improved defensive systems for biological agents and toxins; new and improved defensive systems for chemical threat agents; a sound program for retaliatory systems in chemical munitions; an innovative basic research program in aerosol and obscuration sciences to support the Army smoke program, and new concepts in decontamination methods.

(U) FY 1989 Accomplishments:

- (U) Screened and developed biosystem enzymes capable of mustard agent hydrolysis
- (U) Studied the chemistry and mechanisms of new agent classes relative to neurotransmitter and cellular activity
- (U) Measured Spectroscopic Mueller matrices of biological samples and compared with theoretical results to assess detection discrimination capabilities
- (U) Developed a model to predict absorption affinity of selected vapor challenges on absorptive material
- (U) Conducted experimental studies associated with projectile flight instabilities due to partial liquid/partial solid payloads

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

(U) FY 1990 Planned Program:

- **(U)** Initiate protein engineering studies for enzyme stabilization for application to decontamination
- **(U)** Study fundamental mechanisms of general anesthesia and the chemistry of compounds that cause anesthetic response to lead to safer, more potent incapacitants
- **(U)** Continue studies on mechanisms of agent hydrolysis
- **(U)** Continue study of laser ionization mass spectrometry and ion mobility spectrometry of chemical agents

(U) FY 1991 Planned Program:

- **(U)** Complete investigations of stability phenomena associated with partial solid/partial liquid payloads in projectiles
- **(U)** Investigate methods to control optical effectiveness of obscurants
- **(U)** Expand on new concepts of using lasers in chemical/biological defense to include application of laser spectroscopy to detection of agents on surfaces
- **(U)** Continue protein engineering studies for enzymatic decontamination
- **(U)** Continue fundamental mechanism studies of anesthetic drugs on neurotransmitter systems to improve the potency and safety of incapacitants
- **(U)** Demonstrate intermediate soft oxidation mechanisms for toxic materials

(U) Project AF22 — Research in Vehicular Mobility: This effort provides the scientific foundation for increasing the mobility of tracked and wheeled vehicles in all weather and soil conditions. Principle thrusts include vehicle dynamics, propulsion, survivability and robotics. The goal is greater mobility with smaller crew, and more effective crew requirements including improved survivability and logistics.

(U) FY 1989 Accomplishments:

- **(U)** Derived fundamental diffusivity characteristics of ceramic coatings
- **(U)** Related dynamic heat transfer effectiveness to ceramic coating thickness
- **(U)** Performed topological analysis of vehicle geometry
- **(U)** Phased synchronous detection of temporal infrared (IR) signatures
- **(U)** Measured transient heat flow boundary layer effects in diesel engines

(U) FY 1990 Planned Program:

- **(U)** Implement flexible element inertial projection algorithms
- **(U)** Optimize real-time vehicle/turret motion based simulator hardware interface algorithms
- **(U)** Characterize ceramic coatings using thermal imaging
- **(U)** Verify adiabatic engine boundary lubrication models

(U) FY 1991 Planned Program:

- **(U)** Develop solid lubrication models for friction and wear reduction
- **(U)** Implement 2-D lock-in detection for rapid thermal image analysis
- **(U)** Solve non-linear vehicle/soil interaction model
- **(U)** Develop steering control algorithms
- **(U)** Utilize filters to establish a metric for acoustic target/background discrimination

(U) Project AH40 — Signals Warfare Laboratory: Experimentation directed toward extending the frontier of knowledge in signals warfare. Accomplishing this task involves extending the knowledge base in computers and artificial intelligence (AI) for intelligence/electronic warfare (IEW) applications and to provide research on complex signal processing problems.

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

(U) FY 1989 Accomplishments:

- (U) Simulated the robust theory of problem context for possible use in a computer threat assessment system
- (U) Developed automated techniques to recognize a scenario by aggregating the behaviors of its primitive constituents
- (U) Characterized a variety of modulation waveforms through simulation
- (U) Developed a message waveform distortion theory for measuring the electronic message distortion when no preamble accompanies the message

(U) FY 1990 Planned Program:

- (U) Implement concepts of suspicion and volume accumulation for message filtering
- (U) Implement inference tradeoff and resource allocation theory
- (U) Develop and implement improvements to situation assessment paradigm
- (U) Develop enhanced analog-digital neural network formalism
- (U) Develop machine characterizations of complex forms of signal modulation

(U) FY 1991 Planned Program:

- (U) Develop a theory of deterministic plan development which subsumes previous plan recognition and non-deterministic process testing theory
- (U) Investigate and implement methodologies which can be used to realistically evaluate and predict the battlefield performance of a robust, domain independent and extensible threat recognition and assessment system
- (U) Develop the theory to propagate the deterministic solutions provided by computational, geometry research upward to a level useful for tactical decision making
- (U) Characterize a variety of modulation waveforms through simulation
- (U) Develop a theory which would aid in the miniaturization of HF antennas

(U) Project AH42 — Materials and Mechanics: This project provides the Army with basic scientific research in materials and mechanics related to structural materials. Results will ultimately be applied to aircraft, ground combat vehicles, armament systems and personnel support. Major thrust areas include: corrosion prevention and control, armor/anti-armor, advanced structural composites, superconducting materials and chemical protection.

(U) FY 1989 Accomplishments:

- (U) Initiated model development on thermoplastic structural adhesives
- (U) Quantified surface environments effects of wear/tribology
- (U) Completed interfacial reaction study of bonding surfaces
- (U) Performed analytical study of compression failure of ceramics at high strain rates

(U) FY 1990 Planned Program:

- (U) Develop corrosion prediction methodology utilizing neutron radiographic techniques
- (U) Develop model for life prediction of thermoplastic structural adhesives
- (U) Evaluate ballistic plugging resistance of carbide-free alloys
- (U) Evaluate failure mechanisms in ceramic armor
- (U) Investigate synthesis process to impart laser resistance to polymeric materials
- (U) Evaluate high critical-temperature superconductors for Army applications
- (U) Develop automated synthesis method for self-reinforcing (ordered) polymers
- (U) Develop predictive methodology for absorption/desorption of chemical agents in organic materials

Program Element: **#0601102A**

PE Title: **Defense Research Sciences** Budget Activity: **#1**

(U) FY 1991 Planned Program:

- **(U)** Evaluate corrosion of ion-implanted materials
- **(U)** Evaluate novel synthesis techniques for improved adhesives
- **(U)** Develop enhanced radiographic imaging for ceramic armor
- **(U)** Continue evaluations of compressive failure of ceramic at high strain rates
- **(U)** Continue synthesis methods to impart laser resistance to polymers
- **(U)** Continue evaluations of high critical-temperature superconductors for Army applications
- **(U)** Investigate application of artificial intelligence to ordered polymer synthesis
- **(U)** Continue predictive methodology for absorption/desorption of chemical agents in organic materials

(U) Project AH43 — Research in Ballistics: This project contains research on propulsion physics, reaction kinetics, and advanced constitutive modeling for ballistic codes.

(U) FY 1989 Accomplishments:

- **(U)** Evaluated chemical interaction between nitramine-based explosives and burn rate catalysts and characterized low vulnerability ammunition (LOVA) ignition and early combustion
- **(U)** Developed computational fluid dynamics techniques for projectile mass injection and combustion effects
- **(U)** Extended shear ignition data base to energetic materials in which mechanical properties vary in a systematic fashion
- **(U)** Developed a mathematical architecture for decision support and configuration control of vulnerability/lethality data bases and assessments

(U) FY 1990 Planned Program:

- **(U)** Develop constitutive propellant grain model and advance the expert system for gun propellant formulation
- **(U)** Expand super computer computational fluid dynamics (CFD) for complex projectile configurations
- **(U)** Investigate effects of communications interference when interference parameters are only partially known and develop algorithms to reduce processing to near real time
- **(U)** Correlate thresholds for energetic materials deconsolidation during burning with the effects of plasticizers, binders, and particle size
- **(U)** Further development of decision support systems to aid in vulnerability analysis in model and data selection

(U) FY 1991 Planned Program:

- **(U)** Exploit expert system to identify new energetic formulations and characterize LOVA combustion as a function of gun operating temperatures
- **(U)** Extend super computer computations of transient gas dynamics to projectile muzzle device interactions
- **(U)** Validate millimeter wave and infrared background clutter models
- **(U)** Conduct computational and experimental studies on effects of brittle damage in granular high explosive materials
- **(U)** Evaluate corrosion of ion-implanted materials
- **(U)** Evaluate novel-synthesis techniques for improved adhesives
- **(U)** Develop enhanced radiographic imaging for ceramic armor

Program Element: **#0601102A**

PE Title: **Defense Research Sciences** Budget Activity: **#1**

(U) Project AH44 — Sensor Systems Research: This project exploits new opportunities in the technological areas of signal processing, radar, fuses for smart munitions and nuclear hardening and survivability in the Radio Frequency (RF), microwave, near millimeter wave (NMMW) and infrared (IR) spectra. Current ongoing work includes: Signal processing using the acousto-electro-optic effect and neural networks, synthetic aperture radar (SAR) polarimetric scattering properties of targets and clutter and nuclear radiation hardening of microelectronics structure.

(U) FY 1989 Accomplishments:

- **(U)** Generated high quality microwave signals from DC to 40 GHz by infrared laser heterodyne techniques
- **(U)** Used superlattice to modulate and control phase and amplitude of microwaves
- **(U)** Developed models to describe electronic states in gallium arsenide (GaAs) quantum well and super lattice structures applicable to opto-electronic sensor and signal processing applications; optimized techniques to evaluate non-destructively GaAs semiconductor layered structures
- **(U)** Formulated powerful electromagnetic scattering simulation for fuze encounters with foreign air and ground targets. Theory was formulated for RF, radar, and infrared active sensors and was hosted on a super computer with interactive graphics
- **(U)** Demonstrated the effects of radiation-induced trapped holes and interface states on the channel mobility of metal oxide semiconductor field effect transistors (MOSFETS) and degradation of high speed circuit performance

(U) FY 1990 Planned Program:

- **(U)** Demonstrate intracavity laser modulation for signal processing functions
- **(U)** Continue investigation of polarimetric Foliage Penetration Synthetic Aperture Radar (FOPEN SAR) techniques
- **(U)** Investigate radiation produced device parameter changes through oxide growth or doping
- **(U)** Calculate scattering properties of complex structures and low-observables using splined and lofted surface models
- **(U)** Assemble impulse radar experimental instrumentation to measure image formation and foliage penetration
- **(U)** Initiate new program in microdynamic silicon sensors and actuators that are integrable with microelectronics

(U) FY 1991 Planned Program:

- **(U)** Explore use of holographic processing for reconfigurable neural interconnects
- **(U)** Continue tests and analysis for impulse radar; evaluate target and clutter issues and enhancements for image formation with improved pulse code sequences
- **(U)** Investigate charge generation and trapping in integrated circuit (IC) technologies employing advanced isolation techniques
- **(U)** Continue calculation of RF and millimeter wave scattering using splined and lofted-surface target models

(U) Project AH45 — Air Mobility: Basic and applied research in aerodynamics, structures, propulsion and avionics as applied to rotary wing aircraft. Analysis, code development, test and evaluation are conducted on rotor unique aerodynamics, dynamics, performance, stress, structures and aircraft performance and acoustics, as well as transmissions, turbines, and compressors applicable to small engines.

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

(U) FY 1989 Accomplishments:

- **(U)** Developed computional fluid dynamics (CFD) off design code for centrifugal compressors
- **(U)** Developed interlaminar toughness criteria for fatique
- **(U)** Determined effects of dynamic stall on forward flight stability

(U) FY 1990 Planned Program:

- **(U)** Fabricate highly maneuverable, agile rotor models
- **(U)** Investigate actively stabilized compressors
- **(U)** Evaluate water intrusion effects on composites

(U) FY 1991 Planned Program:

- **(U)** Include combined loading conditions in delamination theories
- **(U)** Investigate artificial intelligence engine controls
- **(U)** Conduct tests of adaptive airfoils

(U) Project AH47 — Electronic Device Research: Perform research on critical electronic components and technologies vital to supporting Army requirements in electronic warfare (EW); reconnaissance, surveillance and target acquisition (RSTA); and fire and forget munitions. Exploit emerging technologies and develop needed device concepts for: Smart tactical electronics for real-time signal/data processing in tactical scenarios; millimeter-wave technology for mini-radars, missile seekers, and secure communications; tactical power sources for broad spectrum of manportable electronic equipment.

(U) FY 1989 Accomplishments:

- **(U)** Developed integratable optoelectronic ultrahigh-speed devices using quantum-well and superlattice concepts; designed, fabricated, evaluated .02 micron gate-length field effect device structures in mm-wave circuits; developed and evaluated high electron mobility transistors (HEMT's) and dual-channel HEMT's for high frequency/fast switching applications in 30-100 GHz spectral range
- **(U)** Assessed magnetic circuits to deflect hyper-kinetic projectiles; enhanced the operating field of helical free-electron laser bias structure; investigated the use of high-energy permanent magnets in high-efficiency motors/generators
- **(U)** Explored possibility of creating excitation mediated high temperature superconductivity in layered materials and superlattices and initiated synthesis of high quality thin film and formable high temperature superconductive material
- **(U)** Superlattice gallium arsenide/gallium aluminum arsenide (GaAs)/AlGaAs Heterostructures were grown and employed to fabricate high quantum efficiency infrared (IR) detectors operating in the technologically important 10 micron region

(U) FY 1990 Planned Program:

- **(U)** Design, fabricate and evaluate artificial neural circuits for real-time signal processing and adaptive learning
- **(U)** Explore optically-bistable devices/materials for super high-speed optical computing
- **(U)** Fabricate and test high-power, enhanced, free electron laser bias structure; design magnetic circuits to shield high-speed projectiles; construct and test a high-efficiency permanent-magnet rotor assembly
- **(U)** Apply mechanism and theory to selection of high temperature superconducting material systems for epitaxial growth, sputtering and high quality Czochralski bulk single crystal growth; synthesize materials in optimal form and fully characterize for device application to high-Q cavities and broadband infrared sensors

Program Element: #0601102A
PE Title: **Defense Research Sciences** Budget Activity: #1

- (U) Explore/invent high power density cathode materials for use in ambient temperature and fused salt rechargeable lithium cells

(U) FY 1991 Planned Program:

- (U) Provide ultradense/fast, three-dimensional microelectronics using quantum devices, optoelectronic integration, and neural networks
- (U) Assess emerging new technologies for high-speed real-time signal processing requirements
- (U) Design and fabricate high-field permanent magnet structures using high temperature superconductors for field shaping and shielding
- (U) Fabricate and demonstrate magnetic deflection of high-speed projectiles
- (U) Fabricate high-Q cavity using high temperature superconductor material for potential utilization as narrow band pass filter or stable frequency oscillator; identify suitable diffusion barrier compounds and prepare structure utilizing them to stabilize high temperature epitaxial film growth
- (U) Explore conducting polymer anodes for rechargeable ambient temperature cells for advanced communications, command, control and intelligence (C^3I) applications. Such anodes will enable high energy batteries to be recharged under future battlefield scenarios

(U) Project AH48 — Communications Research: This project addresses the following technical barriers: survivable data/voice communications; knowledge representation and automated reasoning. Research is conducted in: network management and switching concepts, math modeling of command, control, communications (C^3) system designs; expert systems; man-machine interface and adaptive system technology; network oriented electronic countercounter measures (ECCM); electromagnetic (EM) propagation; antennas; airland battle management (ALBM)

(U) FY 1989 Accomplishments:

- (U) Developed likely combat setup configurations for multi battle/multi-stage/multi-phase/multiforces allocations
- (U) Continued International Standard Data Network (ISDN) protocol validation and developed a model and language to specify internetwork functions for ISDN
- (U) Applied game theory to develop average and worse case tradeoff analysis of jammer and network communications alternatives
- (U) Completed theory of new electromagnetic coupled field method for microstrip dipole arrays on thick substrates
- (U) Start High Frequency (HF) communication reliability studies using digisondes with European measurements
- (U) Study optics for parallel processing and second generation Very Large Scale Integration (VLSI)/Very High Speed Integrated Circuit (VHSIC) technology

(U) FY 1990 Planned Program:

- (U) Investigate knowledgebase/database couplings to improve performance of artificial intelligence (AI)/expert system techniques with realtime access measurements
- (U) Develop network failure detection and reconstitution schemes. Develop integrated packet-circuit switch routing protocol
- (U) Develop knowledgebase of Electronic Warfare (EW) attacks and countermeasures in distributed spread spectrum networks
- (U) Investigate approach to obtain frequency dependent explicity for antennas
- (U) Study ionospheric and terrain effects on transmission in the HF through millimeter wave band

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

- **(U)** Continue efforts to maximize material growth techniques for gallium arsenide opto-electronic devices on silica based fibers

(U) FY 1991 Planned Program:

- **(U)** Investigate integrated approach to extend ALBM related knowledgebase/databases and analytical models to include terrain reasoning
- **(U)** Continue development of ISDN protocol interconnect models and strategies
- **(U)** Evaluate effectiveness of network-based attacks and corresponding countermeasures through simulation
- **(U)** Design fully functional experimental model of modulated scattering technique near-field antenna measurement system
- **(U)** Develop first order opto-electronic devices such as light emitting diodes and p-intrinsic n-type field effect transistor (PIN FET) receivers directly on silica fibers
- **(U)** Develop Electromagnetic (EM) propagation assessment tools to plan & implement communications system

(U) Project AH49 — Research in Missiles and High-Energy Lasers: This project contains research on missiles including optical devices, photonic-electronic processors and neural network models.

(U) FY 1989 Accomplishments:

- **(U)** Conducted drop tests of optical correlator guided missile to hit a special target
- **(U)** Continued study of photonics for missile system applications
- **(U)** Continued study of integrated optics devices for missile systems
- **(U)** Continued study of laser induced chemistry (LIC) techniques for material synthesis problems

(U) FY 1990 Planned Program:

- **(U)** Conduct captive carry tests of advanced optical correlator guidance system against real targets in clutter
- **(U)** Continue study of deformable mirror device (DMD) technology for real time matched spatial filters
- **(U)** Apply neural network theory to optical computers

(U) FY 1991 Planned Program:

- **(U)** Demonstrate optical correlator terminal guidance top attack against a tank target
- **(U)** With the Air Force, test hybrid photonic-electronic processor for adaptive phased array radar
- **(U)** Extend neural network study to automatic target recognition applications

(U) Project AH51 — Combat Support: This research is focused on three fields of endeavor, countermine, countersurveillance, and materials, fuels and lubes which have the highest potential for technological breakthroughs to enhance effectiveness. The majority of the programs are joint ventures with universities to capitalize on their research facilities and capabilities while providing unique training experiences for our technical staff.

(U) FY 1989 Accomplishments:

- **(U)** Completed reactive munitions assessment
- **(U)** Developed mine vulnerability program
- **(U)** Implemented expert countermine data base
- **(U)** Continued new concepts feasibility investigations with the Army Research Office (ARO)

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

- **(U)** Completed preliminary investigations on fuel-elastomer interactions involving identification of those compounds most reactive to elastomeric materials

(U) FY 1990 Planned Program:

- **(U)** Develop in-house mine component/external force modeling capability
- **(U)** Continue new concepts feasibility investigations with ARO
- **(U)** Complete fuel-elastomer interaction study identifying mechanisms by which elastomeric fabrics/material deteriorate including isolation of "elastomer-reactive" fuel components
- **(U)** Complete study of diesel wear phenomena using modified Cameron-Flint Laboratory devices

(U) FY 1991 Planned Program:

- **(U)** Continue work on application of autonomous mobility systems to countermine and counterobstacle functions
- **(U)** Continue new concepts feasibility investigations with ARO
- **(U)** Complete study of mechanisms of lubricating additives functions when they are exposed to high temperatures and pressures
- **(U)** Complete 1st generation design parameters for advanced-design, minimal-cooled engine lubrication
- **(U)** Complete flammability hazards study on low viscosity alternative fuels

(U) Project AH52 — Equipment for the Soldier: Basic research to enhance the performance and survivability of the individual soldier through the creation and application of advanced technology for combat clothing, individual equipment, and military rations. Research is conducted on chemical and biological protective mechanisms and materials, new and/or chemically modified materials for enhanced ballistic and Directed Energy Weapons (DEW) protection, as well as, on means to improve the quality and reduce the size and weight of future combat rations.

(U) FY 1989 Accomplishments:

- **(U)** Developed and transitioned immobilized enzymes, which provide chemical agent detoxifying capabilities for enhanced chemical agent protection
- **(U)** Developed high performance fibers with improved ballistic protection to reduce weight and bulk of body armor
- **(U)** Increased food and fluid consumption in the field through application of acceptance models to reduce risks of dehydration induced casualties
- **(U)** Included effects of material porosity in determining flow field about moving decelerators with computational fluid dynamics
- **(U)** Conducted controlled extrusion experiments to determine the effects of ingredient selection on food product properties for design and producibility of logistically effective ration systems

(U) FY 1990 Planned Program:

- **(U)** Develop reactive polymers for enhanced protection against multi-agent threats
- **(U)** Develop multi-functional polymers for use in laser and nuclear flash eye protection
- **(U)** Using computational fluid dynamics, a model will be developed to describe the dynamics of a decelerator as it changes shape
- **(U)** Develop genetically modified biological materials for improved ballistic, biological and chemical protection
- **(U)** Determine if calcium, proteins/phospholipids enhance fat digestion of high calorie/low volume ration systems designed for upgraded soldier performance to insure maximum utilization of nutritional content

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

(U) FY 1991 Planned Program:

- **(U)** Develop coherence/noncoherence filter discriminators for eye protection against tuneable lasers
- **(U)** Exploit biotechnology concepts for combat feeding
- **(U)** Incorporate reactive polymers into films and fibers for enhanced chemical protection for the individual soldier
- **(U)** Develop energy absorbing spun fibers using rodlike sequences of copolymers for enhanced ballistic protection for the individual soldier
- **(U)** Develop bioengineered microbial colorants for use on clothing/equipment for signature reduction

(U) Project AH60 — Research in Armaments: This project contains research in the following areas: smart projectiles/mines, autonomous launchers, and fire control

(U) FY 1989 Accomplishments:

- **(U)** Completed experimental generic variable configuration algorithms and control module for direct fire weapons
- **(U)** Initiated development of simplified infrared/millimeter wave models for tactical vehicles
- **(U)** Initiated generic processor module/algorithms for intelligent gunner/loader automation

(U) FY 1990 Planned Program:

- **(U)** Initiate research to eliminate countermeasure hardening deficiences for precision munitions
- **(U)** Conduct experiments at short wavelengths and for laser survivability
- **(U)** Integrate optical logic components with fiber optic gyro
- **(U)** Complete validation of a cooperative dual arm compliant control algorithm

(U) FY 1991 Planned Program:

- **(U)** Optimize fire control algorithms for the XM291 Gun program and evaluate fire-on-the-move accuracy potential
- **(U)** Optimize the interface logic between the hierarchical control architecture and enbedded artificial intelligence (AI) weapon station modules
- **(U)** Develop laboratory demonstration prototype multi-platform fire control/battle management system
- **(U)** Conduct laboratory evaluation of high-speed waveguide signal processor

(U) Project AH61 — Research in Close Combat Weaponry: This project contains research in surface sciences including molten salt electrodeposition, phase transition theory, and processing of refractory alloys and ceramics

(U) FY 1989 Accomplishments:

- **(U)** Investigated erosion resistance capability of ceramic coatings of titanium nitride and titanium carbide
- **(U)** Applied the technology of shape memory alloys to determine phase transformations in high temperature superconducting ceramics
- **(U)** Designed and fabricated new flux compressors using superconducting field coils
- **(U)** Evaluated various concepts for mission kill mechanism

(U) FY 1990 Planned Program:

- **(U)** Investigate aerodynamic heating of various projectile flow fields
- **(U)** Determine heat fluxes on hyper-velocity projectiles

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(U) FY 1991 Planned Program:

- **(U)** Heat conducting techniques will be developed and existing gun tubes will be modified to test this concept

(U) Project AH68 — Processes in Pollution Abatement Technology: This project provides a fundamental understanding of the physical, chemical, and biological properties that control the degradation and treatment of military-unique hazardous wastes. This research is used in the design of treatment systems for both cleanup of existing hazardous waste sites and control of future hazardous waste generation. Wastes of concern include explosives, propellants, chemical agents and smokes. This project supports exploratory development efforts in Program Element 0602720A, Projects AF25 and D048.

(U) FY 1989 Accomplishments:

- **(U)** Completed determination of biochemistry and kinetics controlling the biodegradation of volatile organic compounds of concern to the Army

(U) FY 1990 Planned Program:

- **(U)** Complete studies to determine fate of chemical agents in contact with building masonry
- **(U)** Complete determination and evaluation of mechanisms involved in the recovery of heavy metals from waste sludges
- **(U)** Complete determination of basic mechanisms responsible for biodegradation of explosives by composting

(U) FY 1991 Planned Program:

- **(U)** Complete evaluation of biodegradation mechanisms for volatile organic contaminants in soils
- **(U)** Initiate efforts to determine the critical environmental consequences of in-place treatment of contaminated soil and groundwater using biodegradation

(U) Project AT22 — Soil and Rock Mechanics: The research conducted in this project provides the Army with the fundamental knowledge for determining and modeling relationships among environmental and geologic processes, terrain factors and the performance of military equipment, structures and operations. Emphasis is on wheel/track/ground interactions which affect vehicle mobility and maneuverability; characterizations of acoustic, seismic, and electromagnetic energy phenomena that provide the basis for research in standoff mine detection; statistical evaluation of the dynamic response of geologic materials for input to probabilistic explosive-induced ground shock environment calculations, and defining the penetration resistance of advanced high-strength construction materials for application in antipenetration shield systems. Studies of vehicle dynamics are conducted to provide data for design of advanced pavements for military construction. This research directly supports Program Element #0602784A, Project AT40.

(U) FY 1989 Accomplishments:

- **(U)** Determined the applicability of acoustic to seismic signal coupling phenomena for buried mine detection
- **(U)** Delineated fundamental chemistry and physics governing alkaline cementing interaction mechanism(s) between soil/water and chemical reactors leading to an aggregate binder system which is superior to Portland cement
- **(U)** Established computerized statistical database on response of structure backfill materials to explosive loadings
- **(U)** Conducted normal-impact tests of a subscale semiarmour piercing (SAP) projectile against both conventional and high-strength concrete targets

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(U) FY 1990 Planned Program:

- **(U)** Develop electromagnetic-theory-based models to predict reflectivity and depolarization of radar and laser wave scattering for standoff mine detection
- **(U)** Define and measure dynamic target background parameters for application to advanced scatterable mine sensor evaluation
- **(U)** Determine state-of-the-art of high-strength concrete construction and associated material costs/availability in Central Europe
- **(U)** Develop empirical technique for predicting airblast diffraction through openings and computer code for predicting room-to-room propagation of in-structure airblast

(U) FY 1991 Planned Program:

- **(U)** Develop a first-principle thermal model to predict signatures of forest canopies for smart weapon sensor evaluation
- **(U)** Define the applicability of imaging and focusing antennae radar to buried minefield detection
- **(U)** Complete oblique-impact tests of a subscale SAP and armour piercing (AP) projectiles against conventional and high-strength concrete targets
- **(U)** Conduct laboratory tests to supplement deficient areas in database for typical in-situ-soils/rocks in Central Europe
- **(U)** Develop rheological model to predict the soil-structure sheering response to track and wheel dynamics to provide required design capability for advanced combat vehicles

(U) Project AT23 — Basic Research/Military Construction: This project supports development of fundamental knowledge essential to the exploratory development of solutions to problems in the planning, programming, design, construction, operation and maintenance of permanent military facilities in Program Element #0602784, AT41. The project includes basic research support to energy systems, energy conservation and environmental quality in Program Element #0602784, Project AT45 and Program Element #0602720, Project A896.

(U) FY 1989 Accomplishments:

- **(U)** Investigated the properties of superconductive materials with high transition temperatures for use in improving electromagnetic pulse (EMP)/electromagnetic interference (EMI) shielding
- **(U)** Developed prototype artificial intelligence based system for use as a real property maintenance activity (RPMA) decision tool
- **(U)** Developed the heat transfer algorithms for earth-sheltered buildings to improve design energy analysis techniques

(U) FY 1990 Planned Program:

- **(U)** Develop a mathematical model of the behavior of structural fabrics under biaxial stress
- **(U)** Develop algorithms to simulate the effects of realistic terrain features in blast noise propagation models
- **(U)** Determine the optimal configurations for windows using compound parabolic concentrator (CPC) reflector elements for passive control of solar radiation to reduce energy requirements

(U) FY 1991 Planned Program:

- **(U)** Evaluate multi-sensor techniques/concepts for in-situ testing of hazardous waste contamination in groundwater

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

- **(U)** Evaluate use of a Micro-Electrochemical Probe with Segmented Electrodes (MEPSE) for use in evaluating scaling and localized corrosion in tubes and the corrosivity of potable water

(U) Project AT24 — This project provides fundamental information on the properties of snow, ice and frozen ground, and their impact on materiel, military operations and facilities construction. This information is critically important to the Army's ability to operate effectively in Europe, Korea and Alaska, as well as to support strategic arctic construction. This research provides the basis to exploit the environment in materiel design, tactical operations and facilities construction accomplished in Program Element #0602784, Project AT42.

(U) FY 1989 Accomplishments:

- **(U)** Developed mathematical/physical relationships to forecast snowfall characteristics in denied areas
- **(U)** Investigated advanced vapor detection technology for detecting obscured and buried mines
- **(U)** Developed a two-stream multispectral radiative transfer model quantifying light reflection, absorption and transmission in snow and ice
- **(U)** Developed predictive relationships for density of accreted ice from measurable meteorological variables
- **(U)** Developed Boundary Layer refractive index structure model for electro-optic (E-O) propagation over snow-covered terrain

(U) FY 1990 Planned Program:

- **(U)** Characterize freeze and thaw regimes and long-term environmental and climatic trends for future Department of Defense (DOD) strategic facility construction
- **(U)** Determine the relationship between temperature and pressure on unfrozen water content of frozen soil for application to toxic/hazardous waste management
- **(U)** Analyze physical-chemical relationships of ice grown in brackish waters for application to strength and background signature computations

(U) FY 1991 Planned Program:

- **(U)** Investigate wave action on ice growth and breakup in rivers, lakes, and oceans for ice cover forecasting affecting logistics-over-the-shore operations
- **(U)** Develop model of chemical agent simulant transport in cold regions soils

(U) Project B52C — This project supports research in fundamental topographic sciences to improve the tactical commander's knowledge of the battlefield; to extract natural and man-made features from reconnaissance imagery in near-real time, to exploit terrain reasoning/artificial intelligence techniques for combat planning and operations, to support unmanned/autonomous vehicle navigation using sensor enhanced dynamic data bases, and to explore the potential of space technology to provide real-time terrain intelligence, command and control, and targeting support. The research provides the theoretical underpinnings for Program Element #0602784, Project A855.

(U) FY 1989 Accomplishments:

- **(U)** Completed basic software implementation for automatic extraction of elevation data from aerial photographs
- **(U)** Completed hyperspectral data bases (spectral reflectance and luminescence) of natural and man-made features
- **(U)** Developed concepts for exploiting space technology to support Knowledge of the Battlefield family of future systems

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

- **(U)** Integrated computer vision with digitized elevation data to support development of dynamic control and maneuver decisions during unmanned vehicle operations
- **(U)** Completed investigation of artificial intelligence techniques for modeling atmospheric and terrain effects on a variety of military scenarios

(U) FY 1990 Planned Program:

- **(U)** Develop concepts for demonstrating the advantages of artificial intelligence in solving problems impacting intelligence preparation of the battlefield
- **(U)** Develop, test and evaluate hyperspectral models used for the evaluation of camouflage and target detection applications
- **(U)** Investigate multi-spectral imagery data to determine impediments to the support of tactical decision aid development
- **(U)** Investigate and develop artificial intelligence techniques to meet air defense and other atmospheric & terrain information management requirements
- **(U)** Identify systems specifications for development of a Light Detection and Ranging (LIDAR) sensor to meet Army battlefield information requirements
- **(U)** Investigate new and unique software for automated change detection and feature extraction from digital radar imagery
- **(U)** Implement image sensor geometry constraints into automatic elevation data extraction algorithms

(U) FY 1991 Planned Program:

- **(U)** Complete the initial phase of the terrain reasoning expert system and demonstrate its feasibility
- **(U)** Develop an expert system for determining the military significance of landforms in support of battlefield commander's decision making
- **(U)** Design on-board processing capabilities, sensor (LIDAR) and communications technologies for integration into small payloads that will support the knowledge of the battlefield future systems

(U) Project B53A — Atmospheric Sciences: Provide in-depth understanding of the complex atmospheric behavior associated with electro-magnetic propagation, transport and diffusion, and remote sensing, which affect Army operations and systems, such as electro-optics, high energy lasers, smoke deployment, and target designators

(U) FY 1989 Accomplishments:

- **(U)** Verified models developed for improved prediction of battlefield boundary layer meteorological conditions
- **(U)** Developed theory and methodology for classifying and sorting aerosol fluorescence signatures to determine level of atmospheric interference to bioagent detection
- **(U)** Quantified atmospheric turbulence and obscuration effects on standard image features for enhanced, aided target recognition
- **(U)** Developed theory of laser extinction caused by ionized aerosol gases to predict atmospheric effects on laser weapon performance
- **(U)** Developed theory for modeling reconstruction of imagery degraded by atmospheric turbulence

(U) FY 1990 Planned Program:

- **(U)** Evaluate ultraviolet (UV) Light Direction and Ranging (LIDAR) as a multisensor for detection of battlefield targets and atmospheric constituents

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

- **(U)** Use large eddy simulation to predict stochastic fluctuations in smoke and chemical clouds
- **(U)** Develop inhomogeneous plume model for emissive sources

(U) FY 1991 Planned Program:

- **(U)** Evaluate concept of standoff bioagent detection LIDAR system
- **(U)** Demonstrate methods to mitigate obscuration effects on imagery and target acquisition
- **(U)** Complete large area smoke screening and fixed installation smoke screening research model
- **(U)** Develop a nonlinear heat and mass transfer code to calculate time-resolved sizes of an evaporating droplet irradiated with an intense laser beam

(U) Project B74A — Human Engineering: This project supports research in soldier performance, sensor/information processing and other elements of soldier-machine interface critical to design of Army weapons systems.

(U) FY 1989 Accomplishments:

- **(U)** Conducted a preliminary laboratory experiment to better quantify and further isolate those visual features that lead to rapid detection and recognition of friendly and threat combat vehicle systems. Data will contribute to the design of future combat vehicles and aided target recognition systems
- **(U)** Completed a comprehensive experimental evaluation of combat vehicle noise and communication between crew members within the vehicle, the vehicle commander and higher levels of command. Evaluation results indicated that crew performance and thus total combat vehicle system performance was adversely affected. New noise cancelling communication technology is being investigated to overcome the performance degradation
- **(U)** Successfully completed a major field exercise utilizing 120 Army & Marine Corps riflemen to determine the quantitative effects of combat-like stress effects on markmanship performance. Data has been analyzed and is being transitioned for use in future small arms design and battlefield simulation and modeling

(U) FY 1990 Planned Program:

- **(U)** Develop and provide to Tank Automotive Command (TACOM) preliminary combat vehicle design information with respect to non-detectability of US armor vehicles and systems
- **(U)** Expand communication studies to establish the relationship between speech intelligibility and aviation combat operations. Evaluations of both armor and aviation intelligibility levels will be conducted to determine the relationship between levels of speech intelligibility and crew combat mission performance
- **(U)** Develop a metric to measure hit probability and soldier marksmanship performance when subjected to "combat-like" stresses for transition to Army analysis and design communities. Data will also be provided to the Armament Research, Development and Engineering Center (ARDEC) as well as the Infantry School for incorporation into Advanced Combat Rifle Technology assessment

(U) FY 1991 Planned Program:

- **(U)** Expand research efforts in visual detection and recognition to further develop the visual application to aided target recognition systems
- **(U)** Based on previous intelligibility studies, develop a metric to be used in evaluating the effect of speech intelligibility on crew performance for application to combined arms operations

Program Element: **#0601102A**

PE Title: **Defense Research Sciences** Budget Activity: **#1**

(U) Project B74F — Personnel Performance and Training: This project conducts behavioral science research in three areas of human performance: 1) decision-making in stressful environments and countermeasures for performance decrements, 2) processes and variables determining effective and efficient group functioning (e.g., leader-group interaction, group problem solving), and 3) theoretical understanding of computer-mediated methods (such as artificial intelligence) for promoting cognitive and perceptual learning in individuals and groups.

(U) FY 1989 Accomplishments:

- **(U)** Determined training parameters that support long-term retention of skills not practiced frequently
- **(U)** Using new communication techniques, extended a theory of learning in complex domains (such as foreign languages and military strategy)
- **(U)** Advanced theories that predict, and working techniques that enhance, human performance relating to safety, courage and practical intelligence
- **(U)** Tested model of cognition in human-machine interfaces that uses human memory retrieval as basis for the retrieval of computer-stored information
- **(U)** Tested theory of stress-bound military performance to produce stress-reduction

(U) FY 1990 Planned Program:

- **(U)** Develop theory of cooperative group learning to specify relationships between issues such as personnel turnover and group performance
- **(U)** Analyze the behavioral elements of communication and determine how each affects understanding of information transmitted to spatially-separated, but electronically-linked, groups
- **(U)** Investigate influence of high workload and other performance determinants on human error, and examine implications for design of safety-enhancement programs
- **(U)** Investigate interactions of human time perception and task characteristics as determinants of accuracy and effectiveness of performance

(U) FY 1991 Planned Program:

- **(U)** Determine how human communication processes influence group problem solving and decision making in realistic environments
- **(U)** Identify variables and mechanisms involved in the formation of individual-organization relationships, as determinants of organizational reliability in high-risk situations
- **(U)** Empirically determine the role of individual differences and other factors in performance under stress
- **(U)** Determine time-dependent factors influencing learning and performance

(U) Project BH27 — Research in Munitions Science: This project contains research on explosives and gun propellants including synthesis and characterization research on warheads including assessment of ceramic materials

(U) FY 1989 Accomplishments:

- **(U)** Synthesized a new intermediate more powerful caged explosive
- **(U)** Developed a light induced fluorescence technique to study fast reaction zone of explosives
- **(U)** Explored ignition mechanisms of insensitive propellants and provided guidelines for ignition trains
- **(U)** Scaled up castings of Rapid Solidification Technology (RST)/Depleted Uranium (DU) tungsten alloy for Kinetic energy (KE) penetrator studies

Program Element: #0601102A
PE Title: **Defense Research Sciences** Budget Activity: #1

- (U) Initiated high pressure oscillation studies on liquid propellant to determine stability and gun fatigue effects

(U) FY 1990 Planned Program:

- (U) Synthesize more highly nitrated caged molecules
- (U) Perform theoretical calculations for polynitration and stability of caged molecules
- (U) Investigate fast reaction explosive zone by light induced fluorescence method
- (U) Determine mechanical properties of scaled up RST/DU tungsten alloy KE penetrator castings
- (U) Complete high pressure liquid propellant measurements in laboratory combustor

(U) FY 1991 Planned Program:

- (U) Synthesize more highly nitrated caged explosive molecules
- (U) Initiate modeling of fast reaction in explosives
- (U) Initiate subcaliber ballistics testing of RST/DU tungsten alloy cast KE penetrators
- (U) Analyze high pressure oscillations of liquid propellant on gun stability and fatigue

(U) Project BH57 — Scientific Problems with Military Applications: This project seeks to capture and exploit new scientific opportunities, primarily at universities, to improve Army operational capabilities of the future. Research efforts in such basic disciplines as mathematics and the physical, engineering and biological sciences are supported primarily at outstanding universities, historically black colleges and universities, and to a lesser extent, at research institutes and industrial laboratories with the objective of providing a base for emerging and future Army technologies. Assessment of foreign capabilities is the responsibility of overseas liaison offices in Europe and the Far East.

(U) FY 1989 Accomplishments:

- (U) Gallium aluminum arsenide lasers grown on silicon have been demonstrated capable of continuous room-temperature operation for over 10 hours
- (U) The world's first direct measurements of electronic switching in a trillionth of a second has enabled the characterization of ultrafast electronic devices
- (U) Patent pending polymer-modified aluminum conversion coatings offers greater corrosion resistance for Army systems
- (U) A new non-destructive evaluation technique for "in-process" monitoring of cure reactions in epoxy networks has been developed
- (U) A coherent laser radar system theory has provided the fundamental rules for predicting the performance of automatic target recognition with imaging radar
- (U) A new catalyst has been found which accelerates the electrochemical decontamination of mustard gas
- (U) Support of Historically Black Colleges increased over threefold from FY88 to 3% of project funding ($1.8M)
- (U) Supported photonics research laboratory at U.S. Military Academy

(U) FY 1990 Planned Program:

- (U) Fundamental mathematical models for rotating blade systems fabricated from fiber reinforced composite materials will be developed
- (U) Plasma powder synthesis and mechanical alloying will yield superior materials with high fracture toughness
- (U) The processes controlling the interaction of excimer lasers with semiconductor surfaces will be determined

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

- **(U)** Processing techniques for the growth of high temperature superconducting films compatible with the fabrication of high performance compound-semiconductor electronic devices will be established
- **(U)** Computational geometry will lead to the design and implementation of navigation algorithms for autonomous systems
- **(U)** Research on proteins and genetic materials will provide agent detection and decontamination capabilities
- **(U)** New models and procedures will be developed for high dimensional data sets based on graphical and resampling procedures
- **(U)** Understanding the dynamic response of varistors to electromagnetic pulse (EMP) will improve electronic subsystem protection

(U) FY 1991 Planned Program:

- **(U)** Mathematical models of intelligent structures consisting of composite components in which sensors and actuators are embedded will be developed
- **(U)** Surface acoustic wave devices that are insensitive to acceleration will be developed
- **(U)** Techniques to measure aerosol concentration and temperature over short path lengths will be investigated for feasibility
- **(U)** Molecular events of transmembrane signalling involved in sensing capabilities of biosystems will be characterized
- **(U)** Investigate real-time, compact optical processors for pattern recognition and terminal guidance
- **(U)** Expansion of the realism of penetration, missile problems to three-dimensions will be investigated

(U) Project BS04 — Military Pollutants and Health Hazards: This element provides for the development of innovative, less costly, and less time consuming toxicity assessment methods for determining potential human health and environmental effects of military unique hazardous wastes and chemicals, including explosives propellants and smokes. These new toxicity testing techniques will help to prioritize hazardous wastes site cleanups, evaluate proposed waste treatment technologies and screen new Army chemicals for potential toxic effects

(U) FY 1989 Accomplishments:

- **(U)** Utilized a mobile biomonitoring facility to evaluate effluent toxicity at an Army wastewater treatment plant
- **(U)** Completed validation of an algal assay technique for determining the toxicity of contaminated soils
- **(U)** Evaluated the eye irritation potential of munitions chemicals using a quick, inexpensive in-vitro toxicity screening technique
- **(U)** Initiated research on in-vitro techniques for determining dermal and respiratory toxicity

(U) FY 1990 Planned Program:

- **(U)** Complete development of automated toxicity monitoring system
- **(U)** Complete second phase of on-site toxicity monitoring at an Army site

(U) FY 1991 Planned Program:

- **(U)** Complete aquatic microcosm test development
- **(U)** Determine interlaboratory variability of a non-mammalian developmental toxicity test method

Program Element: **#0601102A**

PE Title: **Defense Research Sciences** Budget Activity: **#1**

(U) Project BS11 — Science Base/Medical Chemical Defense: Basic studies are performed to delineate mechanisms and sites of action of identified and emerging chemical threats to thereby generate required information for initial design and synthesis of medical countermeasures. These studies are further designed to maintain and extend a science base to prevent technologic surprises. Army has been designated the Department of Defense (DOD) Executive Agent for medical chemical defense research and development.

(U) FY 1989 Accomplishments:

- **(U)** Developed new concept for the life detector for chemical casualties
- **(U)** Developed new test models and technologies for the study and protection against emerging threats and vesicants
- **(U)** Carry-out restructuring of Chemical and Biological Defense programs by transferring the management of selected existing and planned resources and programs from the medical chemical defense research program to the medical biological defense research program. Changes in funding between FY89 and FY90 and current submission reflect this transfer. The restructuring actions capitalize on unique technical resources in the neural sciences, which were carefully cultivated, organized and employed in the effort to improve medical defense against the nerve agents, by redirecting these assets to the biological defense program, where they can be utilized for an accelerated program in medical defense against neurotoxic substances of biological origin in response to proliferation of BW threat capabilities

(U) FY 1990 Planned Program:

- **(U)** Determine mechanisms of action and toxicity of vesicants and emerging chemical threats and identify potential protective mechanisms
- **(U)** Develop new test models and technologies for testing potential medical countermeasures to the effects of vesicants and emerging threats
- **(U)** Continue multidisciplinary basic biomedical research for better protection of the soldier against chemical agents

(U) FY 1991 Planned Program:

- **(U)** Continue to determine mechanisms of action and toxicity of vesicants and emerging chemical threats, and identify potential protective mechanisms
- **(U)** Develop required initial design and synthesis data for conceptualized new medical countermeasures to chemical agents particularly vesicants and emerging threats
- **(U)** Continue multidisciplinary basic biomedical research for better protection of the soldier against chemical agents

(U) Project BS12 — Science Base/Medical Biological Defense: This project funds the medical/biological science base to study basic mechanisms and modes of action necessary to develop adequate countermeasures against agents of biological origin, both natural and synthetic. Emerging threats of low molecular weight toxins, toxic fractions of snake venoms (neurotoxins), immunomodulators, and genetically altered microorganisms, isolated from various sources in nature and duplicated in the laboratory, with the potential for mass production, must be studied and fully characterized in order to develop effective prophylactic and therapeutic countermeasures. Classical, naturally occuring disease agents, adapted to biological warfare systems coupled with the proliferation of biological warfare threat capabilities, continue to constitute significant threats to US forces. The objective is to identify mechanisms of action common to a variety of agents and devise generic therapeutic and prophylactic measures against them.

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

(U) FY 1989 Accomplishments:

- (U) Investigated humoral and cellular immune responses to vaccinia virus protective peptides in model systems to better understand host responses to immunization
- (U) Determined that several biological response modifiers, including interleukin-2, interferon, and transforming growth factor, play distinct and critical roles in modulating cellular infection and inflammation
- (U) Identified and synthesized nontoxic analogs of conotoxin (biotoxin from snails) that block activity of the native toxin, which may lead to development of a generic vaccine against these types of toxins
- (U) Demonstrated, in experimental models, that post-exposure immunotherapy is effective in treatment of Crimean-Congo hemorrhagic fever virus infecion
- (U) Identified, from several different strains of Crimean-Congo hemorrhagic fever (CCHF) virus, polypeptides that are closely related; therefore, a single vaccine should protect against multiple strains of CCHF virus
- (U) Determined, using x-ray crystallography, the crystal structure of mojave toxin, which will give important insights into the mechanism of action of toxins from this class of snake venoms
- (U) Produced a potential vaccine candidate for Hantaan virus (which causes hemorrhagic fever with renal syndrome) using recombinant deoxyribonucleic acid (DNA) technology
- (U) Established an enzyme-linked immunosorbent assay (ELISA) for the detection of phospholipase-2 type snake neurotoxins at clinically significant levels
- (U) Carry-out restructuring of Chemical and Biological Defense programs by transferring the management of selected existing and planned resources and programs from the medical chemical defense research program to the medical biological defense research program. Changes in funding between FY 1989 and FY 1990 and current submission reflect this transfer. The restructuring actions capitalize on unique technical resources in the nueral sciences, which were carefully cultivated, organized and employed in the effort to improve medical defense against the nerve agents, by redirecting these assets to the biological defense program, where they can be utilized for an accelerated program in medical defense against neurotoxic substances of biological origin in response to proliferation of BW threat capabilities.

(U) FY 1990 Planned Program:

- (U) Continue comparison of immunogenicity of anthrax toxin component genes in a variety of strains
- (U) Continue studies on botulinum toxin peptide fragments
- (U) Produce reagents for rapid diagnostic assays of Crimean-Congo hemorrhagic fever
- (U) Continue studies on mechanisms of action of mammalian low molecular weight peptides, such as neurohormones, on host systems
- (U) Continue testing attenuation and immunogenicity factors in Rift Valley fever recombinant vaccines

(U) FY 1991 Planned Program:

- (U) Continue structure-function analyses of neurotoxins leading to concepts for broad spectrum, "class-specific" synthetic or engineered vaccines for these toxins
- (U) Use Crimean-Congo hemorrhagic fever peptides to map vaccine-relevant determinants, and evaluate as protective immunogens
- (U) Evaluate the actual mechanisms of immune cell destruction in both the vaccinia recombinant and in natural infections with Rift Valley fever virus

Program Element: #0601102A
PE Title: **Defense Research Sciences** Budget Activity #1

- (U) Develop a prototype information management system for medical and research data on families of militarily important toxins for use by research and development personnel

(U) Project BS13 — Science Base/Medical Research Infectious Disease: This project funds the basic research into infectious diseases (excluding AIDS) of military importance. These are naturally occurring diseases which have the potential to impact upon military operations, deployment, mobilization, and training of US forces. Prevention/control of these diseases thru immunization is a primary objective. Infectious diseases accounted for more hospital admissions in WWII, Korea and Vietnam, than combat injuries and nonbattle injuries combined. The US Army is the lead agency for infectious disease research and development by congressional mandate.

(U) FY 1989 Accomplishments:

- (U) Identified a variant of Plasmodium vivax from Thailand which has a circumsporozoite (CS) gene sequence differing from other P. vivax strains, thus future malaria vaccines may have to be modified to protect troops against variant strains of malaria
- (U) Demonstrated that the factor responsible for the spread of Shigella from infected to uninfected cells was the vir G gene carrier on a plasmid, an important finding in efforts to protect troops from diarrheal diseases
- (U) Determined through the use of manbiting rates and sporozoite rates that the major vector of malaria in the Philippines, Anopheles flavirostris, may have a subspecies
- (U) Demonstrated an enhanced antibody response to falciparum sporozoite vaccine 2 (FSV-2) in mice which had prior influenza A infections, suggesting that immunologic priming may enhance the host response to malaria vaccines
- (U) Confirmed the first epidemic of hepatitis E virus (non-A, non-B hepatitis virus) in a military population in Pakistan
- (U) Adapted the polymerase chain reaction to detect hepatitis A virus in stools of live-attenuated vaccine recipients
- (U) Produced species and stage-specific monoclonal antibodies against Leishmania species to identify parasites causing human disease in Central and South America

(U) FY 1990 Planned Program:

- (U) Continue gene cloning for the identification and characterization of epitopes and receptors
- (U) Continue studies defining mechanisms of action and resistance of parasites to drugs with applications to developmental programs
- (U) Continue work on the mechanism of lymphocyte homing in the gut

(U) FY 1991 Planned Program:

- (U) Begin construction of more sophisticated experimental immunogens designed to accentuate or inhibit various aspects of the immune response
- (U) Continue basic experimental programs on drug metabolism, modes of actions of drugs and biological molecules such as cytokines, drug resistance, the molecular biology of infectious disease agents and toxins, and the general chemical and cellular mechanisms operative in the immune response
- (U) This is a continuing program

(U) Project BS14 — Science Base/Combat Casualty Care Research: Basic biomedical research programs are funded in combat casualty care to understand basic mechanisms of combat related trauma. This basic research is of fundamental importance as the basis for development of treatment and surgical procedures to "buy time" and enhance survival and return to duty rates.

Program Element: #0601102A
PE Title: **Defense Research Sciences** Budget Activity: #1

(U) FY 1989 Accomplishments:
- (U) Defined the cellular mechanism of action of new battlefield shock and resuscitation therapies
- (U) Evaluated the cellular effects of an electromagnetic field upon wound healing

(U) FY 1990 Planned Program:
- (U) Expand automated data analysis technique for the prediction of the type of infectious organism in burn wounds. This will allow early prophylactic measures to be started
- (U) Biosynthetically manufacture liposome substitutes for platelets for enhanced blood clotting

(U) FY 1991 Planned Program:
- (U) Investigate the pathophysiology of head wounds, to determine what drug interventions will allow prolonged preservation times
- (U) Determine the gastrointestinal and respiratory cellular and molecular effects of blast injury

(U) Project BS15 — Science Base/System Health Hazards Research: Project objectives focus on physiological and psychological factors limiting soldier effectiveness, and the characterization of health hazards generated by military systems. Research is conducted on military relevant aspects of environmental physiology and neurobehavioral aspects of stress. The hazards of exposure to several classes of directed energy, impulse noise, and toxic chemicals are also investigated under this project.

(U) FY 1989 Accomplishments:
- (U) Investigated the effect of combat stress on vision and crew display parameters
- (U) Improved the capability to quantify injury from exposure to various forms of directed energy
- (U) Continued research on the effects of heat, cold and altitude on soldier performance
- (U) Expanded the database on military toxic hazards

(U) FY 1990 Planned Program:
- (U) Expand research on injury from directed energy to include mechanism of tissue repair
- (U) Continue military task-specific vision research
- (U) Continue research on environmental and psychological stress
- (U) Continue database expansion for impulse noise and toxic hazards

(U) FY 1991 Planned Program:
- (U) Match research efforts to refined estimates of the directed energy threat
- (U) Match environmental and psychological stress research to updated operational concepts
- (U) Continue military systems health hazard research

(U) Project BS16 — Science Base/Combat Dentistry Research: Basic biomedical research directed toward understanding biological mechanisms of repair of military relevant maxillofacial injuries. This basic research is of fundamental importance for the development of treatments which enhance survival and the return to duty rate.

(U) FY 1989 Accomplishments:
- (U) Continued study of use of microencapsulated antibiotics in bone infection wound model
- (U) Studied combined effects of several angiogenic factors on bone repair
- (U) Analyzed host response to biodegradable bone implants

Program Element: **#0601102A**
PE Title: **Defense Research Sciences** Budget Activity: **#1**

(U) FY 1990 Planned Program:

- **(U)** Evaluate shikonin, a product with possible wound healing enhancement effects
- **(U)** Evaluate feasibility of using a wound dressing impregnated with sustained release antibiotics
- **(U)** Conduct studies on demineralized bone matrix as a possible bone repair material

(U) FY 1991 Planned Program:

- **(U)** Study feasibility of incorporating a wound healing enhancer into an antibiotic skin dressing for wounds
- **(U)** Complete studies of the use of biodegradable splinting devices

(U) Work Performed By: The research supported under this program is performed by 31 in-house Army laboratories and activities and by academic institutions, not-for-profit organizations, and industrial laboratories through contracts and grants. The laboratories/activities responsible for conducting the project of this program are as follows:

A31B — Center for Night Vision and Electro-Optics, Fort Belvoir, VA

A71A — Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD

AF22 — Tank-Automotive Command, Warren, MI

AH40 — Center for Signals Warfare, Warrenton, VA

AH42 — Materials Technology Laboratory, Watertown, MA

AH43 — Ballistic Research Laboratory, Aberdeen Proving Ground, MD

AH44 — Harry Diamond Laboratories, Adelphi, MD

AH45 — Aviation Systems Command, St. Louis, MO

AH47 — Electronics Technology and Devices Laboratory, For[illegible]mouth, NJ

AH48 — Communications and Electronics Command, Fort Mon[illegible]n, NJ

AH49 — Missile Command, Redstone Arsenal, AL

AH51 — Belvoir Research, Development and Engineering Center, Fort Belvoir, VA

AH52 — Natick Research, Development and Engineering Center, Natick, MA

AH60 — Fire Support Armaments Center, Dover, NJ

AH61 — Close Combat Armaments Center, Dover, NJ

AH68 — Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD

AT22 — US Army Engineer Waterways Experiment Station, Vicksburg, MS

AT23 — The Construction Engineering Research Laboratory, Champaign, IL

AT24 — Cold Regions Research and Engineering Laboratory, Hanover, NH

B52C — Engineer Topographic Laboratories, Fort Belvoir, VA

Program Element: **#0601102A**

PE Title: **Defense Research Sciences** Budget Activity: **#1**

B53A — Atmospheric Sciences Laboratory, White Sands Missile Range, NM

B74A — Human Engineering Laboratory, Aberdeen Proving Ground, MD

B74F — US Army Research Institute for Behavioral and Social Sciences, Alexandria, VA

BH27 — Armament Engineering Directorate, Dover, NJ

BH57 — Army Research Office, Research Triangle Park, NC

BS04 — US Army Biomedical Research Laboratory, Ft. Detrick, MD

BS11 — US Army Medical Research Institute of Chemical Defense, Edgewood Proving Grounds, MD

BS12 — US Army Medical Research Institute of Infectious Diseases, Ft. Detrick, MD

BS13 — Walter Reed Army Institute of Research, Washington, DC

BS14 — Letterman Army Institute of Research, Presidio of San Francisco, CA

BS15 — Walter Reed Army Institute of Research, Washington, DC

BS16 — Institute of Dental Research, Washington, DC

(U) **Related Activities:** PE #0601103D, University Research Initiative; the Navy, Air Force, and other Department of Defense agencies, National Aeronautics and Space Administration; National Science Foundation, Department of the Interior, Department of Energy; National Bureau of Standards, other Government agencies, and government agencies of Allied nations sponsor related research in areas of this program. Coordination to eliminate duplication is accomplished by tri-Service topical reviews, exchange of progress reports and technical reports; inter-Service/agency liaison; and formal national and international meetings and symposia. Informal coordination occurs through visits to governmental, industrial, and academic laboratories and installations; review of the scientific literature, and publications of current research. The Army's Defense Research Sciences Program is included in the Tri-Service Technology Coordinating Papers.

(U) **Other Appropriation Funds:** ($ in Thousands) Not Applicable.

(U) **International Cooperative Agreements:** The Army Research Office, which is the Army's primary interface to the university community, maintains cognizance of free-world research that is potentially relevant to the Army in addition to maintaining liaison offices in Japan and Europe.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602105A**
PE Title: **Materials Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A1AL	Admin & Mgmt — Materials Tech Lab	4492	- 0 -	- 0 -	—	—
AH84	Materials	6078	10756	13276	Cont	Cont
PE TOTAL		10570	10756	13276		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program is the technical foundation for materials technology in metals, ceramics, plastics, and composites for all future Army systems. It is also the basis for solving materials related problems in existing fielded systems. The efforts address technologies required to meet increased performance, reliability and survivability demands of current and future systems in aircraft, armaments, missiles, ground vehicles, combat support and personnel support equipment. This Program Element (PE) also provides funds for overall administration and management of RDTE,A laboratories. The costs include salary, travel, equipment, and general support of civilian management personnel and their administrative support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernizations plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A1AL — Administration and Management for the Materials Technology Laboratory. These resources were transferred to Project AH84, this PE as a zero sum transfer within the Appropriation.

(U) Project AH84 — Materials:

(U) FY 1989 Accomplishments:
- (U) Fabricated prototype engine components from ceramic materials
- (U) Tested and evaluated laser protective glasses
- (U) Continued chemical protection efforts on polymers

(U) FY 1990 Planned Program:
- (U) Develop high performance coatings for turbine and compressor blades
- (U) Develop adhesives for bonding rubber to organic composites
- (U) Perform blast-resistance measurement of thick organic matrix composite (OMC) armor
- (U) Initiate design/development of materials systems to counter directed energy threats and initiate laser protection testing
- (U) Develop new polymer coatings for chemical protection

(U) FY 1991 Planned Program:
- (U) Fabricate/demonstrate test of metal matrix composite (MMC) howitzer components
- (U) Continue development of oxynitride glass matrix composites
- (U) Develop Improved Light Armor for Soldiers/Light Mobile Vehicles

Program Element: **#0602105A**

PE Title: **Materials Technology** Budget Activity: **#1**

- **(U)** Investigate the response of various materials/coatings to directed energy threat and continue laser protection testing
- **(U)** Improve chemical barrier materials for food, clothing, and ammunition

(U) Work Performed By: Work is done in-house by the Army Materials Technology Laboratory, Watertown, MA; Department of Energy, Los Alamos, NM.; Army Research Office, Research Triangle Park, NC.; Tank-Automotive Command, Warren, MI.; Troop Support Command, Ft Belvoir, VA; Naval Research Laboratory, Washington, DC.; and very limited support via other Government agencies. The primary contractors are: Kratos Analytical Inc., Ramsey, NJ.; Colt Industries, Mecklenberg, NC.; Aluminum Corp. of America, Alcoa Center, PA. and Geo-Center, Newton, MA

(U) Related Activities: Activities are coordinated with other Government services and agencies including annual OSD Tri-Service Reviews in materials and the Tri-Service Joint Directors of Laboratories. There is no unnecessary duplication of effort within the Department of Defense

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element #0602120A

PE Title **Electronic Survivability and Fuzing Technology** Budget Activity #1

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A035 Classified Program	4939	3558	0	—	—
A140 Hi-Power Microwave (HPM) Technology	3556	6685	12119	Cont	Cont
A1PL Admin & Mgt — Harry Diamond Laboratory	8800	0	0	—	—
A1UL Admin & Mgt — Vulnerability Assessment Laboratory	6681	0	0	—	—
AH16 Electronic Fuze Technology	2845	5326	5368	Cont	Cont
AH25 Nuclear Effects Survivability Technology	10308	9063	7410	Cont	Cont
PE TOTAL	39127	28632	24897		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides three critical technologies to increase the survivability and combat effectiveness of tactical Army forces: Nuclear effects survivability technology; High Power Microwave (HPM) technology and Electronic Fuze Technology. The reduction in funding from FY 1989 to FY 1990 is due to the transfer of funds from project A1UL to Program Element (PE) #0605604A. This PE also provides funds for overall administration and management of Harry Diamond Laboratory. The costs include salary, travel, equipment, and general support of civilian management personnel and their administrative support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A035 — Classified Program. Project transferred to program element 0602123A.

(U) Project A140 — HPM Technology. The objective of this project is to determine the susceptibility and vulnerability of Army equipment and systems to various types of radio frequency(RF)/high power microwave (HPM) environments, to identify and evaluate the technology required to protect/harden US equipment and systems against postulated threat weapons and to develop and evaluate technology required to conduct a RF/HPM weapon proof-of-principle demonstration. This is an emerging technology program and is supported by the Battlefield Development Plan.

(U) FY 1989 Accomplishments:

- **(U)** Completed HPM weapon simulator source and test chamber
- **(U)** Evaluated new hardening technologies such as frequency selective coatings and dielectrics for chip circuit protection for integrated circuits and fast switching/high power protective devices for radar receivers
- **(U)** Expanded system susceptibility data base by testing critical systems such as communications, anti-armor missiles and avionics electronics

Program Element: **#0602120A**

PE Title: **Electronic Survivability and Fuzing Technology** Budget Activity: **#1**

- **(U)** Initiated investigations of new classes of HPM simulation sources and components such as modulators, mode converters and pulse forming networks for simulator testing capabilities

(U) FY 1990 Planned Program:

- **(U)** Complete design guidelines and trade-off analysis for protection of microwave receiver front-ends and incorporate information into the hardening handbook
- **(U)** Continue susceptibility testing of critical systems to include helicopter systems
- **(U)** Continue evaluations of HPM sources and components as candidates for laboratory proof of principle demonstrations to confirm the technology
- **(U)** Operate and upgrade as required the HPM test and source development chamber in support of susceptibility and source/component efforts
- **(U)** Establish damage threshold for different classes of semiconductor devices (e.g. Complementary Metal on Oxide Semiconductor (CMOS), Gallium Arsenide Field Effect Transistor (GAAS FET), Very High Speed Integrated Circuit (VHSIC), etc) to assist in systems design for improved survivability

(U) FY 1991 Planned Program:

- **(U)** Complete final volume of hardening handbook, publish and distribute
- **(U)** Perform a major system hardening demonstration using the resolved technologies from evaluations of HPM sources and components
- **(U)** Continue susceptibility testing of critical systems and subsystems to include target acquisition systems; continue to expand effects data base

(U) Project A1PL — Administration and Management for the Harry Diamond Laboratories. Effective in 1990, these resources were transferred to this PE, Projects AH25, AH16, and A140 as a zero sum transfer within the Appropriation.

(U) Project A1UL — Administration and Management for the Vulnerability Assessment Laboratory. Effective in 1990, these resources were transferred to Project D190, PE #0605604A, as a zero sum transfer within the Appropriations.

(U) Project AH16 — Electronic Fuze Technology Base: This project provides the technology for sensors, signal processors, power supplies, and safety and arming controls which are essential parts of fuzes to achieve burst point control for future munitions. The goal for guided munitions (against both ground vehicles and aircraft) is to achieve the necessary burst point control with the same sensor which is used for guidance. The goal for unguided rockets and projectiles is to maintain the desired safety and reliability while reducing the number of fuze types to a minimum, and minimizing their cost. The long standoff antiarmor fuze, the multioption fuze for artillery, fuzing for self contained munitions, low altitude air defense missile fuzing, countermeasure resistance, and the electronic safety and arming system are thrusts of this project.

(U) FY 1989 Accomplishments:

- **(U)** Built and successfully flight-tested Long Standoff Anti Armor (LSAA) fuzes on live firings of Tube-Launched Optically-Tracked, Wire-guided (TOW) missiles
- **(U)** Designed and evaluated the low cost wide band antenna, received and tested Monolithic Integrated Circuit (MIMIC) chips, and completed phase 2 safety and arming (S&A) system contract for the Multi Option Fuze for Artillery (MOFA)
- **(U)** Acquired polarimetric radar clutter data at S-band and Ku-band and completed 0.9 micrometer clutter data acquisition system to permit discrimination of targets vs clutter for air defense fuzing sensors

Program Element: #0602120A

PE Title: **Electronic Survivability and Fuzing Technology** Budget Activity #1

- (U) Completed instrumentation radar for obtaining 95 GHz target signatures for ground target guidance integrated fuzing (GIF)

(U) FY 1990 Planned Program:

- (U) Perform telemetry tests of LSAA fuze vs countermeasures (obscurity, magnetic cluster)
- (U) Begin addressing requirement for greater standoff range of anti-armor warheads
- (U) Build and demonstrate feasibility of MOF-A for transition to development programs
- (U) Address tree clutter discrimination in ADF signal processing
- (U) Demonstrate feasibility of Air Defense Fusing (ADF) solid state microwave transmitter
- (U) Acquire and analyze GIF signatures to permit encounter simulation of the target list to define signal processing requirements
- (U) Start developing algorithms for GIF processing
- (U) Address Electronic Safety and Arming (ESA) for missiles

(U) FY 1991 Planned Program:

- (U) Select sensor for greater standoff in LSAA
- (U) Collect signatures of armor targets with selected sensors to validate data base used in encounter simulations
- (U) Evaluate clutter resistant fuze signal processors to determine adequacy for weapons development
- (U) Evaluate GIF algorithms in simulated encounters of munitions against armor vehicles and aircraft
- (U) Demonstrate Electronic Safety and Arming (ESA) for missiles

(U) Project AH25 — Nuclear Effects Survivability Technology This project provides the technology for nuclear hardening of fielded and developmental systems. This is the Army's primary project to provide technology for survivability on the tactical nuclear battlefield. The goal is to develop cost effective off-the-shelf technological products for designing nuclear survivable equipment, assessing and validating system survivability, and maintaining that survivability throughout the system life cycle. The project is divided into five technology thrust areas. (1) Nuclear Survivability Integrated Effects Support provides investigations into potential nuclear weapon environments created by evolving tactical nuclear threats. Intermediate Nuclear Forces (INF) Treaty will not change the threat to Field Army. Effects phenomenology and energy coupling mechanisms into materials and electronic components are evaluated to provide a data base on material and component vulnerabilities. Analytical predictions and basic hardening methods are developed and maintained for use by materiel developers in designing and validating system survivability. Nuclear weapons effects simulators are developed, and maintained for designing survivable equipment and associated environmental issues are addressed as required. Radiation shielding technology is developed and demonstrated for protection of crews in armored vehicles and other heavy structures. The combat effectiveness of nuclear hardened system designs and tradeoffs are evaluated/quantified using simulation models which include tactical nuclear warfare scenarios. (2) A High Altitude Electromagnetic Pulse (HEMP) burst puts all electronics equipment at risk of catastrophic damage in an area covering thousands of square miles. Protection against Electromagnetic Pulse (EMP) damage is necessary to prevent the loss of the entire inventory of electronic systems from a nuclear weapon burst that causes no other damage on the ground. This task develops analysis methods and techniques for hardening tactical Army systems to EMP effects. In addition, this task is developing a capability to simulate the new standard for High-Altitude Electromagnetic Pulse (HEMP) Environment. (3) Air Blast and Thermal Radiation often act synergistically to damage military equipment because the thermal radiation weakens the structural materials before the arrival of the blast shock. Mobile tactical systems are particularly vulnerable to being overturned

Program Element: #0602120A

PE Title: **Electronic Survivability and Fuzing Technology** Budget Activity: #1

by the blast wave. This task will develop and demonstrate light weight outriggers and other overturning restraints for use with the hardened shelter van versions of the High Mobility Multipurpose Wheeled Vehicle (HMMWV) Commercial Utility Cargo Vehicle (CUCV) and other light wheeled vehicles, which carry mobile Communication Command Control & Intelligence (C³I) systems. Conduct Large Blast/Thermal Simulator (LB/TS) cost reduction research in cooperation with Defense Nuclear Agency (DNA). (4) Tactical Source Region (TSR) is an annular area around the burst point of a low yield nuclear weapon beyond the range where personnel and equipment are disabled by the blast and thermal radiation but where nuclear radiation is being deposited in the air creating a complex, time varying radiation ionizing electron and electromagnetic pulse (EMP) environment. This task will develop the analytical methods and basic technology necessary to design the simulator needed to validate survivability in the tactical source region. (5) Tactical Source Region Simulator will be built based on resolution of basic technology issues.

(U) FY 1989 Accomplishments:

- **(U)** Demonstrated blast/thermal survivability techniques at the HE simulation "MISER GOLD" including lightweight overturn protection devices and the structural use of advanced composite materials in armored vehicles.
- **(U)** Developed 1/6 scale test bed for the large scale testing of critical design elements for the large blast/thermal simulator (LB/TS).
- **(U)** Continued the investigation of cost effective drivers, gas heating, thermal simulator, rarefaction wave elimination and simulating of non-ideal blast and instrumentation.
- **(U)** Developed a test bed to verify low-risk electromagnetic pulse hardening techniques and guidelines for time sensitive C3I systems.
- **(U)** Modified Aurora radiation simulator to allow research on tactical source region (TSR) environments to be conducted involving both the system generated EMP (SGEMP) and source region EMP (SREMP) environments/experiments.

(U) FY 1990 Planned Program:

- **(U)** Continue to develop and maintain the nuclear weapon effects (NWE) survivability technology base in all effect areas and in the related development of vulnerability analysis and hardening technologies and the needed effect simulation efforts.
- **(U)** Continue the new hardening program for Joint Chiefs of Staff (JCS) identified threats that feeds into the fielded system nuclear vulnerability assessment program directed to achieving nuclear survivable Army systems.
- **(U)** Complete Environmental Impact Statement (EIS) and final design and initiate construction of high altitude EMP simulator program to support JCS high altitude burst (HAB) electromagnetic pulse (EMP) and other threats identified in Army 21.
- **(U)** Plan tests with Defense Nuclear Agency (DNA) based on test results of lightweight outrigger designs with new materiel inputs for more efficient, cheaper blast/thermal Army system hardening.
- **(U)** Continue scale model and full size experiments on tactical source region simulator elements using emerging technologies such as Very Large Scale Integrated Circuits (VLSIC) and electro-optics to identify survivable components for use in future systems.
- **(U)** Coordinate and validate source region experiments with DNA using underground nuclear test planned for 1993.
- **(U)** Continue in coordination with DNA techniques and instrumentation for large blast/thermal simulator (LB/TS).

Program Element: **#0602120A**

PE Title: **Electronic Survivability and Fuzing Technology**

Budget Activity: **#1**

(U) FY 1991 Planned Program:

- **(U)** Continue to develop and maintain the nuclear weapon effects (NWE) Survivability technology base in all effects areas to increase the survivability of Army materials
- **(U)** Continue new hardening program efforts for Joint Chief of Staff (JCS) identified threats
- **(U)** Based on the results of final EIS documentation, complete construction phase of high altitude EMP simulator program to support JCS high altitude burst (HAB) electromagnetic pulse (EMP) and other threats identified in Army 21
- **(U)** Continue to coordinate and validate source region experiments with DNA using underground nuclear test planned for 1993
- **(U)** Continue coordination with DNA on research techniques and instrumentation for large blast/thermal sumulator (LB/TS)

(U) Work Performed By: In-house work to be performed by Harry Diamond Laboratories, Adelphi, MD; Ballistic Research Laboratory, Aberdeen Proving Ground, MD; Electronic Technology and Devices Laboratory, Fort Monmouth, NJ. Contract work to be performed by Martin Marietta Corp., Orlando, FL; Mission Research Corp., San Diego, CA; Sol Telecommunications Services, Tucson, AZ; SRI International, Menlo Park, CA; Electronic Fuze Tech: In-house work to be performed by Harry Diamond Laboratories, Adelphi, MD. Contract work to be performed by Electronics Development Corp., Columbia, MD; Hughes Aircraft Company, Torrance, CA; KDI, Cincinnati, OH; Magnavox, Ft. Wayne, IN; Millitech, Deerfield, MA; Motorola, Scottsdale, AZ; Reticon Corp., Sunnyvale, CA; Sandia National Laboratories, Albuquerque, NM; University of Florida, Gainesville, FL; VLSI Inc., Milpitas, CA; Science Applications International Corp., McLean, VA; Booz Allen Hamilton, Bethesda, MD; Mission Research Corp., Santa Barbara, CA.

(U) Related Activities: A Memorandum of Understanding (MOU) exists between the U.S. Army Armament Research Development and Engineering Center, Dover, NJ; U.S. Army Missile Command, Huntsville, AL; and U.S. Army Laboratory Command, Adelphi, MD; which states that the U.S. Army Laboratory Command, Harry Diamond Laboratories, is responsible for the Fuze Technology Base.
PE #0603737D (Balanced Technology Initiative (High Power Microwave))
PE #0603802A (Weapons and Munitions-Advanced Development)
PE #0601102A, AH44 (Defense Research Sciences, Sensor Systems Research)
PE #0603604A/ D153, Nuclear Effects Support Team (NEST)-Coordination of the nuclear program is achieved with the Defense Nuclear Agency (DNA).
The Department of Defense Office of Munitions monitors the Electronic Fuze Technology program to avoid service duplication.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602211A**
PE Title: **Aviation Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A1DL	Admin & Mgmt — Avionics Research & Development Center				
	3790	- 0 -	- 0 -	—	—
A1EL	Admin & Mgmt — Aviation Research & Development Center				
	9756	- 0 -	- 0 -	—	—
A47A	Aeronautical & Aircraft Weapons Technology				
	22248	31471	32577	Cont	Cont
AH85	Aircraft Avionics Technology				
	6788	9145	9320	Cont	Cont
PE TOTAL	42582	40616	41897		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The objectives of this Program Element (PE) are to expand scientific knowledge in aeronautical technology, and demonstrate state-of-the-art technologies as the basis of new and/or upgrades of Army airmobile systems. Helicopter rotors provide low disc loading as compared to the propeller's intermediate disc loading and jet engine exhaust's high disc loading. Low disc loading vertical takeoff and landing (VTOL) aircraft offer a practical solution to many of the Army's operational needs. Such aircraft, with their ability to operate below tree top level for Nap-of-the-Earth (NOE) missions, present significantly different analysis and design challenges from traditional fixed-wing aircraft and flight at higher altitudes. The Army, with assistance from National Aeronautics and Space Administration (NASA) at the three co-located Aviation and Avionics Research Directorates, is the focal point for U.S. Government efforts to address voids in this rotorcraft technology. Technical areas included are: Aeromechanics, Aerodynamics, Structures, Propulsion, Reliability and Maintainability, Safety and Survivability, Mission Support Equipment, Aircraft Systems Synthesis, Aircraft Subsystem, Advanced Helicopter Analyses, Flight Simulation, Man-Machine Integrations, Aircraft Weapons, Aircraft Avionics air-to-air/ground communications, digital avionics, NOE navigation, and air traffic management). These technologies are continuously being researched for applications to improve and correct deficiencies in current Army aircraft systems and to improve the capabilities of future aircraft. This PE also provides funds for overall administration and management of Army Aviation research and development centers. The costs include salary, travel, equipment, and general support of civilian management and research personnel and their administrative support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A1DL — Administration and Management for the Avionics Research and Development Center. Effective with FY 1990, these resources were transferred to Project AH85, this PE, as a zero sum transfer.

(U) Project A1EL — Administration and Management for the Aviation Research and Development Center. Effective with 1990, these resources were transferred to Project A47A, this PE, as a zero sum transfer.

Program Element: **#0602211A**
PE Title: **Aviation Technology** Budget Activity: **#1**

(U) Project A47A — Aeronautical and Aircraft Weapons Technology. The purpose of this project is to ensure a superior aeronautical technical base for Army aviation systems assure improvements in operational effectiveness and combat mission capability including air to air combat higher tactical mobility, increased strategic mobility, improved firepower, use of special weapons and increased combat sustainability. This is essential to maintain the edge in rotorcraft technology. Areas of investigation consist of the following: Fluid mechanics, dynamics, aerodynamics, advanced flight control technology, aircraft and weapons interaction, acoustics, weight prediction, material engineering, internal/external loads, fatigue and fracture, advanced structural concepts, small air flow gas turbines, high temperature materials, mechanical drive systems, environmental control systems, flight simulation, and improved soldier-machine interface. These technologies are being developed for application to all current as well as future Army aircraft systems and all aviation system block improvement programs. The propulsion technology in this program element supports the Integrated High-Performance Turbine Engine Technology (IHPTET) initiative at Office of the Deputy Under Secretary of Defense (Research and Advanced Technology) (ODUSD (R&AT)) to support the development of technology for aircraft and missile power plants. The goal of this program is to demonstrate technology around the turn of the century which would double propulsion system capability for a wide range of potential aircraft and missile applications.

(U) FY 1989 Accomplishments:

- (U) Began the survivable/supportable/safe (S3) demonstration trade-off analysis for the future helicopters
- (U) Tested ceramics and composites for use in high temperature turbine engine components to reduce weight and improve performance of gas generators
- (U) Completed the advanced composite structures field repair effort for weight reduction and improved survivability/repair
- (U) Initiated investigations on a obstacle proximity sensor for helicopters to improve ground/obstacle avoidance and survivability
- (U) Initiated the design of an advanced technology, high speed cargo winch for use on an advanced cargo aircraft
- (U) Performed the pre-design analysis and layout design of future aviation notional systems for the 21st century
- (U) Initiated the development of advanced ice protection concepts to improve performance and aircraft survivability
- (U) Continued investigation of advanced rotorcraft crew/cockpit interface design requirements
- (U) Initiated optimization efforts in sensor fusion technology to enhance target detection and identification to maximize the effectiveness of weapons on the Army aircraft. This effort has the potential for use on ground combat vehicles
- (U) Completed design, fabrication, and testing of a 15 to 1 pressure ratio centrifugal compressor stage
- (U) Evaluated generalized rotor dynamics models in an attempt to improve performance and stability predictions

(U) FY 1990 Planned Program:

- (U) Continued development of the Helicopter Structural Integrity Program (HSIP) Loads analysis, sensors, and associated reports to reduce rotorcraft design and development cost
- (U) Continue advanced composite structure repair effort to enhance aircraft maintainability
- (U) Initiate development of advanced crashworthy troop seats
- (U) Continue definition of an advanced high speed cargo winch for advanced cargo aircraft

Program Element: #0602211A
PE Title: **Aviation Technology** Budget Activity: #1

- (U) Conduct preliminary design studies of new and innovative aircraft configurations to evaluate their capability to perform Army aviation missions
- (U) Continue development of advanced ice protection concepts
- (U) Continue crew/cockpit interface design research to improve future aircraft operational effectiveness
- (U) Continue sensor fusion technology effort by characterizing potential conflict areas into general categories of environment that are related to multi-spectral target acquisition and missile seeker systems
- (U) Continue evaluation of advanced ceramics and composite materials for gas turbine engine combustor at advanced engine cycle conditions
- (U) Develop application of lightweight, high modulus materials for engine cold section components to reduce weight, inertia, and vulnerability
- (U) Develop techniques to define what levels of agility and maneuverability are needed for a rotorcraft in air-to-air combat or aggressive ground attack

(U) FY 1991 Planned Program:

- (U) Initiate testing of tailored control, optimized rotor, aeroelastic models to enhance helicopter stability, control and performance
- (U) Initiate investigation of advanced engine cycle concepts including wave cycle
- (U) Continue the advanced composite structure repair effort
- (U) Continue the advanced crashworthy troop seats development
- (U) Complete the definition of an advanced technology high speed cargo winch
- (U) Continue pre-design analysis and layout design of aviation notional systems
- (U) Continue laboratory tests of advanced ice protection concepts
- (U) Continue engineering validation of Second Generation Comprehensive Helicopter Analysis System (2GCHAS) technology modules and full up codes
- (U) Continue the investigation of crew/cockpit interface design requirements
- (U) Initiate the investigation of a digital terrain data base to enhance aircraft position/target acquisition and combat effectiveness
- (U) Complete HELLFIRE Air-to-Air effectiveness investigation
- (U) Develop design criteria for ceramic mixed-flow turbine rotor
- (U) Test modified rotor blade plan forms and airfoils to achieve very high thrust levels for high maneuverability and agility with low acoustic radiation
- (U) Investigate attack and maneuver flight paths to maximize use of both Helicopter capability and pilot capability

(U) Project AH85 — Aircraft Avionics Technology

The objective of this project is the exploration of new concepts and techniques in aviation electronics for developing highly sophisticated avionics systems to perform battlefield functions more effectively. Emphasis is on reducing pilot workload, expanding flight envelopes in day/night adverse weather and improving operations on the obscure battlefield using automated Command Control and Communications (C3) techniques.

(U) FY 1989 Accomplishments:

- (U) Conducted the laboratory and flight tests of low speed data modem with the goal of improving non-line-of-sight High Frequency (HF) communications through augmenting voice communications with data communications
- (U) Initiated the development of hardware/software for a speaker independent voice recognition system

Program Element: **#0602211A**
PE Title: **Aviation Technology** Budget Activity: **#1**

- **(U)** Completed and transitioned the Mission Planning Station for use in the demonstration of the Automated Battle Management Concept (ABMC) in PE #0603003A Project DB97

(U) FY 1990 Planned Program:

- **(U)** Conduct the flight test of the Integrated Communication Navigation, Identification Avionics (ICNIA) system in the System Testbed for Avionics Research (STAR) aircraft
- **(U)** Initiate the development of software for air/air and air/ground embedded training
- **(U)** Complete the prototype of a Doppler, over-water, navigation system with enhanced capability. Initiate performance test verification of specifications for over water flight navigation systems. Doppler navigation systems are not accurate when flying over large bodies of water
- **(U)** Complete the hardware/software development and integration of speaker independent, voice recognition system. Initiating testing of the system. Current systems are limited to one person's voice only
- **(U)** Integrate Terrain Avoidance/Terrain Following (TA/TF) software into US Army Avionics Research and Development Activity (AVRADA) Hot Bench (Coop NASA/AVRADA Program)

(U) FY 1991 Planned Program:

- **(U)** Initiate the flight test of software for air/air and air/ground embedded training in test aircraft
- **(U)** Complete the Doppler over-water, navigation system performance testing. Finalize specifications for the system
- **(U)** Complete expert subsystem status monitor (ESSM) real-time aircraft diagnostics program (Coop industry IR&D) and flight test on STAR Aircraft
- **(U)** Conduct Wide Field of View Helmet Mounted Display Laboratory evaluation
- **(U)** Initiate an effort to develop algorithms (patterned after the voice recognition methodology) to analyze signatures of tactical vehicles for the purpose of identifying friendly vehicles and tactical targets

(U) Work Performed By: In-house developer for avionics is US Army Avionics Research and Development Activity (AVRADA), Fort Monmouth, NJ. Major contractors include: Vitronics, Eatontown, NJ; Anocapa Sciences, Santa Barbara, CA; ITT Corp, Nutley, NJ; AEL, Lansdale, PA. In-house developer for aeronautical and aircraft weapons is the US Army Research and Technology Activity, Moffett Field, CA; Aerostructures Directorate, Langley Research Center, VA; Propulsion Directorate, Lewis Research Center, OH; Aeroflightdynamics Directorate, Moffett Field, CA; and the Aviation Applied Technology Directorate, Fort Eustis, VA. The principal contractors are Sikorsky Aircraft, Stratford, CT; Pratt and Whitney Aircraft, LTD, Montreal, Quebec, Canada; Bell Helicopter-Textron, Fort Worth, TX; Computer Sciences Corporation, Mountain View, CA; Boeing-Helicopter Company, Philadelphia, PA; McDonnell Douglas Helicopters, Mesa, AZ; Hughes Aircraft, Los Angeles, CA; General Electric Company, Lynn, MA; and Martin Marietta, Orlando, FL.

(U) Related Activities: National Aeronautics and Space Administration — NASA (Low Speed Aircraft Research and Technology); Navy (PE #0602122N — Aircraft Technology); and Air Force (PE #0602201F Aerospace Flight Dynamics). Coordination to eliminate unnecessary duplication is accomplished by joint program reviews, exchange of program data sheets, research and technology resumes, technical reports; inter-Service liaison; attendance at scientific meetings and conferences; and joint participation in The Technical Cooperation Program (TTCP), NASA Research and Technology Committees, and the North Atlantic Treaty Organization (NATO) Advisory Group on Aerospace Research and Development (AGARD). Efforts under this program lead into

Program Element: **#0602211A**

PE Title: **Aviation Technology** Budget Activity **#1**

demonstration/validation programs under the following PEs #0603601A (Aviation Advanced Development) and #0603003A (Aviation Advanced Technology). Active joint Service programs include the Army/Air Force Digital Map Generator Development and the Integrated Communications, Navigation, Identification Avionics System. The Army is also engaged in the development of the Army Airspace Command and Control System.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable

(U) International Cooperative Agreements: Not Applicable

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602270A**
PE Title: **Electronic Warfare Technology** Budget Activity: **#1**

Projects A442 and A906 transferred from PE#0603270A - Electronic Warfare Technology Projects A042 and A904 respectively, beginning in FY 1991 as a zero sum change.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) FY 1991 Planned Program:

- **(U)** Complete improved infrared (IR) decoy and jointly test with Armament Research Development and Engineering Center (ARDEC)
- **(U)** Continue Semi-Automatic Command-To-Line-Of-Sight (SACLOS) countermeasures (CM) development
- **(U)** Initiate development of countermeasures techniques against missiles using imaging seekers
- **(U)** Perform Rosette Scan Seeker (RSS) Missile exploitation to determine most effective countermeasures
- **(U)** Initiate high accuracy angle of arrival missile warning receiver techniques for directional IR jammers
- **(U)** Complete joint testing with TACOM of tank Radar Warning Receiver (RWR) integrated into Vehicle Integrated Defense System (VIDS) and assess candidate countermeasures
- **(U)** Complete Integrated Aircraft Survivability Equipment (IASE) HOTBENCH
- **(U)** Initiate development of high accuracy direction finding for Advanced Technology Very High Speed Integrated Circuit (VHSIC) RWR
- **(U)** Continue high accuracy laser warning techniques
- **(U)** Integrate Surface Acoustic Wave (SAW) channelizer with baseline Miniturized Electronic Support Measures Direction Finding Location Intercept (MEDFLI) hardware and test
- **(U)** Continue low-cost phase shifter development
- **(U)** Initiate two-dimensional passive intercept techniques to provide target ranging information for air defense/multi-sensor fusion applications
- **(U)** Initiate artificial intelligence (AI) techniques for Electronic Support Measure (ESM) for increased speed of emitter platform identification assessing both neural network and knowledge based approaches

(U) Project Project A906 — Tactical EW Techniques, transfer from PE 0603270A Proj A904: This exploratory development program develops the countermeasures technology and components and the control technology that the Army will use to reduce the enemy's command and control capability by disrupting its communications systems (including data links), and to protect our forces from detection.

- **(U)** Initiate effort to insert "smart" software for automated threat emitters recognition, ECM, and deception prioritization of threat emitters
- **(U)** Investigate Palletized Communication Jammer which allows for the mobilization of modular ECM Equipment
- **(U)** Initiate effort to produce a small, inexpensive, light-weight, efficient, and rugged antenna for high frequency (HF) coverage
- **(U)** Examine the unique needs of airborne platforms for HF antenna requirements
- **(U)** Examine the possible utility and feasibility of impulse ECM Components
- **(U)** Continue implementation of data fusion and sensor management algorithms for testing
- **(U)** Continue development and testing of multi-sensor fusion algorithms

Program Element: **#0602270A**

PE Title: **Electronic Warfare Technology** Budget Activity: **#1**

- **(U)** Continue Transceiver Susceptibility Analysis, Jammer Model Upgrades, Integration Waveform, and ECM Fratricide Techniques
- **(U)** Complete 1-600 MHz Field Transistor effort for transition to 6.3A Distributed Communication Jamming and EXJAM Improved Prototype Development

(U) Work Performed By: In-house work: USA CECOM Center for Electronic Warfare/Research Development Center; Electronics Technology and Devices Laboratory, Fort Monmouth, NJ, USA CECOM Center for Signals Warfare, Vint Hill Farm Station, Warrenton, VA and USA Harry Diamond Laboratories, Adelphi, MD. Supporting work: Air Force Avionics Laboratory, Wright Patterson AFB, OH; Rome Air Development Center, Griffiss AFB, NY; Naval Weapons Center, China Lake, CA; Letterman Research Institute, San Francisco, CA; Pacific Missile Test Center, Point Mugu, CA; National Security Agency, Ft Meade MD. Contract work: GE/RCA Corporation, Camden, NJ; Defien Corporation, San Jose, CA; Hughes Aircraft Corporation, Fullerton, CA; Sanders Associates, Nashua, NH; Quest Research Corporation, McLean, VA; Lockheed Electronics, Plainfield, NJ.; Georgia Tech Research Institute, Atlanta, GA; Digital Radio Corporation, Redondo Beach, CA; E-Systems, Greenville, TX; GTE Sylvania, Mountain View, CA; MACOM-PHI, Torrance, CA; Microwave Semi-conductor, Somerset, NJ; American Electronic Laboratories, Lansdale, PA; SCS Telecom, Port Washington, NY; Martin Marietta, Orlando, FL; ESL, Inc., Sunnyvale, CA.

(U) Related Activities: Program Element #0602782A (Command, Control Communications Technology)
Program Element #0603789F (Command, Control and Communications and Intelligence Technology Development)
Program Element #0604573N (Shipboard Electronic Warfare Improvements)
Program Element #0603270A (Electronic Warfare Technology)
Program Element #0604270A (Electronic Warfare Development)
Program Element #0603745A (Tactical Electronic Support Measure (ESM) Systems)
Program Element #0603755A (Tactical Electronic Countermeasures (ECM) Systems-Advanced Development)
Program Element #0602131M (Marine Corps Landing Force Technology)
Program Element #03058856 (Tactical Cryptologic Program)

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Current Memorandum of Understanding (MOU) on Electro-Optical Countermeasures (EOCM) with United Kingdom. Pending MOU with Canada on MEDFLI/SILENT FOX effort, a NATO ESM payload.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602303A**

PE Title: **Missile Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A214	Missile Technology	23637	26958	23996	Cont	Cont
DC04	Smart Munition Technology Management	- 0 -	3171	3157	Cont	Cont
PE TOTAL		23637	30129	27153		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is the only Army exploratory development work to improve fielded Army missile and rocket components and to develop and evaluate technical options for future tactical missile systems and in response to U.S. Army Training and Doctrine Command (TRADOC) mission area analyses of deficiencies. These deficiencies are addressed through work in concept synthesis, laboratory hardware development, and limited technology demonstrations in the areas of close combat, fire support, air defense, and intelligence and electronic warfare. This program is needed to achieve technological superiority in tactical missile and rocket technology while providing the Army a critical capability to acquire the best missile/rocket systems at the least life cycle costs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A214 — Missile Technology Efforts in this project are focused on missile and rocket technologies that support high fire power/logistic support weight ratio concepts for the Light Forces, allow system concepts that enhance the survivability of launch systems, provide greater effectiveness under adverse battlefield conditions, and increase kill probabilities against hard targets. This project encompasses seven major thrust areas:

- **(U)** Seekers/Sensors
- **(U)** Guidance
- **(U)** Simulation
- **(U)** Aerodynamics
- **(U)** Propulsion
- **(U)** Structures
- **(U)** Technology Integration

(U) FY 1989 Accomplishments:

- **(U)** Conducted field evaluations of available imaging sensors/seekers for an advanced air defense seeker
- **(U)** Integrated and tested receiver modules in prototype radar for digital beamforming
- **(U)** Completed helicopter captive flight data collection tests for dual mode Terminally Guided Submissile (TGSM) seeker
- **(U)** Conducted laboratory testing of candidate airborne midcourse guidance system for mid-range surface to air missile
- **(U)** Demonstrated distributed processor software and hardware techniques
- **(U)** Upgraded real-time helicopter model for real time hardware-in-the-loop simulation

Program Element: **#0602303A**
PE Title: **Missile Technology** Budget Activity **# 1**

- (U) Defined bifurcated nozzle exhaust plume interference
- (U) Investigated curved grid-fins as control surfaces in small missiles
- (U) Initiated evaluation of materials as shielding/protective devices for propulsion systems
- (U) Continued development of a lightweight vertical launcher and a container insensitive to small arms and fragments
- (U) Validated guidance transmission through booster smoke for Advanced Kinetic Energy & Missile (ADKEM)
- (U) Conducted hardware-in-the-loop simulation Tested optical correlator terminal homing system and fabricated new system upgrades
- (U) Developed critical demonstration hardware for initial Combined Arms Multi-Purpose Missile (CAMM) initial flight test
- (U) Demonstrated candidate rugged non-detonable minimum smoke propellant in an analog motor
- (U) Evaluated energetic polymers in insensitive munitions minimum smoke compositions

(U) FY 1990 Planned Program:

- (U) Complete analyses and tests necessary to define critical parameters for the air defense infrared focal plane array (FPA) seeker
- (U) Evaluate low cost guidance hardware for precision guided systems
- (U) Begin next generation electronic countermeasures guided systems
- (U) Complete turbojet integration into extended range fiber optic guided missile
- (U) Initiate evaluation of energetic reduced hazards minimum smoke propellants
- (U) Develop improved methods of propulsion hazards analysis
- (U) Demonstrate producibility of minimum signature oxidizers and polymers
- (U) Test high performance minimum smoke propellant for boost motor of ADKEM
- (U) Conduct inertially guided flight test of ADKEM
- (U) Demonstrate millimeter wave tracking accuracy for ADKEM guidance concept
- (U) Conduct wind tunnel tests of boost and separation phase configuration of ADKEM
- (U) Conduct captive carry tests of advanced optical correlator system against real targets in clutter
- (U) Integrate and conduct captive flight tests and demonstrate target acquisition algorithms for CAMM
- (U) Initiate multi-spectrum sensor suite experimental program for passive target acquisition
- (U) Conduct antenna pattern tests for the two-dimensional digital beamforming antenna array

(U) FY 1991 Planned Program:

- (U) Complete infrared search and track (IRST) proof of principle tests, evaluate hand-off experiments and complete algorithm developments
- (U) Initiate efforts to apply infrared polarization concepts for sensor/seeker applications
- (U) Complete dual mode TGSM exploratory development and transition to advanced development
- (U) Demonstrate fast response, low cost, electro-mechanical actuator system
- (U) Establish and demonstrate reduced user skill requirement for distributed processing software development
- (U) Integrate hardware to support guidance system for combined arms requirements
- (U) Complete detailed airframe design for extended range fiber optic guided missile
- (U) Develop rotary wing aero-propulsion interaction model

Program Element: **#0602303A**
PE Title: **Missile Technology** Budget Activity: **#1**

- **(U)** Conduct a complete guidance flight test of ADKEM
- **(U)** Demonstrate optical correlator terminal guidance top attack against a tank target
- **(U)** Demonstrate insensitive munitions energetic minimum smoke propellant in an analog motor
- **(U)** In-house testing of advanced turbojet engine
- **(U)** Conduct feasibility flight demonstration for CAMM test bed missile concept

(U) Project DC04 — Smart Munition Technology Management: U.S. Army Missile Command (MICOM) is executive agent under charter from Army Materiel Command (AMC) to operate the AMC Smart Weapons Management Office (AMC-SWMO). This special management office is AMC focal point for smart munitions weapon systems to look broadly across all range bands, user requirements, materiel developments, proposed concepts and technologies, other service programs, industry independent research and development, and allied research and development. Office provides unbiased broad perspective recommendations to Army decision makers from a system-of-systems point of view to sort out what requirements and materiel solutions will make the most significant contribution on the integrated battlefield.

(U) FY 1989 Accomplishments: Not Applicable

(U) FY 1990 Planned Program:

- **(U)** Conduct smart weapons Technology Base survey and assessment to produce investment strategy
- **(U)** Update previous year's smart weapon systems master plan
- **(U)** Provide developers, analysts, and decision makers with weapon system performance analytical tools and make performance trade-off decisions of precision guided munitions and smart munitions in the close combat scenario
- **(U)** Maintain technology concept, system data base and conduct technical assessments for technology base and acquisition managers

(U) FY 1991 Planned Program:

- **(U)** Conduct smart weapon concept and system technical and programmatic assessments to produce business investment strategy (Smart Weapons Systems Master Plan)
- **(U)** Update previous year's smart weapons technology base investment strategy
- **(U)** Perform technical assessments of close combat, and fire support smart weapon system competing concepts to validate technical performance data used in force-on-force cost and operational effectiveness analyses
- **(U)** Provide US Army Materiel Command (AMC), US Army Training and Doctrine Command (TRADOC), and Headquarters, Department of Army independent, unbiased findings, conclusions and recommendations on competing smart weapon technologies, concepts and systems encompassing target acquisition functions, command and control function, and target engagement functions using missile, guns and rockets on ground vehicles, aircraft, and unattended robotic platforms

(U) Work Performed By: The Research, Development, and Engineering Center (RD&EC), U.S. Army Missile Command, Redstone Arsenal, AL, has primary responsibility for execution of this program. The major contractors performing work for this program include Boeing Aerospace Company, Seattle, WA; General Dynamics Corporation, Pomona, CA; Georgia Institute of Technology, Atlanta, GA; Hercules, Incorporated, Cumberland, MD and Simulation Technology, Huntsville, AL. Contractors with capabilities in UAV airframes, propulsion, simulation, data links, and ground station design will be selected and funded for specific tasks. The AMC-SWMO obtains Government technical expertise from MICOM RD&EC, Armament Research Development and Engineering Center, all Laboratory Command Laboratories and contractor support through a competitive smart

Program Element: **#0602303A**
PE Title: **Missile Technology** Budget Activity: **#1**

munitions master planning direct support contract, existing competitively awarded time and material contracts in Government laboratories and from the guidance and control information analysis center (GACIAC) currently operated and competitively awarded to IIT Research Institute, Chicago, with offices in Dayton Ohio, Lanham MD, Los Cruces NM, and Huntsville, AL. All contractors are analytical houses and are in non-conflict of interest with project managed smart weapon systems

(U) Related Activities: — Defense Advanced Research Projects Agency (DARPA) PE #0602711E (Tactical Technology) U.S. Navy PE #0602332N (Surface/Aerospace Weaponry Technology) U.S. Air Force PE #0602602F (Conventional Munitions) and PE #0603601F (Conventional Weapons); U.S. Army PE #0603306A (Terminally Guided Projectiles); PE #06043724/DK61, U.S. Army Missile Command; PE #0602782/AH93, PE #0603321/DK72, Harry Diamond Laboratories; PE #0602711E, DARPA; #0604737A, UAV; all Army, Navy, Air Force and DARPA PEs associated with conventional weapons technology.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Joint USA/Canada defense development sharing agreement.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0602307A

PE Title: **Laser Weapons Technology** Budget Activity #1

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A139 Laser Weapons Technology	6243	544	559	Cont	Cont
PE TOTAL	6243	544	559		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides for the limited development of flashlamp pumped dye laser technology and the evaluation of such technology for Army weapon applications. A laser damage database developed in prior years will be maintained. The program provides for an on-going assessment effort to monitor and analyze the developing technologies for high energy laser. A strong interface is to be maintained with the Army Strategic Defense Command (SDC) and the Strategic Defense Initiative Office (SDIO) to insure maximum tactical utilization of SDC/SDIO developed technology which could offer significant spin-offs with tactical weapons potential. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A139 — Laser Weapons Technology

(U) FY 1989 Accomplishments:

- (U) Demonstrated scalability of flashlamp pumped dye technology to kilowatt class level
- (U) Completed characterization of kilowatt class dye laser
- (U) Completed formal Concept Evaluation Program for DAZER
- (U) Comleted initial integration of laser and fire control system in Laser Light Air Defense System (LLADS)

(U) FY 1990 Planned Program:

- (U) Monitor & assess evolving technologies for tactical laser weapons applications
- (U) Demonstrate the scalability of dye laser phase conjugation concept by an order of magnitude from 100 mj to 1 joule

(U) FY 1991 Planned Program:

- (U) Evaluate shortwave length high energy laser concepts for tactical applications
- (U) Moniter & assess evolving technologies for tactical laser weapons applications

(U) Work Performed By: The U.S. Army Missile Command, Redstone Arsenal, AL.

(U) Related Activities: PE #0605806A — Army Test Ranges and Facilities; PE #0602101N — Navy Tactical Directed Energy Technology; PE #0602601F — Air Force Advanced Weapons; PE #0603221D — Strategic Defense Initiative Program; PE #0602301E — Defense Advanced Research Projects Agency HEL Technology; PE #0602707E — Particle Beams; PE #0603606F — Air Force Advanced Radiation Technology.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602601A**

PE Title: **Combat Vehicle and Automotive Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A1WL Admin & Mgmt Tank—Automotive Command Laboratory	6364	- 0 -	- 0 -	--	--
AH91 Tanks & Automotive Technology	15632	23039	26771	Cont	Cont
DC05 Heavy Armor	- 0 -	9058	9313	Cont	Cont
PE TOTAL	21996	32097	36084		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program advances the state-of-the-art of tank and automotive technology allowing for the development of mobility systems as well as componentry that will improve the Army's ability to fight, survive against, and defeat the anticipated battlefield threat. Both strategically mobile, lightweight and heavy integrated vehicles are being pursued. A new project for heavy armor supports findings of the 1985 Defense Science Board Summer Study on Armor/Anti-Armor Competition between US and Soviet land combat forces and reflects the Army's decision to place added emphasis on solving armor deficiences that bear on our ability to survive on the conventional battlefield. This project is critical to provide new technology to improve heavy force survivability against advanced anti-armor weapons. This Program Element (PE) also provides funds for overall administration and management of the US Army Tank-Automotive Command (TACOM) Research Development and Engineering Center. The costs include salary, travel, equipment, and general support of civilian management personnel and TACOM's administrative support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A1WL — Administration and Management for the Tank-Automotive Command Laboratory. Effective in 1990, these resources were transferred to Project AH91, this PE, as a zero sum transfer.

(U) Project AH91 — This project provides for advancement and innovative concepts integration of tank and automotive technology, leading to product improvements to currently fielded equipment and to the development of future systems that will enable the Army to economically and efficiently fight and survive against an ever-increasing conventional warfare threat. It includes conceptual design, physical and analytical simulations, and analyses of ground vehicle systems to identify high potential emerging technologies, as well as the benefits, limitations and trade-offs related to ground vehicle applications. The program is comprised of five tasks: future vehicle concepts and subsystem integration; mobility; survivability; vehicle electronics; and life simulation. The survivability efforts include signature reduction, countermeasures, and fire suppression, which complement, but do not duplicate, the work performed under the Heavy Armor program in enhancing the overall survivability of combat vehicles.

Program Element: **#0602601A**

PE Title: **Combat Vehicle and Automotive Technology** Budget Activity: **#1**

(U) FY 1989 Accomplishments:

- **(U)** Three Concept Exploration/Definition contractors provided their Best Technical Approach (BTA) for Heavy Force Modernization (HFM); each concluded the HFM concept is feasible and that more cost-effective, improved warfighting capabilities can be achieved through this concept
- **(U)** Completed advanced concept design, and initiated simulation and detailed design for the Component Advanced Technology Test Bed (CATTB)
- **(U)** Initiated Phase II of Congressionally directed demonstration of the Hansen Rotary valve system in a non-military diesel engine
- **(U)** Fabricated a low heat rejection, high temperature single cylinder demonstration engine and conducted base line tests
- **(U)** Conducted performance testing of the high temperature recuperator module for the advanced ground vehicle turbine engine
- **(U)** Coordinated requirements for implementation of laser hazard protected sights and periscopes for current and future combat vehicles
- **(U)** Jointly, with US Army Materiel Command (AMC) agencies, integrated advanced radar & infrared materials on a combat vehicle, and demonstrated the signature suppression merits for use on current vehicles and the CATTB
- **(U)** Developed the video display screen formats for the combat vehicles using the Vetronics Crew & Display Demonstrator
- **(U)** Completed hardware development of the Turret Motion Base Simulator, which will provide the capabilities to perform laboratory evaluations of full scale combat vehicles

(U) FY 1990 Planned Program:

- **(U)** Complete design, fabricate and initiate testing of the Congressionally-directed Hansen Rotary valve in a non-militarized diesel engine
- **(U)** Conduct analytical simulations of final CATTB design and initiate development of field test and evaluation plans
- **(U)** Develop vehicle concepts for a future test bed, employing composite lightweight materials, electromagnetic armor, electric drives, and electromagnetic or electrothermal guns
- **(U)** Initiate electric drive analysis to identify critical components for application to future ground combat vehicle chassis
- **(U)** Perform a laboratory evaluation of the Vehicle Integrated Defense System, that combines threat sensing & neutralization prior to integration into the CATTB
- **(U)** Define the CATTB soldier monitor display & control interface using the Vetronics Crew Display Demonstrator
- **(U)** Develop tracked vehicle evaluation Dynomometer Work Station which will perform computer simulations on concept vehicle providing engineering guidance in development of future vehicles
- **(U)** Initiate expert maintenance system to provide computer aided diagnostics and prognostics

(U) FY 1991 Planned Program:

- **(U)** Complete congressionally-directed evaluation of Hansen Rotary Valve system, integrated in a diesel engine
- **(U)** Continue analysis and concept design of future electrically-driven chassis, and initiate concept development of a light weight assault vehicle chassis
- **(U)** Initiate critical electric drive component development based on the FY 1990 study for application to an electrically-driven chassis

Program Element: **#0602601A**

PE Title: **Combat Vehicle and Automotive Technology** Budget Activity: **#1**

- **(U)** Assess active suspension system concepts with emphasis on feasibility, performance, and complexity constraints
- **(U)** Integrate electrical and electronic subsystems in the CATTB using the Vetronics architecture
- **(U)** Develop an active noise cancellation system and visible signature suppression system for future combat vehicles; Apply current signature suppression to CATTB
- **(U)** Conduct simulations and initiate development of active suspension design
- **(U)** Conduct field exercises with user to optimize the expert maintenance system and to refine the software validity for the Prognostic Monitoring System
- **(U)** Complete assembly, integration and rating of Crew Station/Turret Motion Base Simulator to assess full scale vehicle and subsystems in simulated field tests

(U) Project DC05 — Heavy Armor. There has been minimal research to pursue new heavy armor technology within the Army over the past few years because resources have been used to support the joint Defense Advanced Research Projects Agency (DARPA)/Army/US Marine Corps (USMC) armor/anti-armor program and to apply technology to the M1A1 tank to solve near-term deficiencies. This project lays the technical foundation to solve critical frontal armor deficiencies and improve the survivability of conventional ground combat forces against increasingly lethal threat anti-armor weapons. Within the broader field of armor development, it addresses a problem that is unique to the Army; protection of our main battle tanks and other combat vehicles requiring high levels of armor protection against large caliber kinetic energy projectiles and chemical energy warheads. The project draws upon earlier work in Army programs and in the DARPA/Army/USMC Armor/Anti-Armor Initiative, providing for the transition of products from those programs to Army applications, such as Heavy Force Modernization. In addition to development of specific armor concepts, the project includes supporting work in armor materials, bringing together the collective expertise of the Department of Defense, the Department of Energy, and industrial and academic sources. Supporting work also includes development of armor performance models and integration tools necessary to realize the benefits of this technology on the battlefield. This project covers all types of armor, including passive, reactive, and electromagnetic.

(U) FY 1989 Accomplishments: Not Applicable.

(U) FY 1990 Planned Program:

- **(U)** Conduct tests of passive armor combining US and foreign armor technology
- **(U)** Conduct tests of multiple-hit performance on new passive armor arrays
- **(U)** Complete characterization and development of energy-absorbing polymers and other improved materials for use in armor arrays

(U) FY 1991 Planned Program:

- **(U)** Complete testing of multiple-hit passive armor configuration with kinetic energy, unitary shaped charge, and tandem shaped charge threats
- **(U)** Complete development and full scale tests of hybrid armors with combined kinetic energy and shaped charge protection
- **(U)** Continue support of heavy armor industrial base created in DARPA/Army/USMC Armor/Anti-Armor Program through supplementation of DARPA contracts to develop armors for Army requirements
- **(U)** Initiate concept development for second generation armor modules for Block III tank and other HFM systems
- **(U)** Support advanced material development for integral reactive armors
- **(U)** Continue transition of programs and products from DARPA/Army/USMC Armor Anti-Armor program

Program Element: **#0602601A**

PE Title: **Combat Vehicle and Automotive Technology** Budget Activity: **#1**

(U) Work Performed By: The US Army Tank-Automotive Command (TACOM) and Program Executive Officer, Heavy Force Modernization, Warren, MI. Major contractors include: Williams International, Walled Lake, MI; Adiabatics Incorporated, Columbus, IN; Boeing Company, Seattle, WA; TRW, Redondo Beach, CA; Perkin-Elmer, Norwalk, CT; FMC, San Jose, CA; General Dynamics Land Systems Division, Warren, MI; General Motors Military Vehicle Operation, Warren, MI; Honeywell Corp., Hopkins, MN; General Electric, Lynn, MA; Texas Instruments, Dallas, TX; Garrett Corp., Phoenix, AZ.

(U) Related Activities:

PE #0601102A (Defense Research Sciences)
PE #0602105A (Materials Technology)
PE #0602624A (Weapons and Munitions Technology)
PE #0602618A (Ballistics Technology)
PE #0603102A (Materials and Structures-Advanced Technology)
PE #0602786A (Logistics Technology)
PE #0603001A (Logistics Advanced Technology)
PE #0603003A (Aviation Advanced Technology)
PE #0603004A (Weapons and Munitions Advanced Technology)
PE #0603005A (Combat Vehicle and Automotive Advanced Tech)
PE #0203735A (Combat Vehicle Improvement Program)

A close relationship is maintained with other Services and Government agencies to preclude duplication of effort. Information concerning allies technology is shared via data exchange agreements, memorandums of understanding, and separate bilateral working groups.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602618A**
PE Title: **Ballistics Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A1FL Admin & Mgmt-Ballistics Research Lab (BRL)	9648	- 0 -	- 0 -		
AH80 Ballistics Technology	20947	26609	27700	Cont	Cont
PE TOTAL	30595	26609	27700		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides ballistic technologies required for defensive and offensive Army weapon systems development to counter the increasing threat. Focus is on anti-armor warhead mechanics; penetration mechanics; munition-target interactions; terminal effects; propulsion dynamics; and launch and flight dynamics and remote sensing. Corresponding emphasis is placed on advanced armor technology and vulnerability/lethality/survivability analysis and efforts to optimize effectiveness and survivability of armored combat vehicles. Funding is also to support work in hyper-velocity penetrators that could result in increased anti-armor capability. This Program Element (PE) also provides funds for overall administration and management of RDTE,A laboratories. The costs include salary, travel, equipment, and general support of civilian management personnel and their administrative support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A1FL — Administration and Management for the Ballistics Research Laboratory. Effective in 1990 these resources were transferred to Project AH80, this PE as a zero sum transfer within the Appropriation.

(U) Project AH80 — Ballistics Technology:

(U) FY 1989 Accomplishments:

- **(U)** Extended Electrothermal propulsion studies through use of new 30mm Electrothermal (ET) gun
- **(U)** Via Super computer, evaluated Kinetic Energy (KE) projectile aero-thermal/aero-dynamics, and predicted critical aero-dynamic coefficients to improve accuracy of long range artillery shells
- **(U)** Developed shock wave model for ceramic armor tile isolation for improving resistance of ceramic armors to multiple hits
- **(U)** Completed joint Ballistic Research Laboratory (BRL)/LTV Corporation test of segmented projectiles against modern armors and assessed the effectiveness of shape charge performance for hot forged and hot formed linear fabrication techniques

(U) FY 1990 Planned Program:

- **(U)** Design and test temperature compensating igniter/charge for large calibre gun
- **(U)** Develop and validate structural performance model for inhomogeneous laminate components to aid in ascertaining materiel strength
- **(U)** Expand electrothermal data base and predictive capability based on 30mm firings to initiate evaluation of future weapons potential

Program Element: **#0602618A**
PE Title: **Ballistics Technology** Budget Activity: **#1**

- (U) Characterize and approve launch dynamics of large smart munitions
- (U) Demonstrate improved integral composite shroud for 120mm cannon
- (U) Develop warhead debris effects for reactive armor model
- (U) Design and test segmented projectiles at high velocity
- (U) Apply advanced materials to sabots for Electromagnetic/Electrothermal (EM/ET) guns for greater lethality
- (U) Develop hydro-code prediction for short Length/Diameter (L/D) warheads and develop scaling laws for behind armor debris in advanced armor targets

(U) FY 1991 Planned Program:

- (U) Conduct large calibre testing of temperature compensating charges for higher performance guns
- (U) Develop mechanical properties for advanced composite materials for ballistic systems
- (U) Expand electrothermal weapons assessment potential to include Armament Research & Development Engineering Center (ARDEC) 120mm ET gun demonstration
- (U) Eliminate temperature dependent jump and demonstrate gun sensors for dispersion control/accuracy improvement
- (U) Optimize low cost ceramic armor and demonstrate cast P-900 armor for 30mm threat
- (U) Design and test EM gun projectiles
- (U) Evaluate extruded cast explosive with new shape charge liner designs, including molybdenum
- (U) Expand the modular UNIX-based vulnerability evaluation models to include air threats

(U) Work Performed By: In-house efforts accomplished by the US Army Ballistic Research Laboratory, Aberdeen Proving Ground, MD. Research efforts will be supplemented by contract support by New Mexico Institute of Mining and Technology, Socorro, NM; Dynamic Sciences, Inc., Phoenix, AZ; Honeywell, Minneapolis, MN; Aircraft Armaments Inc., Cockeysville, MD.

(U) Related Activities: Program Element #0603004A (Weapons and Munitions Advanced Technology). Activities coordinated with other Government services and agencies. There is no unnecessary duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602622A**

PE Title: **Chemical, Smoke and Equipment Defeating Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A1JL	Admin & Mgmt — Chemical Research, Development & Engineering Center (CRDEC)				
	8082	- 0 -	- 0 -	—	—
A552	Smoke & Obscurant Munitions				
	5791	5539	5925	Cont	Cont
A553	Chemical/Biological (CB) Defense & General Investigations				
	21384	42169	40012	Cont	Cont
A554	Chemical Munitions				
	4162	5071	4904	Cont	Cont
PE TOTAL	39419	52779	50841		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Soviet Union has long recognized and appreciated the ability of chemical-biological (CB) weapons to inflict casualties, degrade combat effectiveness, and disrupt the battlefield. The USSR continues to maintain and improve its formidable capability to conduct CB warfare operations and CB warfare capabilities are proliferating among developing nations. Consequently, the US military may not be able to survive and conduct sustained operations in a CB warfare environment. This program element is in support of the objective to correct deficiencies in CB defense material and avoid technological surprise. Through this accomplishment, the survivability and sustainability of US forces in the event of a CB attack would be significantly improved and the possibility of an attack significantly reduced. This program element represents the exploratory development for all the Services into the chemistry and effects of threat agents, the analysis and integration of CB defense systems and CB simulants, Nuclear Biological Chemical (NBC) survivability and system sciences necessary to avoid technological surprise, and the support of advanced development efforts. The program represents exploratory development for all the Services in reconnaissance, detection, and warning; CB individual and collective protection; decontamination and contamination avoidance and CB antiterrorism. In addition to improving our defenses, we must maintain a credible capability to retaliate with chemical weapons. This contributes to deterring chemical warfare (CW) and eliminating the CW threat through negotiation. This program element addresses the urgent need to provide a credible deterrent to CW. To accomplish this goal, it is necessary to replace the current stockpile with munitions that are compatible with current and developmental delivery systems, provide a rear-echelon attack capability and facilitate demilitarization. Through the Army's Executive Agent responsibilities, the program provides for the conduct of exploratory development for all the Services in chemical agents, chemical agent effects, and chemical munitions. This Program Element also provides funds for overall administration and management of RDTE,A laboratories. The costs include salary, travel, equipment, and general support of civilian management personnel and their administrative support staffs. This program element addresses the urgent need to provide smoke, obscurants and antimateriel flame work which was originally performed under Project A554 and moved to A552 based upon recommendation of the US Army Chemical School. This program element also includes $2.0 million identified for a "classified" program in FY 1990 and FY 1991. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

Program Element: **#0602622A**

PE Title: **Chemical, Smoke and Equipment Defeating Technology** Budget Activity: **#1**

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A1JL — Administration and Management for the Chemical Research, Development and Engineering Center (CRDEC). Effective with FY 1990, these resources were transferred to Project A553, this PE as a zero sum transfer.

(U) Project A552 — Smoke and Obscurant Munitions: This project addresses the urgent need to provide smoke and obscurants to reduce the vulnerability of US forces by defeating or degrading threat weapon sights, guided munitions, target acquisition devices, and surveillance systems. This project also provides technology essential to development of antimateriel and flame systems

(U) FY 1989 Accomplishments:

- **(U)** Smoke
  - Re-entered XM55 Millimeter Wave (MMW) module into the Technology Base to optimize discrimination capability
  - Identified the materials that will serve as the basis for multicomponent mix for multispectral smoke
  - Supported JP-8 investigations
  - Fabricated and tested full size multispectral MMW smoke pot
- **(U)** Antimateriel Flame
  - Drafted and commented on Operational Concept for Antimateriel Flame
  - Initiated preliminary feasibility analysis for Antimateriel Flame

(U) FY 1990 Planned Program:

- **(U)** Smoke
  - Develop the theory, material and processes necessary to produce multicomponent multispectral screening agent
  - Continue support of JP-8 Vehicle Engine Exhaust Smoke (VEESS) investigations
  - Investigate candidate materials for Directed Energy Weapon (DEW) defense
  - Transition Large Area Mobile Projected Smoke System (LAMPSS)
  - Continue optimization of XM-55 multispectral millimeter wave module
- **(U)** Antimateriel Flame
  - Identify Antimateriel Flame candidate payloads, initiate small scale evaluation of candidates, initiate static field trials with best candidate against surrogate targets

(U) FY 1991 Planned Program:

- **(U)** Smoke
  - Develop theory, material and processes necessary to produce multicomponent multispectral screening agent
  - Continue support of JP-8 VEESS investigations
  - Investigate candidate materials for Directed Energy Weapon (DEW) defense
  - Transition XM55 Millimeter Wave (MMW) Module into systems-oriented advanced development
- **(U)** Antimateriel Flame
  - Continue small scale evaluation of antimateriel flame candidates; continue static fields trials with best candidate against surrogate targets
  - Conduct limited candidate payload dissemination/generation studies and antimateriel flame munition design studies

Program Element: **#0602622A**

PE Title: **Chemical, Smoke and Equipment Defeating Technology** Budget Activity: **#1**

(U) Project A553 — Chemical/Biological (CB) Defense and General Investigations: This project addresses the urgent need to provide all Services with defensive materiel to protect individuals and groups from threat chemical-biological agents. It also provides for special investigations into the chemistry and effects of threat agents, the analysis and integration of CB defense systems and CB simulants, NBC survivability and Systems Sciences necessary to avoid technological surprise, and supports advanced development efforts. The project represents the exploratory development for all the services in CB reconnaissance, detection, and warning; CB individual and collective protection; CB decontamination/contamination avoidance and CB antiterrorism.

(U) FY 1989 Accomplishments:

- (U) Threat Agent Chemistry
  - Developed new analytical methods for chemical analyses for threat agents and hazardous materials for immediate application for environmental sample analyses and potential application for treaty verification
  - Developed a computerized data base of over 350 naturally occurring toxic materials that have potential as chemical/biological threat agents
  - Completed collaborative toxicology study with U.S. Army Medical Research Institute of Chemical Defense on an assessment of lung damage caused by a class of highly toxic irritants of concern as threat agents
  - Prepared updated report of International Task Force-6 on Tripartite Agent Assessment which categorizes biological/chemical threat agents by priority
  - Identified threat agents from a variety of sources
  - Synthesized potential threat agents
  - Conducted Nuclear Magnetic Resonance (NMR) analysis of threat compounds
- (U) Analysis and Integration of Chemical Defense Systems
  - Extended the dual binary (DB) agent weapon evaluation model for tracing the vaporization of changing liquid component mixture as a function of time from two into five liquid components
  - Completed CB Threat Assessment Plan
  - Completed enhanced version of DB Nusse to address multi-component agent mixtures
  - Completed integrated CB Defense front end analysis to access the individual and collective interactions of CB defense materiel, threat, and combat procedures and provide direction for continued exploratory/advanced/engineering development for an integrated battlefield
- (U) Reconnaissance, Detection and Identification (RDI)
  - Completed breadboard design for Biological-Chemical (BC) Detector
  - Selected the Light Addressable Potentiometric Sensor as technology for BC Detector
  - Initiated breadboard fabrication for BC Detector
  - Established Memorandum of Understanding (MOU) for Tri-National Cooperative (US/UK/Canada) Development of BC Detector
  - Completed and demonstrated Phase I CB Mass Spectrometer
  - Initiated Phase II of CB Mass Spectrometer
  - Completed technical and performance specifications for a frequency agile lightweight laser for standoff detection of airborne/ground threat agent contamination
  - Designed and fabricated passive lightweight interferometer for IR standoff detection package for Unmanned Aerial Vehicle (UAV)

Program Element: **#0602622A**

PE Title: **Chemical, Smoke and Equipment Defeating Technology** Budget Activity: **#1**

- Initiated an MOU with France for exploratory development of a laser standoff chemical detector under Nunn Amendment

- **(U)** Individual Protection
  - Designed alternate sizes for the prototype Aircrew Protective Mask System
  - Conducted technology workshop to identify new technology areas relevant to next generation protective mask (RESPO 21) and future respiratory system design
  - Installed 3-D anthropometric scanner system and began developing algorithms to fuse all images into a common reference system
  - Reached joint service agreement to use standardized protection factor test methodology using sodium chloride
  - Convened technology workshop on RESPO 21 design
- **(U)** Collective Protection
  - Identified a charcoal impregnant that provides enhanced filtration performance against the top nonstandard agent
  - Performed process engineering studies to develop the impregnation technology for chromium-free carbon
  - Developed drying technology to reduce the level of ammonia off-gassing from the chromium-free impregnated carbons
- **(U)** Decontamination
  - Determined effect on materials, temperature limits for use, storage stability, mixing properties and decontamination efficacy for microemulsion for deliberate decontamination
  - Initiated studies of catalytic improvements to microemulsion
  - Initiated investigations of biotechnology for decontamination of mustard agent
  - Sponsored NATO "Biotechnology in Decontamination" meeting
  - Determined optimal formulation of self-stripping coating using CD-260 based polymer for agent decontamination efficacy and autorelease
  - Identified transition metal complexes as catalyst for oxidation of mustard agent
- **(U)** CB Antiterrorism
  - Completed design of expedient hood and transferred to production
  - Completed antiterrorism front end analysis which identifies potential use of CB agent in terrorist situations
  - Finalized threat handbook for publication
- **(U)** CB Simulants, Survivability and Systems Science
  - Held 3rd International Simulant Workshop
  - Expanded molecular modeling system to calculate interactions between molecules to enable chemical reaction modeling
  - Completed draft report on NBC survivability of the US Army Chemical Research Development and Engineering Center's (CRDEC) developmental items
  - Continued efforts with other users/developers to assess NBC survivability status in USA Materiel Command (AMC), DoD, and other countries
  - Completed Individual Protective Equipment Manikin baseline trials in systems science
  - Completed aerosol deposition model for clothing system
  - Established test plan and initiated trials to exploit microencapsulation of agents
  - Establish International Simulant Data Center

Program Element: **#0602622A**

PE Title: **Chemical, Smoke and Equipment Defeating Technology** Budget Activity: **#1**

(U) FY 1990 Planned Program:

- **(U)** CB Threat Agents
  - Update International Task Force-6 Report
  - Synthesize and characterize compounds within classes of greatest threat potential based on threat assessments from FY 1989
  - Provide threat agent assessments
- **(U)** CB Analysis and Integration of Chemical Defense Systems
  - Initiate program to develop a transport and diffusion research model
  - Provide a working version of Modular Chemical Assessment System (MCAS)
  - Complete integrated CB defense front end analysis
  - Initiate/complete updated decontamination front end analysis
  - Initiate Reconnaissance, Detection and Identification (RDI) front end analysis
  - Complete and automate update of threat assessment data base
  - Initiate program to develop compendium of threat CB challenge levels
- **(U)** Reconnaissance, Detection and Identification
  - Complete breadboard fabrication of BC Detector
  - Complete test and evaluation of BC Detector
  - Evaluate the UK breadboard ION Mobility Spectrosopy (IMS) Module
  - Complete Phase II CB mass spectrometer design and fabrication
  - Test Phase II CB mass spectrometer using CB simulants, background and interferents
  - Conduct critical design review of Phase II CB mass spectrometer breadboard
  - Build and evaluate new lightweight passive detector
  - Integrate detection system into Unmanned Aerial Vehicle (UAV) and conduct field test
- **(U)** Individual Protection
  - Continue technology monitoring on RESPO 21
  - Complete development of mask/periphery sizes for Aircrew Protective Mask
  - Design and fabricate lens attachment system for Aircrew Protective Mask
  - Finalize agreement on standardized protection factor test methodology
  - Evaluate vapor full ensemble test methodology developed at the US Army Chemical, Research, Development and Engineering Center
- **(U)** Collective Protection (Heavy Force Modernization)
  - Establish technology transfer mechanism/process for Reactive Bed Plasma Filtration System
  - Complete Optimization of new reactive absorbent
  - Complete environmental explosive testing of chromium-free carbon
  - Characterize a ASC carbon filtration performance against high priority nonstandard agents
  - Establish required performance levels for advanced canister for M40 and future individual respirators
  - Evaluate canister design options
  - Evaluate filter media options for advanced canisters
  - Initiate support of Heavy Force Modernization (HFM) Program
  - Deliver Pressure Swing Absorption (PSA) prototype hardware to Component Advanced Technology Test Bed (CATTB)
  - Initiate development of performance prediction model

Program Element: #0602622A
PE Title: **Chemical, Smoke and Equipment Defeating Technology** Budget Activity: #1

- Initiate absorption/desorption technology base contract to gather data

- (U) Detection (HFM)
  - Design, fabricate and test Multipurpose Integrated Chemical Agent Detector (MICAD) integration with Automatic Chemical Agent Detector and Alarm (ACADA) sampling system and Collective Protection Equipment (CPE)
  - Provide warning and reporting specification to HFM integration
  - Develop Sample Transfer System technology and provide prototype
- (U) Smoke (HFM)
  - Initiate fabrication of inhouse Infrared Smoke Sustaining System (ISSS) prototype
  - Initiate selection compounds for millimeter wave (MMW) Smoke Sustaining System (SSS)
  - Provide Multi-Smoke Grenede Launcher (MSGL) to TACOM
- (U) Auxiliary Environmental Control System (APECS) (HFM)
  - Award contract for design and fabrication of Auxiliary Powered Environmental Control System (APECS)
  - Develop test plan for APECS hardware tests
  - Develop code to conduct parametric studies of Reverse-Brayton systems
- (U) Decontamination
  - Complete application/mixing hardware for microemulsion decontamination
  - Begin evaluation of candidate replacements for Freon 113
  - Transition Multipurpose Chemical/Biological Decontamination (MCBD) microemulsion to full scale engineering development
  - Complete agent evaluations of modified CD-260 formulation for selfstripping coating and compare to agent data of baseline polymer
  - Complete final modification to CD-260 polymer for optimum autorelease and decontamination efficacy
  - Begin evaluation of oxidation catalysts with mustard and VX
  - Begin evaluation of combined hydrolytic and oxidative catalysts for VX
- (U) Chemical-Biological (CB) Antiterrorism
  - Develop special purpose defensive materiel necessary to combat CB terrorist threat
  - Continue assessment through the CB terrorism working group
- (U) Chemical-Biological (CB) Simulants, NBC Survivability, Systems Science
  - Conduct International Simulant Workshop
  - Update Simulant Data Center and perform international data exchanges
  - Apply molecular modeling techniques to chemical reactions to predict rates of reaction and products
  - Determine fate of simulants in selected environments
  - Complete state-of-knowledge summary on agent persistence or terrain in support of International Task Force

(U) FY 1991 Planned Program:

- (U) Chemical-Biological (CB) Threat Agent
  - Develop methodology directly in support of sample analysis program to provide means of addressing unforeseen problems in chemical analysis
- (U) Chemical-Biological (CB) Analysis and Integration of Chemical Defense Systems
  - Continue program to develop a transport and diffusion research model
  - Continue Modular Chemical Assessment System (MCAS) development

Program Element: **#0602622A**

PE Title: **Chemical, Smoke and Equipment Defeating Technology** Budget Activity: **#1**

- Complete RDI front end analysis
- Complete collective protective equipment front end analysis
- Complete compendium of threat CB challenge levels

• **(U)** Reconnaissance, Detection and Identification
- Conduct user/test evaluation of BC detector breadboard
- Complete design and fabrication of concept model of BC Detector
- Complete Test/Evaluation of concept model of BC Detector for transition to 6.3B
- Complete Phase II CB mass spectrometer breadboard test evaluation
- Complete Phase II CB mass Spectrometer concept model design and fabrication
- Construct a mass spectra database for algorithm/pattern recognition efforts
- Deliver lightweight frequency agile Laser
- Evaluate US and French laser systems

• **(U)** Individual Protection
- Complete technology monitoring on RESPO 21
- Continue Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) design studies
- Initiate component design/fabrication efforts
- Continue investigations into reducing physiological burden of next generation mask

• **(U)** Collective Protection (HFM)
- Continue development of a performance prediction model for evaluation of contractor NBC systems
- Design and fabricate full scale Pressure Swing Absorption (PSA) units for verification of prediction model
- Continue evaluation of catalytic oxidation systems
- Conduct component optimization studies in reactive bed plasma
- Complete process development studies on new reactive adsorbants
- Select final reactive adsorbant formulation and design the production process
- Complete development of and implement chromium free carbon
- Determine materials of construction for advanced canister
- Design canister concepts

• **(U)** Detection (HFM)
- Fabricate prototype Sample Transfer System
- Integrate MICAD/ACADA Sampling System — CFE into Vetronics
- Provide technical support to HFM integration

• **(U)** Smoke (HFM)
- Support integration/demonstration of MSGL
- Investigate storage and materials for ISSS
- Explore MMW SSS dissemination methods

• **(U)** APECS support (HFM)
- Complete fabrication, test evaluation integration of the APECS

• **(U)** Decontamination
- Continue evaluation of replacement candidates for Freon 113
- Initiate hardware integration study and hardware prototype design for CD-260
- Determine decontamination efficacy of modified CD-260

Program Element: **#0602622A**

PE Title: **Chemical, Smoke and Equipment Defeating Technology** Budget Activity: **#1**

- Continue evaluation of oxidation catalysts with mustard and VX
- Continue evaluation of hydrolysis catalysts with VX
- Continue evaluation of combined hydrolytic and oxidative catalysts for VX
- Develop use concepts and applications for sorbent powder systems

- **(U)** CB Antiterrorism
  - Continue development of special purpose defensive materiel necessary to combat the CB terrorist threat
- **(U)** CB Simulants, Survivability and Systems Science
  - Conduct International Simulant Workshop
  - Update Simulant Data Center

(U) Project A554 — Chemical Munitions: This project supports exploratory development efforts in chemical agents, chemical agent effects, and chemical munitions to deter the threat of chemical warfare by developing a credible retaliatory capability. It addresses the urgent need to replace the current stockpile with munitions which will be compatible with current and developmental weapon systems, provide a rear echelon attack capability, minimize the transportation logistic burden, and facilitate demilitarization and avoid technological surprise.

(U) FY 1989 Accomplishments:

- **(U)** Synthesized small quantities of candidate incapacitant agent and intermediates for physical-chemical and toxicological testing
- **(U)** Completed preliminary structure activity correlation model for adrenergic compounds
- **(U)** Completed physical property measurements for candidate incapacitant compounds

(U) FY 1990 Planned Program:

- **(U)** Initiate technology transfer of an antiprotective munition for system oriented advanced development
- **(U)** Transition technology associated with a viable Antiprotective compound for use in an antiprotective device
- **(U)** Evaluate candidate incapacitant compounds by defined screening mechanisms and toxicological testing
- **(U)** Synthesis and determination of physical properties of selected incapacitant compounds to support effectiveness analysis, dissemination studies and weapon system selection

(U) FY 1991 Planned Program:

- **(U)** *Perform inhalation studies on candidate incapacitant compounds to evalulate route of* entry effectiveness
- **(U)** Synthesize metabolic and dissemination breakdown products of selected candidates to evaluate toxicological and physical-chemical properties
- **(U)** Utilize computer simulations to enhance design of optimum generation system
- **(U)** Evaluate dissemination methods of incapacitant compound

(U) Work Performed By: Smoke and Obscurant Munitions and Chemical/Munitions: In-house work is performed by the US Army Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD. Some other government agencies performing work for CRDEC are: US Army Ballistics Research Laboratory, Aberdeen Proving Ground, MD; Natick Research and Development Center, Natick, MA; Army Research Office, Research Triangle Park, NC; Lawrence Livermore National Laboratory, Livermore, CA; Night Vision and Electro Optics Laboratory, Ft Belvoir, VA; Los Alamos National Laboratory, Los Alamos, NM; and Army Medical Research Institute of Infectious Disease, Ft Detrick, MD. The top five contractors are AAI, Cockeysville, MD,

Program Element: **#0602622A**

PE Title: **Chemical, Smoke and Equipment Defeating Technology** Budget Activity: **#1**

Quest, Falls Church, VA; JAYCOR, Crystal City, VA; Bendix, Columbia, MD; and Teledyne, Alexandria, VA.

Chemical/Biological Defense and General Investigations In-house work is performed by the U. S. Army Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD. Some other Government agencies performing work for the Center are: Army Medical Research Institute of Infectious Disease, Ft. Detrick, MD; Dugway Proving Ground, Dugway, Utah; U.S. Army Ballistics Research Laboratory, Aberdeen Proving Ground, MD; Natick Research and Development Center, Natick, MA; Army Research Office, Research Triangle Park, NC; Lawrence Livermore National Laboratory, Livermore, CA; and Night Vision and Electro Optics Laboratory, Ft Belvoir, VA. The top five contractors are Battelle Columbus Laboratories, Columbus, OH; Geocenter, MA; University of Florida, Gainsville, FL; Bendix, Columbia, MD; and Teledyne, Alexandria, VA.

(U) Related Activities:

PE #0601102A (Defense Research Sciences)
PE #0603806A (Chemical/Biological Defense Equipment Advanced Development)
PE #0603627A (Smoke and Equipment Defeating Systems — Advanced Development)
PE #0603759A (Chemical Biological Defense and Smoke Advanced Technology)
PE #0603803A (Chemical Systems — Advanced Development)
Activities coordinated with other Government services and agencies. There is no unnecessary duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) MOU with France for joint R&D effort titled "Laser Stand-Off Chemical Detection System," dated September 1988.

(U) International Cooperative Agreements:

- MOU with France — Joint R&D of a Laser Stand-Off Chemical Detector
- Trinational MOU with UK/Canada/US on cooperative development of Biological-Chemical Detector

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602623A**

PE Title: **Joint Service Small Arms Program** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A1BL	Admin & Mgmt-Armament Research Dev & Engrg Center (ARDEC)				
	8949	- 0 -	- 0 -	—	—
AH21	Joint Service Small Arms Program (JSSAP)				
	4123	5051	5381	Cont	Cont
PE TOTAL	13072	5051	5381		

B. (U) BRIEF DESCRIPTION OF ELEMENT: Joint Service Small Arms Program (JSSAP). This effort provides a coordinated program for the exploratory development of small arms weapons to meet future battlefield requirements for all Services. The JSSAP effort is configured to overcome the technological barriers associated with energy conversion and projection, all environment target acquisition, mechanism dynamics, high velocity launch and materials to achieve substantial improvements in threat defeat (personnel with body armor and next generation lightly armored vehicles) per pound of combatant load. All JSSAP efforts are based upon approved Joint Service Science and Technology Objectives (JSSTO) which are drawn from the following Mission Area Analyses and other Service documents: The Army Close Combat Light and Special Operations mission areas and Small Arms Master Plan (SAMP), specifically addressing deficiencies for light forces and special operations forces; the Marine Corps Infantry Aspects of Close Combat; the Air Force Air Base Ground Defense; and Navy Special Warfare. This effort maximizes return on investment as all services are participants in this program. The main efforts include the following: (1) Helicopter door-gun beam sight — primary application is to special operations forces for anti-personnel, anti-materiel, anti-armor — increase burst hit probability from 0.15 to 0.9; (2) Advance Crew Served Weapon — Replace M2MG & MK19 grenade launcher with a dual purpose man-portable system (75% weight reduction); (3) Hyper velocity kinetic energy projectile — greater than 100% increase in light armor penetration; and (4) Bursting Munition — 40% increase in hit probability for first shot to a range of 500 meters. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A1BL — Administration and Management for the Armament Research Development and Engineering Center (ARDEC). Effective in 1990 these resources were transferred to Program Element (PE) #0602624 A, and Projects AH28, AH18, and AH19 as a zero sum transfer within the appropriation for the purpose of improved management controls.

(U) Project AH21 — Joint Service Small Arms Program:

(U) FY 1989 Accomplishments:

- **(U)** Awarded contract for bursting munitions concept in preparation for FY 1990 target effect demonstration in support of Army Small Arms Master Plan (SAMP) Decision Process
- **(U)** Demonstrated single shot advanced propulsion hypervelocity kinetic energy projectile survivability in preparation for burst-fire technology demonstration
- **(U)** Released broad agency announcement and selected conceptual approaches for an Advanced Crew Served Weapon in support of Army SAMP
- **(U)** Began assembly and checkout in preparation for technology demonstration of helicopter door gunner Advanced Beam Sighting System in FY 1990

Program Element: **#0602623A**

PE Title: **Joint Service Small Arms Program** Budget Activity: **#1**

(U) FY 1990 Planned Program:

- (U) Complete bursting munition conceptual design in preparation for component fabrication and FY 1991 demonstration in support of Army SAMP Decision Process
- (U) Perform burst-fire demonstration of advanced propulsion hypervelocity kinetic energy projectile test bed
- (U) Complete design and begin fabrication of critical fuzing, warhead and fire control components for Advanced Crew Served Weapon breadboard
- (U) Conduct inflight technology demonstration of helicopter door gunner Advanced Beam Sighting System

(U) FY 1991 Planned Program:

- (U) Conduct breadboard bursting munition demonstration in support of Army SAMP
- (U) Transition hypervelocity kinetic energy efforts to USMC advanced development
- (U) Complete fabrication, demonstration and evaluation of critical componentry for Advanced Crew Served Weapon breadboard
- (U) Transition helicopter door gunner Advanced Beam Sighting System to non-system advanced development

(U) Work Performed By: This exploratory development program is under the direction of the Joint Service Small Arms Program Management Committee. The prime in-house organization responsible for the program is the US Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ, with other efforts at: The Naval Weapons Support Center, Crane, IN, and the Air Force Armament Laboratory, Eglin AFB, FL. Primary contractors for JSSAP exploratory development activities are: University of Texas, Austin, TX. Batelle Columbus Labs, Columbus, Ohio; Baird, Bedford, MA; CAMDEC, Santa Anna, Calif.

(U) Related Activities:

PE #0601102D (Defense Research Sciences)
PE #0602624A (Weapons and Munitions Technology).
PE #0603607A (Joint Service Small Arms Program).
PE #0603004A (Weapons and Munition Advanced Technology).
PE #0603802A (Weapons and Munitions-Advanced Development).
The Joint Service Small Arms Program (JSSAP) was created to assure that there is no unnecessary duplication of small arms efforts within the Department of Defense and to adequately address all Services small arms needs. Full coordination among all the Armed Services is maintained by the JSSAP Management Committee and Joint Service working groups representing the user, developer and evaluator communities. Program scope and activities are governed by the Memorandum of Agreement on the Management of Multi-Service Systems/Programs/ Projects and Department of Defense Directive 5000.1, Major System Acquisition.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602624A**

PE Title: **Weapons and Munitions Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
AH18	Artillery & Combat Support Technology				
	19999	19000	19104	Cont	Cont
AH19	Close Combat Weaponry				
	5647	8448	8971	Cont	Cont
AH28	Munitions Technology				
	9045	8575	8791	Cont	Cont
PE TOTAL	34691	36023	36866		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program develops technologies for the future generation of conventional artillery weapons/munitions and firepower for the Army's combat vehicles. It conducts exploratory development of armament systems for future tanks/combat vehicles, advanced guns, autoloaders, automatic cannon, and fire control systems. The program explores advanced gun propulsion technologies, lightweight composites for weaponry applications and novel recoil concepts for artillery applications. The Program Element (PE) supports insensitive munitions technology for increased survivability of combat vehicles and safety in explosive manufacturing facilities. It supports advances in warhead technology to defeat future tank threats; develops technology for more powerful explosives for increased battlefield lethality and propellants with reduced signature; and supports technology advances in mine warfare and demolitions. In FY 1990, the U.S. Army Research Development and Engineering Center's (ARDEC) Administration and Management line was transferred from PE #0602623A.A1BL to PE #0602624A and distributed to projects AH18, AH19 and AH28 in order to provide for improved management controls. This PE provides funds for overall administration and management of RDTE,A laboratories. The costs include salary, travel, equipment, and general support of civilian management personnel and their administrative support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project AH18 — Artillery and Combat Support Technology: For the Fire Support mission area, technology is being developed to increase self propelled howitzer battlefield survivability three fold and fire power six fold to counter the Soviet Fire Support threat. Automation of the armament system will decrease the manpower requirements by fifty percent (50%). Technology for precision guided munitions is being pursued to expand the search footprint 3 to 10 fold to provide a significant increase in anti-armor capability while baseburn/rocket technology is being refined to provide extended ranges for improved conventional munitions. Component technologies are being developed to lighten towed howitzers by 44% resulting in improved strategic and tactical mobility for the light forces. Novel recoil concepts for guns will decrease recoil forces by 30 percent. The joint Army/Defense Advanced Research Projects Agency (DARPA) mine program will develop command and control technology for mine warfare that provides the capability to defend against Soviet armor with stand off munitions, allow U.S. forces to manuever through minefields and provide a new Battlefield Intelligence capability for the Deep Battle. The Joint Army/DARPA Anti-Helicopter Mine Program will utilize Identify Friend/Foe (IFF) and warhead technologies to develop an Anti-Helicopter Munition to enhance our air defense capabilities. Laser protection techniques are being pursued to counter the "Agile Laser Threat". The program is also developing

Program Element: #0602624A
PE Title: **Weapons and Munitions Technology** Budget Activity: #1

broad-based technology in the areas of advanced electrical propulsion to achieve hyper velocity launch with improved hit and kill probability against future Soviet armor and tactical air assets, extending effective ranges.

(U) FY 1989 Accomplishments:

- (U) Completed testing of Electronic Controlled Recoil Mechanism on 155mm M198 Howitzer
- (U) Completed fabrication of extended range (40+km) cannon and initiated testing
- (U) Supported joint Army/DARPA mine warfare technology efforts for secure radio frequency (RF) data links, controllable safing and arming devices and high energy power packs
- (U) Completed Very High Speed Integrated Circuits (VHSIC) full-up fire control fabrication and testing for transition to advanced development (6.3a)
- (U) Completed passive target identification, location and tracking system for air defense and transitioned to air defense Line-of-Sight-Forward and Non-line of Sight (Heavy) program
- (U) Launched electro magnetic gun projectiles weighing 10 kilograms at 2km/sec, conducted rapid fire tests, and completed design of a 100KA/5KV semiconductor switch. Complete fabrication of 9MJ gun
- (U) Completed Laser Protection Phase I technology efforts and initiated Phase II component fabrication
- (U) Conducted drop tests of Dual Mode Seeker for smart munitions; fabricated and tested extended range maneuvering unit parafoil for self-contained munitions

(U) FY 1990 Planned Program:

- (U) Test and evaluate Vickers (United Kingdom (UK)) lightweight 155mm Towed Howitzer
- (U) Complete testing and evaluation of extended range cannon and autoloader technology for transition to advanced development
- (U) Initiate passive Non-Line of-Sight ground target acquisition technology to locate, identify and track combat vehicle targets
- (U) Continue smart munitions component technology development. Initiate design and fabrication of an improved Explosively Formed Penetrator (EFP) warhead. Conduct flight-test of extended range maneuvering unit parafoil for self-contained munitions
- (U) Support Joint Army/DARPA X-rod program
- (U) Initiate VHSIC based Battlefield Management Fire Control Technology. Design system architecture and initiate development of Tactical Planning/Battle Management Module
- (U) Continue electric launch technology component development, i.e., 60MJ Pulse Power Supply, Electrothermal (ET) Gun, Hydraulically Prestressed Rail Gun, 10MW Lithium Metal Sulfide (LIMS) Battery, etc. Continue tactical projectile development
- (U) Design and fabricate secure data link bread board for controllable mines

(U) FY 1991 Planned Program:

- (U) Continue development of Electric Launch Components, i.e., Electromagnetic (EM) Rail Gun, ET Lab Gun, Improved Power Supplies and Alternate Accelerators, etc. Initiate testing of 10MW LIMS Battery
- (U) Complete design and start fabrication of the Battlefield Management Fire Control; integrate terrain data bases and expert decision evidential reasoning modules
- (U) Integrate passive sensing onto a surrogate weapon platform to determine compatibility issues
- (U) Estimate development of Alternate wide area mine (WAM) Sensors, very WAM components and initiate design of an Explosively Driven High Power Microwave (EDHPM) Mine

Program Element: **#0602624A**
PE Title: **Weapons and Munitions Technology** Budget Activity: **#1**

- **(U)** Test and evaluate secure data links for controllable mines. Test and evaluate controllable safing and arming devices

(U) Project AH19 — Close Combat Weaponry: The objective of this project is to conduct exploratory development of cannon technologies for tanks and automatic cannon for ground and airborne combat vehicles, as well as munitions and feed systems. The scope of the program encompasses the system-oriented areas of combat vehicle, aircraft, and short-range air defense armaments; development of basic technologies in the areas of weapon stabilization and control, weapon and projectile design and fabrication, and ammunition loading and handling equipment. Specific investigations develop both hardware and analytic tools necessary to assess system performance, identify problem areas, and address resolution of these problems. The resulting data base is used for the formulation of all subsequent direct fire cannon and munition advanced and full scale engineering development. The Advanced Tank Cannon (ATAC) main armament will provide a "leap-ahead-stay ahead capability" versus the current and future Soviet tank. The Precision Aircraft Armament Control Experiment (PAACE) will provide helicopter gunships with a true point-fire engagement capability versus airborne threats (burst dispersion reduced from 7 to 1 milliradian). The Combat Vehicle Armament Technology (COMVAT) will provide future infantry fighting vehicles capability to defeat the future light armored threat.

(U) FY 1989 Accomplishments:

- **(U)** Completed design of fire control and stabilization system for the ATAC M1A1 Tank testbed
- **(U)** Transitioned ATAC system to Advanced Development
- **(U)** Completed subsystem fabrication of PAACE components for flight demonstration of gun system point fire capability for attack helicopters
- **(U)** Completed design of 45mm automatic cannon for Fighting Vehicle applications
- **(U)** Test fired 105mm armament module with and without ultra-light (9000 lbs) vehicle

(U) FY 1990 Planned Program:

- **(U)** Conduct pre-flight testing of PAACE components on ground test simulator and Apache Helicopter in preparation for FY91 Flight Demo Aboard an AH64 Apache
- **(U)** Initiate fabrication of Combat Vehicle Armament System (COMVAT) 45mm automatic cannon and continue development of low vulnerability ammunition for Future Infantry Fighting Vehicles (FIFV)
- **(U)** Complete design of wave gun test fixture and evaluate initial cartridge designs (increase launch velocity over conventional ammunition by 200%, reduce time of flight by 60%)

(U) FY 1991 Planned Program:

- **(U)** Conduct PAACE flight test on AH-64 Apache platform to demonstrate air-to-air point fire engagement capability
- **(U)** Complete fabrication of breadboard light gas wave gun and initiate testing
- **(U)** Initiate development of a high performance cannon system for future attack helicopters
- **(U)** Continue COMVAT 45mm cartridge development iterations and complete fabrication of 45mm automatic cannon for fighting vehicle application

Program Element: **#0602624A**

PE Title: **Weapons and Munitions Technology** Budget Activity: **#1**

(U) Project AH28 — Munitions Technology: The Insensitive Munitions program conducted in this project will increase the survivability of tanks, artillery, helicopters and infantry fighting vehicles as well as manufacturing plants. Advances in warhead technology will provide improved Explosively Formed Penetrators (EFP), shaped charge (SC) and tungsten heavy alloy penetrators and liners to defeat the current and future tank threat. More powerful explosives being developed will provide higher energy and density to increase anti-armor lethality. An effort to utilize enzymes in the manufacture of explosives will result in increased safety, reduced cost and advance the state-of-the-art in biotechnology. Countermeasures being developed will protect low/slow Army aircraft. This program lays the ground work for the future generation of survivable conventional weapons/ munitions and firepower for the Army.

(U) FY 1989 Accomplishments:

- (U) Established initial insensitive propellant candidate for unicharge and insensitive high explosive anti-armor warhead candidate fills
- (U) Completed bioengineering synthesis of nitroglycerine
- (U) Scaled up a new more powerful trinitroazetidine (TNAZ) explosive to multi-pound quantities for characterization
- (U) Refined computer model for design of effective heavy metal spin-insensitive EFP warhead liner
- (U) Identified potential candidates for NBC decontaminable wood products

(U) FY 1990 Planned Program:

- (U) Initiate performance lab tests of candidate anti-armor insensitive explosives
- (U) Initiate study on effects of design and loading parameters on vulnerability of propulsion charges
- (U) Prepare pilot scale lots of TNAZ
- (U) Develop/characterize low visibility IR decoy systems to defend Army aircraft
- (U) Demonstrate optimized heavy metal, EFP liners and spin-insensitive EFP warheads for increased performance

(U) FY 1991 Planned Program:

- (U) Complete lab performance test on anti-armor insensitive explosive candidates
- (U) Continue design/loading studies on vulnerability of propulsion charge
- (U) Complete pilot scale up of TNAZ and transition to warheads
- (U) Conduct missile vs. decoy simulations or aircraft
- (U) Design/fabricate/initiate tests of new liner/explosive materials and tandem EFP warhead

(U) **Work Performed By:** In-house efforts accomplished by U.S. Army Armaments Research Development and Engineering Center, Picatinny Arsenal, NJ. Major contractors are: Honeywell Inc., Minneapolis, MN; Dow Chemical, Midland, MI; Geo-Centers, Wharton, NJ; Drexel University, Philadelphia, PA; AVCO Systems Div., Lowell, MA; University of Texas, Austin, TX; Honeywell Corp., Hopkins, MN; Aries Corp., Clinton, OH; General Dynamics and Hughes Aircraft, San Diego, CA.

(U) **Related Activities:**

PE #0602618A (Ballistics Technology);
PE #0601102A (Defense Research Sciences);
PE #0603004A (Weapons and Munitions Advanced Tech); and
PE #0603606A (Landmine Warfare and Barrier Advanced Technology).

There is no unnecessary duplication of effort in DOD.

Program Element: **#0602624A**

PE Title: **Weapons and Munitions Technology** Budget Activity: **#1**

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602705A**
PE Title: **Electronics & Electronic Devices** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A1NL	Admin & Mgmt — Electronics Technology & Devices Lab (ETDL)				
	5307	- 0 -	- 0 -	- 0 -	- 0 -
AH94	Electronic and Electronic Devices				
	16182	17247	17608	Cont	Cont
PE TOTAL	21489	17247	17608		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program supports technology to enable the Army to build systems that have significant improvements to and invention of electron devices that reduce the cost and enhance the performance of Army electronic equipment. Included in these developments are electronic modules, critical components for millimeter/microwave systems (which make communications difficult to jam), high stability crystal oscillators, high resolution multicolor flat panel displays, and expert-system based design and computer aided modeling and assessment methodologies for circuits, subsystems and systems, and battery power sources, which provide reduced costs, improved performance, reduced weight, size, and increased reliability to meet tactical mission requirements in electronic warfare, communications, night vision, navigation, combat surveillance and target acquisition, sensors and smart weapons. The Program Element (PE) also provides funds for administration and management of Electronics Technology and Devices Laboratory (ETDC). The costs include salary, travel, equipment, and general support of civilian managment personnel and their administrative support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A1NL — Administration and Management for Electronics Technology and Devices Laboratory: These resources were transferred into this PE, Project AH94, as well as into PEs #0601102A, Project H47 and #0603804A, Project G10, as a zero sum transfer within this Appropriation.

(U) Project AH94 — Electronic and Electronic Devices.

(U) FY 1989 Accomplishments:

- **(U)** Developed long cycle life rechargeable lithium battery (4-6x capacity of conventional rechargeable cells) for Single Channel Ground/Airborne Radio System (SINCGARS), Battlefield Computer System (BCS) and Position Location and Reporting System (PLRS)
- **(U)** Transferred microcomputer-compensated crystal oscillator (MCXO) to SINCGARS Pre-Planned Product Improvement (P^3I) (antijam and extended radio silence) and to prevent false combat identification
- **(U)** Demonstrated feasibility of one quarter sized, megawatt photoconductive switch for microwave weapons and electromagnetic pulser applications
- **(U)** Demonstrated high reliability next generation transmitter tube for Army and joint Service airborne radar

Program Element: **#0602705A**

PE Title: **Electronics & Electronic Devices** Budget Activity: **#1**

(U) FY 1990 Planned Program:

- **(U)** Complete development and evaluation of long cycle-life Command, Control, Communications, and Intelligence (C3I) rechargeable lithium cells incorporating advanced new high energy, low cost electrochemistry for SINCGARS, BCS and PLRS
- **(U)** Evaluate low noise multiple frequency sources in more survivable frequency multirole agile survivable radar for Forward Area Air Defense (FAAD) and mortar locating radar
- **(U)** Demonstrate first laboratory prototype surface acoustic wave (SAW) adaptive filter for signal interference reduction in co-located Army radios
- **(U)** Demonstrate low cost, small size and weight designs and technologies for beyond next generation millimeter-wave transceiver modules, with increased range
- **(U)** Demonstrate complete millimeter-wave monolithic synthesizers combining analog and digital functions for electronic intelligence and radar systems
- **(U)** Complete full color electroluminescent display panel program and transition to 6.3 module development for application to Army Command, Control, Communications, and Intelligence (C^3I) systems
- **(U)** Demonstrate producible prototype high performance, high data rate radar module with reliable long life, high duty cycle and low noise capability for use in Unmanned Aerial Vehicle (UAV) radar and low probability of intercept (LPI) counter-counter measure systems
- **(U)** Design photoconductive device for high power microwave generator
- **(U)** Develop reliability prediction methods for gas microcircuit
- **(U)** Deliver rubidium/crystal oscillator-based intelligent time and frequency unit to reduce battery consumption and extend autonomy to Single Channel Objective Tactical Terminal (Scott) and Regency Net
- **(U)** Demonstrate through the Very High Speed Integrated Circuits (VHSIC) test workbench multi-processor capability of the Parallel-Bus and Test/Maintenance Bus
- **(U)** Demonstrate alternative interconnection methods for high power microwave (HPM)-resistant packaging
- **(U)** Install Department of Defense/Air Force developed Engineering Information System for interoperability of object-oriented design tools

(U) FY 1991 Planned Program:

- **(U)** Develop universal battery for training and combat incorporating rechargeable lithium cells and associated componentry. Effort is directed to the elimination of 90% of high energy battery procurements. Applications include SINCGARS, BCS, PLRS, short range thermal sights and thermal weapons sights
- **(U)** Demonstrate low cost small size and weight designs and technologies for next generation millimeter wave transceiver seeker modules with electronic beam steering and larger footprint
- **(U)** Demonstrate new high voltage device and amplifier designs for advanced phased array radar
- **(U)** Complete prototype UAV-FAAD radar transmitter and transition to PM-Intelligence/Electronic Warfare (IEW) and PM-UAV
- **(U)** Apply full color electroluminescent display technology to high resolution displays in sizes suitable for map data bases and targeting applications
- **(U)** Demonstrate high power electronics countermeasures tube for jammer 2000 systems
- **(U)** Demonstrate an airborne high power microwave jammer tube for Electronic Warfare/Reconnaissance Surveillance and Target Acquisition (EW/RSTA) for APACHE escort
- **(U)** Demonstrate photo conductiveswitch development for high power microwave source

Program Element: **#0602705A**

PE Title: **Electronics & Electronic Devices** Budget Activity: **#1**

- **(U)** Complete the development and demonstrate Small Business Innovative Research (SBIR)-developed micropower wristwatch time transfer unit to combat identification system and SINCGARS P^3I for reduced battery consumption and logistics costs
- **(U)** Down-select high coulomb gas/solid-state switch for electric guns and high energy lasers

(U) Work Performed By: The Electronics Technology and Devices Laboratory (ETDL), Fort Monmouth, NJ. Principal contractors are: IT&T Corp., Easton, PA; Hughes Aircraft, Los Angeles, CA; GE, Syracuse, NY; Hycom, Inc., Irvine, CA; TRW, Inc., Redondo Beach, CA, and Thermo-Electron Corp., Waltham, MA.

(U) Related Activities:

PE #0603742A, (Advanced Electronic Devices Development): Direct liaison with Army program managers is routinely maintained, as is close coordination with the research and development organizations of the Air Force and Navy. Duplication of effort is also minimized by coordination through the Department of Defense Advisory Group on Electron Devices (AGED) and the Interagency Advanced Power Group.

Activities are coordinated with other Government Services and agencies. There is no unnecessary duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602709A**

PE Title: **Night Vision Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D1TL	Admin & Mgmt-Center for Night Vision and Electro-Optics (CNVEO)				
	7452	- 0 -	- 0 -	—	—
DH95	Night Vision and Electro-Optic Technology				
	14509	18820	19285	Cont	Cont
PE TOTAL	21961	18820	19285		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The key objectives of this program are to provide electro-optical devices which can acquire and track enemy targets at the maximum weapon system ranges under conditions of smoke, countermeasures, and darkness. Development is concentrated on Infrared Focal Plane Arrays, low energy lasers, aided target recognition and performance modeling/analysis for system development programs. Components, devices and techniques developed under this PE directly support systems to meet stated deficiencies in close combat, air defense, fire support, combat support, and Intelligence and Electronic Warfare (IEW). In thermal imaging, the development of a new generation of high performance infrared focal plane arrays to significantly increase the range and sensitivity of Forward Looking Infrared (FLIR) systems is required to meet stringent target acquisition and fire control requirements of the Army's next generation/future systems. Additionally, development of uncooled focal plane arrays with inherently low cost and minimal logistical burdens is emphasized for smart munitions, driving aids and infantry applications.

In signal processing exploitation of automatic target acquisition capabilities afforded by integrating second generation FLIR technology with advanced imaging processing algorithms, emerging processing devices and features from additional sensors are emphasized for the Army's next generation/future systems.

In lasers, the emphasis is placed upon the development of tunable laser and laser radar sources required to meet the Army's directed energy, target recognition and identification, and chemical sensing applications. Additionally, emphasis is placed upon the development of filter and power limiter technology and devices for the protection of existing and developmental electro-optic systems to meet the Army's overall counter-countermeasure program plan. For modeling and analysis the development of performance models for sensor/processor systems and subsequent evaluation/analysis of these systems is critical as a baseline performance indicator to weapon system managers producing high performance, low cost, night vision and electro-optic target acquisition systems. This PE also provides funds for overall administration and management of the US Army Communications-Electronics Command's (CECOM) Center for Night Vision and Electro-Optics (C^2NVEO). The costs include salary, travel, equipment, and general support of civilian management personnel and their administration support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

Program Element: **#0602709A**

PE Title: **Night Vision Technology** Budget Activity: **#1**

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D1TL — Administration and Management for the Center for Night Vision and Electro-Optics: These resources were transferred to Project DH95, this PE, as a zero sum transfer.

(U) Project DH95 — Night Vision and Electro-Optic Technology.

(U) FY 1989 Accomplishments:

- **(U)** Under the accelerated HEADSTART ALICAT program, four interchangeable tactical dewar/FPA assemblies, including the command and control electronics (C&CE), were fabricated on schedule through a cooperative effort of CECOM Center for Night Vision and Electro-Optics (C2NVEO) and Santa Barbara Research Center's scientists and engineers. The performance of these first ever 2nd generation dewar/FPA modules approximated, and in some aspects, exceeded the Standard Army FPA specifications
- **(U)** Delivered Multi-function Target Acquisition Processor (MTAP) and conducted laboratory terrain testing/training. The MTAP is a basic real-time research tool which will promote the Army's Automatic Target Acquisition science. Initial terrain board testing results have indicated that this hardware represents a major step forward in improved target detection and segmentation. Based upon its success the Army has plans in FY 1990 under 63710 to implement an Advanced Technology Transition Demonstrator (ATTD) to demonstrate the ATR functional benefits in multisensor target acquisition suites
- **(U)** The processor evaluation portion of Automated Sensor/Processor Evaluation Center (AUTOSPEC) was completed this year and the system was operational just five months after its delivery. The AUTOSPEC program has made a significant breakthrough in the understanding and evaluation of Aided Target Recognition (ATR's). This facility is unique in the DOD and will serve as the baseline E-O sensor/processor performance specification/verification facility for weapon system managers when developing target acquisition requirements
- **(U)** High density uncooled arrays were fabricated and imaged at full TV data rates in a breadboard system. These arrays met the pixel size and pixel number requirements of the program and were within a factor of 1.5 of the sensitivity required. This demonstration was six months ahead of schedule and represents *the largest 8-12 micron detector array of any kind ever imaged.* This imaging demonstration establishes the technical feasibility of producing uncooled IR arrays for tactical imagers. Their reduced life cycle cost and logistics burden will allow the proliferation of infrared (IR) imagers in applications such as individual weapon sights, driver's aids and ultimately missile seekers
- **(U)** Continued development of laser diode array-pumped solid state laser

(U) FY 1990 Planned Program:

- **(U)** Complete exploratory research of uncooled focal plane arrays and transition to major balanced technology initiative for the development of rifle sights, surveillance sensors and missile seeker sensors
- **(U)** Demonstrate high efficiency diode array pumped solid state lasers to provide order of magnitude improvement in efficiency and reliability over current laser capabilities. The goal is to reduce production cost of an array from current $100.00 per watt to $1.00 per watt. This equates to 100K-150K systems fabrication cost savings
- **(U)** Initiate program for the development of large area cooled staring focal plane arrays. This effort is conducted to meet the target acquisition requirements of higher performance missile seekers and target acquisition systems (i.e., Advanced Anti-Tank Weapons Systems-Heavy (AAWS-H))
- **(U)** Transition 2nd generation focal plane array into Standardized Advanced Infrared Systems (SAIRS) prototype and conduct field trials

Program Element: **#0602709A**

PE Title: **Night Vision Technology** Budget Activity: **#1**

(U) FY 1991 Planned Program:

- (U) Initiate program for monolithic, multispectral focal plane arrays with on-chip processing
- (U) Develop advanced algorithm suites to support implementation to multisensor system suite processors
- (U) Complete Aided Target Recognition model to establish baseline performance characteristics for future development of ATR's

(U) Work Performed By: CECOM Center for Night Vision and Electro-optics, Fort Belvoir, VA. Major contractors are. Honeywell Electro-optics Operations, Lexington, MA; Martin Marietta, Orlando, FL; Hughes Aircraft, El Segundo, CA; Texas Instruments, Dallas, TX and Santa Barbara Research Center, Culver City, CA.

(U) Related Activities: Research work related to this project is performed under PE #0601102A (Defense Research Sciences), Project #A31B (Night Vision and Electro-Optics Research). Advanced development work is performed under PE #0603710A (Night Vision Advanced Development) and #0603774A (Night Vision Devices Advanced Development).

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: International interchange of information is accomplished primarily through active participation on various NATO working groups, The Technical Cooperation Program (US, UK, CA, AS), and the International Standardization Program.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602716A**

PE Title: **Human Factors Engineering Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A1QL	Administration & Management-Human Engineering Lab (HEL)					
		6392	- 0 -	- 0 -	—	—
AH70	Human Factors Engineering Systems Development					
		11688	8195	8019	Cont	Cont
PE TOTAL		18080	8195	8019		

B. (U) BRIEF DESCRIPTION OF ELEMENT: Soldiers using materiel win wars. For materiel to be used by soldiers effectively, it must be designed specifically for soldiers. This project focuses on maximizing the effectiveness of the soldier, in concert with his materiel, in order to survive and prevail on the battlefield. The rapid changes in technology, and the ever increasing emphasis on soldier and equipment performance, provides the driver for this effort. Specialized laboratory studies and field evaluations are conducted to collect performance data on the capabilities and limitations of soldiers, with particular attention on soldier and equipment interaction. The resulting data are the basis for weapon systems and equipment design standards, guidelines, handbooks, and soldier training requirements to improve equipment operation and maintenance. Application yields reduced workload, fewer errors, enhanced soldier protection, user acceptance, and allows the soldier to extract the maximum performance from his system. This Program Element (PE) also provides funds for overall administration and management of RDTE,A laboratories. The costs include salary, travel, equipment, and general support of civilian management personnel and their administrative support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project AIQL — Administration and Management for the Human Engineering Laboratory. Effective in FY 1990 these resources were transferred to Project AH70, this PE, as a zero sum transfer within this Appropriation.

(U) Project AH70 — Human Factors Engineering System Development:

(U) FY 1989 Accomplishments:

- **(U)** Developed artificial intelligence/expert system concepts for a knowledge based decision support system for tactical ammunition management in order to reduce soldier workload and increase efficiency
- **(U)** Provided human factors guidelines for Small Arms Design incorporating performance data pertaining to hit probability, sustainability, and target acquisition capability. The guide will be used by system designers to ensure soldier and individual weapon compatibility
- **(U)** Evaluated fire support maneuver commander's tasks, equipment and information requirements to determine the efficacy of using automation tools/digital display devices as commander aids for combat decision making. Transition successfully demonstrated products to US Army Training and Doctrine Command (TRADOC)
- **(U)** Developed two teleoperated experimental robotic concept vehicles to be used as test beds to determine critical design parameters for robotic manipulator control devices, integration of manipulators with three dimensional viewing and vehicle mobility through low data rate communication links

Program Element: **#0602716A**

PE Title: **Human Factors Engineering Technology** Budget Activity: **#1**

(U) FY 1990 Planned Program:

- **(U)** Demonstrated innovative robotic field materiel handling concepts which will increase productivity in the handling of ammunition in forward area ammunition supply points. Concepts transition to Belvoir Research and Development Engineering Center (BRDEC)
- **(U)** Conduct research to quantify the portability and physiological energy cost of carrying various infantry equipment loads under simulated battlefield conditions. Data will assist materiel developers in efforts to lighten the soldiers load
- **(U)** Complete a combat vehicle design handbook to assist materiel developers in crew area noise reduction for future armored vehicles
- **(U)** Conduct human factors engineering evaluations of advanced combat rifles focusing on such issues as round-to-round dispersion and reliability in order to improve overall performance
- **(U)** Continue direct HFE support to and conduct Human Factors Engineering Analysis (HFEAs) for combat materiel developers as part of the MANPRINT process.

(U) FY 1991 Planned Program:

- **(U)** Initiate field evaluations of new command and control concepts and target cueing techniques to improve the soldier-command-control-communication (C3) interface in a combined arms forward area air defense battlefield situation. Transition results to TRADOC
- **(U)** Conduct laboratory technology developments in artificial intelligence and expert systems to determine the feasibility of the concepts developed in FY 1989 for the knowledge based decision support system for tactical ammunition management. Research is aimed at improving Army logistics capabilities and planning under battlefield conditions
- **(U)** Conduct and complete an evaluation of field artillery battlefield decision making in conjunction with TRADOC. Includes allocation and positioning of units as well as coordination and distribution of fires in order to develop a comprehensive fire support decision aid for battlefield application
- **(U)** Continue direct support to and conduct HFEAs for combat/materiel developers as part of Manpower and Personnel Integration (MANPRINT) process.

(U) Work Performed By: In-house work is performed by the US Army Human Engineering Laboratory (HEL, Aberdeen Proving Ground, MD). The top five contractors are: Armament Systems, Inc., (ASI), Anaheim, CA; AAI Corporation, Baltimore, MD; Systex, Inc., Beltsville, MD; Martin Marietta, Baltimore, MD; Magnavox, Fort Wayne, IN.

(U) Related Activities: Leader in Tri-Service coordination through the DOD Human Factors Technology Advisory Group. US Army Missile Command (MICOM) agent for Human Factors (HFAC) Standardization. There is no unnecessary duplication of effort within DOD.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602720A**

PE Title: **Environmental Quality Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A835 Military Medical Environmental Criteria	3391	3494	3179	Cont	Cont
A896 Base Facility Environmental Quality	2475	2970	2801	Cont	Cont
AF25 Military Environmental Restoration Technology	2234	2961	2038	Cont	Cont
D048 Industrial Operations Pollution Control Technology	1711	2290	1797	Cont	Cont
PE TOTAL	9811	11715	9815		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element (PE) provides technology that will allow the Army to comply with regulations mandated by all Federal, State and local environmental/health laws and to reduce the cost of this compliance. Examples of key laws include the Superfund Amendments and Reauthorization Act of 1986 and the Defense Environmental Restoration Act (the DOD equivalent of this law) in addition to the Resource Conservation and Recovery Act of 1984 as amended. The PE provides the Army with a capability to decontaminate or neutralize, Army-unique hazardous and toxic wastes at sites containing waste ammunition, explosives, propellants, smokes and chemical munitions. The current DOD estimate for the total Army cost of completing this cleanup program is $5 to $10 billion dollars. This PE also provides technology to avoid the potential for future hazardous waste problems, by reducing hazardous waste generation through process control, materials recycling and substitution, and technology to mitigate noise impacts and maneuver damage resulting from Army training activities. Funds were reassigned to Project A896 by the Corps of Engineers by zero sum change. Funds were reallocated from PE #0601101A (In House Laboratory Independent Research) to Project AF25 by the Corps of Engineers to add emphasis to research related to treating explosive contaminated soils for a zero sum change. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A835 — Military Medical Environmental Quality: This project evaluates the human health and environmental effects resulting from exposure to military-unique chemical compounds produced in Army industrial and field operations or disposed in past activities. The end results of this research are determinations of environmental concentration levels that will protect the environment and human health from adverse effects. The products of this research are U.S. Environmental Protection Agency approved health advisories and criteria documents that specify which Army compounds are toxic/hazardous and at what level they become a threat to human health and the environment. These criteria are used by the Army, during negotiations with regulatory officials, to set scientifically and economically rational safe cleanup and pollution abatement levels at Army installations.

(U) FY 1989 Accomplishments:

- **(U)** Updated Preliminary Pollutant Limit Value methodology calculation methods
- **(U)** Completed identification of chemical transformation processes for combustion products at hazardous waste disposal and cleanup sites

Program Element: **#0602720A**

PE Title: **Environmental Quality Technology** Budget Activity: **#1**

- **(U)** Completed updating of the aquatic toxicity data base on munitions compounds — nitroguanidine (NG), trinitroquanidine (TNG), nitroglycerine, nitrocellulose, nitramine-based explosives (RDX), and trinitrotoulerie (TNT)
- **(U)** Completed determination of the acute mammalian toxicity of nitrobenzenes and tetryl
- **(U)** Completed aquatic and subchronic mammalian toxicity studies on ball powder and glycol ester propellants

(U) FY 1990 Planned Program:

- **(U)** Complete joint study with US Environmental Protection Agency on risk assessment data requirements
- **(U)** Validate an automated aquatic toxicity monitoring system
- **(U)** Validate an aquatic toxicity based hazard screening method for contaminated soils
- **(U)** Complete second phase of testing of a mobile biomonitoring facility at an Army site

(U) FY 1991 Planned Program:

- **(U)** Complete development of improved risk/endangerment assessment methods for hazardous materials
- **(U)** Complete study to determine the up-take and metabolism of TNT by small feral animals
- **(U)** Complete development of an air deposition model for off-post migration of military smokes
- **(U)** Complete development of an alternative aquatic based human carcinogenicity model
- **(U)** Complete verification of an in-vitro ocular irritation test method
- **(U)** Complete determination of the efficacy of treating munitions contaminated soils by composting
- **(U)** Complete subchronic (90 day) mammalian toxicity studies on nitrobenzenes and tetryl
- **(U)** Complete studies to estimate the ecological effects from the use of smokes in wind tunnel experiements
- **(U)** Complete studies to determine the effects of inventory smokes on small feral animals

(U) Project A896 — Base Facility Environmental Quality: This project provides the technical capability to control and mitigate blast noise created by large caliber weapons firing and to provide technology to assess, mitigate and restore physical damage to training ranges created by overuse and intensive force-on-force training. In both the U.S. and Europe, the Army is loosing operational capacity at airfields due to noise complaints and resulting lawsuits evolving from surrounding civilian communities. A similar problem is occurring at training ranges. Many installations in this country and Germany are losing the use of firing ranges or are unable to modify or improve existing ranges due to citizens complaints. Loss of training areas due to physical damage such as tree loss, soil erosion and large gullies results in a loss of training realism and creates safety problems including the potential for tanks overturning. This project also provides technology to help installations meet environmental discharge standards for air, water, and solid waste.

(U) FY 1989 Accomplishments:

- **(U)** Added 3-dimensional capability to the Geographic Resources Analysis Support System (GRASS) to facilitate maintaining and restoring Army training lands damaged from overuse
- **(U)** Initiated work on sensor systems to monitor physical degradation of training lands
- **(U)** Initiated research on sound absorbing materials and structures to mitigate the noise impacts of training with small, medium and heavy weapons
- **(U)** Completed development of procedures for cleaning vehicles in adverse climates

Program Element: **#0602720A**
PE Title: **Environmental Quality Technology** Budget Activity: **#1**

(U) FY 1990 Planned Program:

- (U) Develop guidelines for deploying agronomic and reforestation technologies to restore training land
- (U) Develop advanced erosion control technology to protect the condition of the training land
- (U) Complete GRASS application "macros" for training land management applications

(U) FY 1991 Planned Program:

- (U) Develop a meteorologically-based warning system for controlling training range noises
- (U) Provide criteria for recycling systems for waste solvents and oils
- (U) Complete development of a technology for economically renovating potable water systems

(U) Project AF25 — Military Environmental Restoration Technology: This project provides the technology to control off-post migration of hazardous and toxic waste and to safely decontaminate soil, water and structures at less cost. The Army has over 250 known wastes sites with another 2,500 expected to be identified. These sites were created prior to passage of environmental legislation that controlled the safe handling and disposal of hazardous and toxic materials and their wastes products. The Army is under mandate thru the Defense Environmental Restoration Program (which is the DOD equivalent of the Superfund Program) to cleanup all of these waste sites. The current DOD estimate for cleaning up all of the Army sites is $5 to $10 Billion. Current funding levels for the cleanup program are not sufficient without the introduction of the less costly technology that this project provides.

(U) FY 1989 Accomplishments:

- (U) Completed development of technology for decontaminating underground structures
- (U) Conducted field demonstration of technology to treat combined explosives and solvent contaminated groundwater

(U) FY 1990 Planned Program:

- (U) Complete health effects verification of microbial degradation as a safe alternative treatment technology for explosive contaminated soil
- (U) Complete laboratory development of an in-situ treatment technology for soils contaminated with solvents, petroleum fuels and lubricants

(U) FY 1991 Planned Program:

- (U) Pilot test a treatment system for heavy metal contaminated soils
- (U) Conduct bench testing of laboratory developed techniques for in-situ biodegradation of solvent contaminated soils

(U) Project D048 — Industrial Operations Pollution Control Technology: This project provides process control technology required to reduce operating costs resulting from use of hazardous wastes and provides the capability to meet the required environmental discharge standards for current and future waste streams. The Army generates approximately 80,000 tons of hazardous wastes a year. The costs of disposing of these wastes has been escalating and is currently $60 million a year. In addition, the number of approved hazardous waste disposal sites diminishes each year. The Army must have the technology to reduce generation of these wastes in order to meet the goal, set by the Army, of a 50% reduction in waste generation by 1992 and to avoid future hazardous waste problems.

(U) FY 1989 Accomplishments:

- (U) Developed alternative paint stripper technologies for tactical equipment maintenance operations

Program Element: **#0602720A**
PE Title: **Environmental Quality Technology** Budget Activity: **#1**

- **(U)** Tested incineration technology for treating paint stripping sludges

(U) FY 1990 Planned Program:

- **(U)** Demonstrate the use of "off-specification" explosives as supplemental heating plant fuel
- **(U)** Test treatment technology for propellant manufacturing waste water
- **(U)** Demonstrate alternative plating process to reduce/eliminate wastes
- **(U)** Demonstrate advanced paint stripping techniques
- **(U)** Complete development of technology for reworking and requalifying obsolete and off-specification propellants

(U) FY 1991 Planned Program:

- **(U)** Develop low cost treatment technology for TNT production wastes
- **(U)** Pilot test technologies for improved tactical vehicle waste treatment for implementation at Army Depot industrial waste treatment facility modernization projects

(U) Work Performed By:

A835 — Contractors include the following Department of Energy Laboratories: Pacific Northwest Laboratories, Richland, WA; Oak Ridge Laboratories, Oak Ridge, TN; Argonne Laboratories, Argonne, IL. Other contractors include U.S. Department of Agriculture, U.S. Environmental Protection Agency, National Cancer Institute, John Hopkins University, University of Massachusetts, and the University of Maryland. The in-house developing agencies include the Biomedical Research and Development Laboratory, Ft. Detrick, MD and the Chemical Research, Development, and Engineering Center, Aberdeen Proving Ground, MD.

A896 — The prime contractor is the University of Illinois, Champaign, IL. The in-house developing agency is the U.S. Army Construction Engineering Research Laboratory, Champaign, IL.

AF25 — The prime contractor is Roy F. Weston Co., Westchester, PA. In-house developing agencies include U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD; U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH; Hawthorne Army Ammunition Plant, Hawthorne, NV; Louisiana Army Amunition Plant, Minton, LA, and the Badger Army Ammunition Plant, Baraboo, WI.

D048 — The prime contractor is PEI, Inc., Cincinnati, OH. In-house developing agencies include U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD; U.S. Army Construction Engineering Research Laboratory, Champaign, IL; and the U.S. Army Armaments Research Development and Engineering Center, Dover, NJ.

(U) Related Activities: Program Element #0601102A — Defense Research Sciences. Basic research on Processes in Pollution Abatement Control Technology and Health Effects of Military Pollutants supports projects D048 and A835. There is no unnecessary duplication of effort within the Department of Army or the Department of Defense (DOD). Duplication of effort is avoided through annual DOD-sponsored technical reviews of all environmental quality RDT&E programs and quarterly meetings of the DOD-sponsored Installation Restoration Technical Coordinating Committee.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602727A**

PE Title: **Non-System Training Device Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A230 Non-System Training Devices	3634	3483	3607	Cont	Cont
PE TOTAL	3634	3483	3607		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides exploratory development of state-of-the-art generic training methods and equipment to increase overall combat effectiveness while reducing Army training costs. Arrival of sophisticated, high technology equipments and their complex relations to each other, coupled with increased constraints on personnel, money, and time in the field training environment, makes this effort critical to the overall success of the Army. As an example, support from this program previously resulted in a Multiple Integrated Laser Engagement Simulation System (MILES) and a Gas Operated Cannon Simulator for 20mm, 25mm, and 30mm ammunition which eliminated the need to develop and produce blank rounds at a peacetime savings per year of over $10 million. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A230 — Non-System Training Devices

(U) FY 1989 Accomplishments:

- (U) Initiated interdisciplinary program for optimization and evaluation of Army training devices with University of Central Florida Institute for Simulation and Training to explore in coordination with industry: large scale simulation networking techniques, development of modular simulator design standards, rapidly reconfigurable simulator data bases and training systems measures of effectiveness
- (U) Initiated National Training Center (NTC) upgrade concept exploratory studies to evaluate the use of simulation as a cost effective means of expanding from battalion size to brigade size training capability

(U) FY 1990 Planned Program:

- (U) Demonstrate feasibility of simulating Intelligence/Electronic Warfare systems with real time, non-emitting, simulated threat emission signatures for training at the National Training Center and in field units
- (U) Publish modular simulator design standards as part of tri-service/industry Joint Technical Coordinating Group for Training Systems and Devices program

(U) FY 1991 Planned Program:

- (U) Complete and transition successful findings from NTC concept exploratory studies into ongoing developmental efforts and acquisition of simulation software and simulators to expand from battalion size to brigade size training capability
- (U) Implement Modular Simulator Design Standards
- (U) Initiate Training Effectiveness Evaluation of New Emerging Simulation Technologies that have been investigated by the Institute for Simulation and Training

Program Element: **#0602727A**

PE Title: **Non-System Training Device Technology** Budget Activity: **#1**

- **(U)** Complete Beta site testing of automated, rule based system engineering design and evaluation tools for optimizing simulator and training device effectiveness

(U) Work Performed By: Prime contractors: Simulaser, City of Industry, CA; The Analytical Science Corporation, Reading, MA; GM Hughes Electronics Corp., Minneapolis, MN; Honeywell, Minneapolis, MN; Pathfinder, Littleton, CO; University of Central Florida, Institute for Simulation and Training, Orlando, FL; In-house: PM-TRADE, Army Research Institute (ARI).

(U) Related Activities: PE #0603738A and PE #0604715A (Non-System Training Devices Advanced Dev and Engineering Dev). Activities coordinated through Tri-Service, participation of DMA, NAVAIR, and Air Force Deputy for Training Systems to ensure no duplication.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602782A**

PE Title: **Command, Control and Communications (C^3) Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A1HL Administration and Management for Center for Command, Control and Communications Systems	5339	- 0 -	- 0 -	—	—
AH92 Communications Technology	3852	11460	14861	Cont	Cont
AH93 Combat Surveillance and Target Acquisition Technology	7221	4122	5597	Cont	Cont
PE TOTAL	16412	15582	20458		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program contains two related projects: Exploratory development of advanced communications technology and technology base for vehicle/personnel detection radar. This Program Element (PE) also provides funds for overall administration and management of R&D Center for Command, Control and Communication Systems. The costs include salary, travel, equipment, and general support of civilian management personnel and their administrative support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A1HL — Administration and Management for the Center for Command, Control and Communications Systems. These resources were transferred to Project AH92.

(U) Project AH92 — Communications Technology: Perform the exploratory development for Net Radio High Frequency (HF) and Very High Frequency (VHF); common user technology Ultra High Frequency (UHF), Microwave, Millimeter Wave (MMW), and Multichannel services; distributed communications (Photonic and Fiber Optic Systems, Internet Architecture, Integrated Services, Packet Appliques and Mobile Subscriber Equipment (MSE) Applications; Frequency Management; and the Army Secure Operating System (ASOS)), a family of computer operating systems, supporting Ada applications, that will provide multilevel security for Army Tactical Command and Control System (ATCCS), prevent compromise of classified information, and protect against subversive software. This project will meet the threats of Electronic Countermeasures (ECM), the need for survivability on the automated battlefield and the need to avoid unauthorized access.

(U) FY 1989 Accomplishments:

- **(U)** Started development of Frequency Hopping Multiplexer, to enable VHF frequency hopping radios to use a single antenna and reduce cosite interference, and Frequency Agile HF solid state power amplifier/antenna coupler for long range tactical communications
- **(U)** Conducted validation testing of manportable HF sounder
- **(U)** Completed validation testing of Single Channel Ground Air Radio System (SINCGARS) cosite interference reduction filters and noise cancelling/speech processing for intercoms
- **(U)** Designed and installed a fiber optic video and voice communication system in South Korea utilizing Single Mode Fiber Optic Cable Assembly (SIMFOCS) cable

Program Element: **#0602782A**

PE Title: **Command, Control and Communications (C^3) Technology** Budget Activity: **#1**

- (U) Tested and evaluated the integrated digital UHF Electronic Counter Countermeasures (ECCM) radio system in the "Clear" and in "ECCM" modes
- (U) Established concept feasibility of a voice/data Fiber Optic Tactical Local Area Network (FOTLAN) using commercial surrogate equipment as a first step to an integrated communication test bed for future command posts
- (U) Completed Army Tactical Frequency Engineering System (ATFES) Software Development for a multichannel radio network frequency assignment capability (FACTS III)
- (U) Integrated CRONUS distributed operating system with existing computer operating system at Communications and Electronics Command (CECOM) widebank network node
- (U) Complete SINCGARS packet applique serial line internet and ethernet interfaces

(U) FY 1990 Planned Program:

- (U) Continue development of Frequency Hopping Multiplexer and Frequency Agile HF Solid State Power Amplifier and Antenna Coupler
- (U) Complete test and evaluation of the Digital UHF Radio
- (U) Complete battlefield spectrum management process interface studies for ATFES, Communications System Control Element (CSCE), Mobile Subscriber Equipment (MSE), and Battlefield Electronic CEOI System (BECS). Start development of Air/Ground/Air Frequency Engineering System software
- (U) Complete software debugging and Lab characterization for exploratory development models of packet applique
- (U) Initiate effort on wireless Local Area Network (LAN) using existing Ethernet (a coax cable LAN) as part of future Command Posts (CP) Data Networks
- (U) Begin program with the Air Force to develop a Tactical Secure Fiber Optics Link to handle high speed data where no crypto equipment now exists
- (U) Complete validation testing of manportable HF sounder
- (U) Complete Fiber Optic LAN (FOTLAN) Fiber Optic Distributed Data Interface (FDDI) upgrade. Demonstrate integrated data/voice/video transmission
- (U) Integrate CRONUS with Army, Navy and Air Force C2 application software
- (U) Complete software debugging and Lab characterization for exploratory models of VHF packet network applique
- (U) Complete final generic accreditation approach for simplified accreditation of ATCCS risk analysis methodology

(U) FY 1991 Planned Program:

- (U) Complete development of Frequency Agile HF Solid State Power Amplifier and Antenna Coupler
- (U) Continued Development of Frequency Hopping Multiplexer
- (U) Complete design for Extremely High Frequency (EHF) wireless LAN integrating packet switching and covert millimeter wave radio front end technology
- (U) Complete Air/Ground/Air (A/G/A) Frequency Engineering System Software
- (U) Start development of Fiber Optic System based on use of integrated photonic devices
- (U) Develop prototype alarm upon penetration Tactical Secure Fiber Optic Link to enable submission for National Security Agency (NSA) endorsement for ATCCS LAN application
- (U) Improve simulation efficiency and increase Measure of Performance/Measure of efficiency (MOP/MOE) consistency of C3 network analysis
- (U) Demonstrate interface between Packet SINCGARS network and packet Mobile Subscriber Equipment (MSE) network

Program Element: **#0602782A**

PE Title: **Command, Control and Communications (C^3) Technology** Budget Activity: **#1**

- **(U)** Complete development of C2 certifiable and A1 certifiable versions of ASOS for ATCS CH and submit to National Computer Security Center (NCSC) for certification
- **(U)** Conduct joint C3 CRONUS experiment via the Wideband Network

(U) Project AH93 — Radar Technology: Conduct advanced radar and optical processing research and intergrate the technologies to develop a lightweight, modular, low cost, survivable family of radars that will form the base line for future Army systems. The program focuses on the technical radar and signal processing tasks associated with extracting stationary and slow-moving ground targets and low, slow flying aircraft from the intense ground clutter environment, and (2) the advanced optical processing techniques to automatically, at the sensor, process the radar data to target information which is at a low enough bandwidth to be compatible with Army communication systems. Radar technology thrust areas include: (1) Airborne Moving Target Indicating (MTI) radars capable of detecting and identifying moving targets; (2) Wideband Synthetic Aperture Radars (SAR) capable of detecting and identifying targets masked by foliage; and (3) Multistatic techniques to enhance the survivability of both SAR and MTI radars. Optical Processing technology thrust areas include: (1) Improved Second Generation Processing Modules. (2) Model Based and Neural Network Approaches to radar automatic target recognition using optical processors. (3) Development of techniques for processing wideband radar signals. Project has been incremented in FY90 to implement the optical processing efforts.

(U) FY 1989 Accomplishments:

- **(U)** Supported evaluation of ground surveillance radar in Korea
- **(U)** Conducted field tests of ground surveillance radar to characterize its performance
- **(U)** Completed integration of airborne radar and verified performance of the radar and the supporting subsystems
- **(U)** Planned a series of user evaluations of the airborne radar in FY 1990
- **(U)** Performed the system analysis for a wide band synthetic aperture radar designed to detect targets obscured by foliage

(U) FY 1990 Planned Program:

- **(U)** Radar Technology
- **(U)** Conduct field tests with modular radar to enable user to assess utility of airborne radars for intelligence preparation of the battlefield and fire support applications
- **(U)** Complete field evaluation of Modular Ground Based Surveillance Radar in Korea
- **(U)** Support field evaluation of modular radar integrated with electro-optical sensors in combat vehicle command and control.
- **(U)** Collect wide-band Synthetic Aperture Radar (SAR) and Moving Target Indicator (MTI) signatures in support of wide-band radar system analysis
- **(U)** Develop algorithms to take advantage of impulse waveform
- **(U)** Perform system analysis for design of airborne and ground based multistatic moving target indicating receivers operating with airborne illuminator
- **(U)** Optical Processing
- **(U)** Integrate Balanced Technology Initiative (BTI) funded advanced optical detectors into one dimensional brassboard optical processor
- **(U)** Develop wideband optical module for pulse compression. Supports development of test bed for interception radar and communication signals and processing of active radar signals (cooperative program with BTI)
- **(U)** Execute cooperative BTI program for a lightweight optical processor SAR

Program Element: **#0602782A**

PE Title: **Command, Control and Communications (C^3) Technology** Budget Activity: **#1**

- **(U)** Develop processing architecture using both neural net and model based approaches to target recognition of SAR imagery

(U) FY 1991 Planned Program:

- **(U)** Radar Technology
- **(U)** Develop improved helicopter classification algorithm for modular airborne radar
- **(U)** Incorporate high range resolution hardware and software changes in airborne radar to provide a means to identify moving targets
- **(U)** Analyze wideband SAR and MTI Data and develop algorithms to super resolve closely spaced targets
- **(U)** Fabricate breadboard multistatic receiver and initiate data collection effort with airborne illuminator
- **(U)** Optical Processing
- **(U)** Integrate BTI funded advanced optical detectors into two dimensional optical processor
- **(U)** Enhance Electronic Support Measures test bed to handle multiple complex signals
- **(U)** Construct test bed using optical module pulse compression hardware. Demonstrate intercept of radar and communication signals
- **(U)** Construct lightweight optical processor for SAR imagery
- **(U)** Incorporate hybrid optical/digital processing techniques in neural network and model based SAR ATR algorithms

(U) Work Performed By: For Project AH92 the principal contractors are: ITT Corp., Fort Wayne, IN; Hanis Corp., Rochester, NY; Canadian Marconi Corp., Montreal, Canada; Motorola Corp., Scottsdale, AZ; Xetron, Cincinnati, OH, and AT&T, Greensboro, NC. The in-house developing agencies are Center for Command, Control and Communications Systems, U.S. Army Electronics-Communications Command, Ft. Monmouth, NJ; DoD Electromagnetic Compatibility Analysis Center, Annapolis, MD; Rome Air Development Center, Rome, NY; Department of Energy, San Francisco, CA; Jet Propulsion Laboratory, Pasadena, CA and Defense Advanced Research Projects Agency. For Project AH93 in-house work is to be performed by Harry Diamond Laboratories, Adelphi, MD. Electronic Technology & Devices Lab, Ft. Monmouth, NJ; Lincoln Laboratory, Lexington, MA; Defense Advanced Research Projects Agency (DARPA). Contractors include Eaton Corp. AIL Division, Melville, NY; Emerson Electric Corp., St. Louis, MO; Loral/Fairchild Systems, Milpotus, CA.

(U) Related Activities:

PE #0603324A (Army Development and Employment Agency)
PE #0603006A (Command, Control, Communications Advanced Tech)
PE #0208010A (Joint Tactical Communications Program)
PE #0604779A (Joint Interoperability of Tactical Command and Control Systems)

PE #0602705A, Electronics and Electronic Devices
PE #0603737D, DARPA (BTI Optical Processing)
PE #0602303A, Missile Technology

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602783A**
PE Title: **Computer and Software Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A094 Tactical Software Technology	3978	1986	2717	Cont	Cont
DY10 Computer and Information Science Technology	2216	1480	2356	Cont	Cont
PE TOTAL	6194	3466	5073		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element (PE) develops and applies software technology to improve the performance and reduce the cost of computer software for both Army information systems and tactical embedded real-time systems. In Project DY10, efforts exploit advances in computer and communications technology, and develop and modernize standard information management systems in support of the Information Systems Command, the Defense Communication System, and the Combat Service Support Standard Tactical Management Information System base communications for voice, data and video. Program addresses technical issues in the development of the Army's Information Architecture which will interconnect all tiers of regional, local and end user computing services resulting in a fully connected Army information management system with minimum data storage and maximum data access and a distributed database. In Project A094, efforts provide guidance for the development of tactical embedded real-time systems, solve technical problems being encountered in the application of Ada to Army software critical systems and improve the development process by reducing rework, eliminating unnecessary steps and making the process more efficient through such mechanisms as software reuse, application generators, and improved life cycle processes, methods and tools. Software Management practices are improved through the development of software process metrics, capability assessments and modifications to policies, regulations and standards to reflect technology directions. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis. For FY 1991 these funds provide the sole source of direct software related RDTE funding for U.S. Army Materiel Command and the U.S. Army Information Systems Command, respectively, and are critically needed for recurring basic contract costs. This program is critical for improving software producibility and supportability.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A094 — Tactical Software Technology: This project concentrates on the technology needed to improve the productivity of the software development process. The project addresses executive management of software (for providing management insight into the software development process), software reuse (to determine how to realistically reuse software), real-time Ada programming and associated runtime environments (to solve problems being encountered with the application of Ada to real-time systems), Ada interface binding (to bind Ada to other software standards such as Standard Query Language (SQL) software life cycle processes (to create predictable and affordable software developments), requirements engineering (to develop an engineering process that captures system requirements in a dynamic and changing environment), software documentation improvement (to reduce the costs associated with documentation and to make documents more useful) and software methods and tools (for assessing and cataloging existing methods and tools).

Program Element: **#0602783A**
PE Title: **Computer and Software Technology** Budget Activity: **#1**

(U) FY 1989 Accomplishments:

- (U) Defined improved software process models
- (U) Developed technologies for selecting and configuring a Runtime Environment
- (U) Developed technologies to achieve transportable Ada real-time programs
- (U) Developed Ada compiler composite benchmark for IEW domain
- (U) Evaluated US Army Materiel Command (AMC) Software Management Indicators and their utilization
- (U) Experimented with Ada to SQL interface binding
- (U) Initiated development of Improved Software Process Models
- (U) Developed an approach for evaluating Software methods

(U) FY 1990 Planned Program:

- (U) Experiment to support real-time scheduler concepts
- (U) Investigate runtime environment interface issues
- (U) Develop and experiment with improved software process metrics
- (U) Develop and provide proof of concept on techniques to achieve software reuse
- (U) Evaluate the improved software process models
- (U) Explore Rapid Prototyping techniques
- (U) Hold Requirements Engineering/Rapid Prototyping workshop
- (U) Explore Hypertext, Semantic Database & Artificial Intelligence (AI) for information capture

(U) FY 1991 Planned Program:

- (U) Conduct experiments in distributed runtime environment for distribution application
- (U) Continue testing software process metrics
- (U) Continue experiments in software reuse approaches
- (U) Develop Constructor Tools for use in application of common Ada Missile packages
- (U) Provide proof of concept on Information Capture Technology

(U) Project DY10 — Computer and Information Science Technology

- (U) This project provides for the adaptation and application of research for the development and modernization of standard Army computer and information systems.

(U) FY 1989 Accomplishments:

- (U) Completed video teleconferencing evaluation and develop long range plan for Army and Historically Black Colleges and Universities (HBCUs) to use the technology to improve student recruitment, research support, and general communications.
- (U) Completed Beta test of Executive Information System to link ASA(RDA), Program Executive Officer (PEOs), and Project Manager (PMs).
- (U) Specified protocols for gateways between Integrated Systems Digital Network (ISDN) and Local Area Network (LAN), and verified via Artificial Intelligence (AI)-based tools.
- (U) Developed modeling tool for steady-state network performance for multi-media networks carrying heterogeneous traffic.

(U) FY 1990 Planned Program:

- (U) Develop prototype tools for the verification of reusable, trusted software code.
- (U) Develop an object-oriented adaptable distributed system on a high speed fiber optic network.

Program Element: **#0602783A**

PE Title: **Computer and Software Technology** Budget Activity: **#1**

- **(U)** Develop modeling tools to enable the study of adaptive routing and flow control within multimedia, multimission networks.

(U) FY 1991 Planned Program:

- **(U)** Complete demonstrations of Group Decision Support System (GDSS) technology
- **(U)** Complete the development of prototype tools for the validation and verification of reusable, trusted software code.
- **(U)** Reusability guidelines will be incorporated into the requirements and design phases of the software life cycle.

(U) Work Performed By: DY10 — Major contractors are Georgia Institute of Technology; Massachusetts Institute of Technology; Purdue University; University of Connecticut; University of Virginia; University of Alabama; Atlanta University; University of Arizona, North Carolina State University; Oak Ridge National Laboratory; Information and Systems Networks Company; CMC Electronics; Consultant's Choice; Harris Corporation; Honeywell and Honeywell Federal Systems; Martin Marietta, Energy Systems, Software Engineering Research Center; and Office of the Future, Inc. In-house developing agencies include: the US Army Institute for Research in Management Information, Communications and Computer Sciences (AIRMICS). A094—In-House: Center for Software Engineering, US Army Communications-Electronics Command, Ft. Monmouth NJ; ISSI, Austin, TX; ITTRI, Lanham, MD; LabTek, Woodbrige, CT; Computer Sciences Corp., Shrewsbury, NJ; TAMSCO, Eatontown, NJ; Monmouth College, West Long Branch, NJ.

(U) Related Activities:

Project DY10 is related to the following PEs: #0603805A (Combat Service Support Computer System), #0603096A (Tactical C4 Technology Integration), #0603756D (Consolidated DOD Software Initiative (STARS)) (Software Technology for Adaptable Reliable Systems)), #0603152A (Worldwide Military Command and Control System (WWMCCS) Information System), #0303126A (Long-Haul Communications (OCS)), and #0602234N (Systems Support Technology (Software Technology Project)). Research projects supported by this progam element are coordinated by the Directorate for Computer and Electronics Technology in OSD and other DOD panels/committees. Continued liaison at the laboratory and action office level with Navy, Air Force, and AMC counterparts eliminates unnecessary duplication of work. Liaison with research efforts of Europeans Allies is maintained through correspondence and exchange visits coordinated through the US Army Research, Development, and Standardization Group (United Kingdom).

Project A094 is coordinated with and supported by the Department of Defense Ada Joint Project Office and Software Technology for Adaptable Reliable Systems (STARS) Program as well as the Software Engineering Institute. There is no unnecessary duplication of efforts within the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) (Not Applicable)

(U) International Cooperative Agreements: (Not Applicable)

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602784A**

PE Title: **Military Engineering Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A1CL	Admin & Mgmt — Atmospheric Sciences Laboratory					
		4208	- 0 -	- 0 -	—	—
A4AL	Admin & Mgmt — Cold Regions Research & Engineering Laborabory					
		1107	- 0 -	- 0 -	—	—
A4BL	Admin & Mgmt — Construction Engineering Research Laboratory					
		2452	- 0 -	- 0 -	—	—
A4CL	Admin & Mgmt — Engineer Topographic Laboratories					
		2039	- 0 -	- 0 -	—	—
A4DL	Admin & Mgmt — Waterways Experiment Station					
		2265	- 0 -	- 0 -	—	—
A855	Mapping and Geodesy — Topography Geodesy Technology					
		6040	9482	9840	Cont	Cont
AH71	Atmospheric Investigations					
		6860	6345	5659	Cont	Cont
AT40	Mobility & Weapons Effects Technology					
		9726	13766	14886	Cont	Cont
AT41	Military Facilities Engineering Technology					
		3288	5923	6533	Cont	Cont
AT42	Cold Regions Engineering Technology					
		3393	5189	5771	Cont	Cont
AT45	Energy Technology Applied to Military Facilities					
		1601	3098	3364	Cont	Cont
PE TOTAL		42979	43803	46053		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The research conducted in this Program Element provides technology in direct support of the critical Army combat engineer missions of mobility, countermobility, survivability, sustainment engineering and topography needed to win on the modern battlefield. The countermine work directly responds to the National Defense Authorization Act for Fiscal Year 1989 in which both House and Senate Armed Services Committees urged a new emphasis on countermine research. Research is also conducted that supports the special requirements for tactical decision aids, weather intelligence products and capabilities to exploit space assets. Key operational technologies developed are demonstrated to Army units under Program Element #0603734A, Military Engineering Advanced Technology. Results are also tailored to support the materiel development, test and acquisition community in evaluating the impacts of weather, terrain and atmospheric obscurants. In addition, a portion of the program is directed towards developing technology for Echelons Above Corps and Army-in-garrison activities to vastly improve the efficiency of facility acquisition and operations (design, construction, operations and maintenance) thereby providing significant cost savings and improving military personnel productivity through better quality of life. This Program Element also provides funds for overall administration and management of RDTE,A laboratories. The costs include salary, travel, equipment, and general support of civilian management personnel and their administrative support staffs. Administration and management projects have been consolidated into research projects under this Program Element for the purpose of improved management control. In FY 1988 funds from AH71 and A855, this Program Element, were allocated to initiate work on Space Technology. The work is being continued under Project D492, Space Technology Integration, Program Element #0603006A, Command, Control and

Program Element: **#0602784A**

PE Title: **Military Engineering Technology** Budget Activity: **#1**

Communications, Advanced Technology. The work in this program element is consistent with the Army resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A1CL — Administration and Management for the Atmospheric Sciences Laboratory. Effective FY 1990, these resources were transferred to this PE, Project AH71 as well as PE #0601102A, Project B53A, and PE #0605702, Project D127, as a zero sum transfer within this Appropriation.

(U) Project A4AL — Administration and Management for the Cold Regions Research and Engineering Laboratory. Effective FY 1990, these resources were transferred to Project AT42, this PE, as a zero sum transfer.

(U) Project A4BL — Administration and Management for the Construction Engineering Research Laboratory. Effective FY 1990, these resources were transferred to this PE, Projects AT41 and AT45, and PE #060720A, Project A896, as a zero sum transfer within this Appropriation.

(U) Project A4CL — Administration and Management for the Engineer Topographic Laboratories. Effective FY 1990, these resources were transferred to Project A855, this PE, as a zero sum transfer.

(U) Project A4DL — Administration and Management for the Waterways Experiment Station. These resources were transferred to Project AT40, this PE, as a zero sum transfer.

(U) Project A855 — Mapping and Geodesy — Topography & Geodesy Technology. This project funds the technology to enhance the tactical commander's ability to visualize the battlefield in an easily understandable, 3-dimensional perspective and exploit his knowledge of combat relevant intelligence as a force multiplier to win the AirLand Battle. Using tactical/strategic/space sensor data, together with terrain data bases as input, the technology program emphasizes automating the processes of detecting changes on the battlefield, identifying battle significant features (e.g., tank ditches), and integrating the impacts of the battlefield environment (e.g., rain, snow, dust, etc) to significantly improve combat planning and operations. Development efforts will enable the commander to locate and position enemy and friendly forces in day/night/all-weather conditions, provide crucial terrain data for command and control systems (C^2), and enhance the speed and accuracy of maneuver and weapon systems. The technology being developed will help those who move, shoot, and communicate on the battlefield to "fight smarter" through superior knowledge of the total battlefield terrain and environment. Information required on weather and atmospheric effects is provided by the Atmospheric Sciences Laboratory under Project AH71.

(U) FY 1989 Accomplishments:

- **(U)** Installed and initiated in-house evaluation of real-time computer image generation system
- **(U)** Developed and transferred to PE #0603734A Tactical Decision Aids (TDAs) for 3-D perspectives of the battlefield
- **(U)** Demonstrated the technical feasibility of obtaining azimuth using a single Global Positioning System (GPS) receiver for field artillery use
- **(U)** Developed software on the Space Research Test Facility for the analysis of hyperspectral imagery
- **(U)** Completed investigations of radar image analysis and artificial intelligence techniques for the automatic detection of terrain information and targets

Program Element: **#0602784A**

PE Title: **Military Engineering Technology** Budget Activity: **#1**

(U) FY 1990 Planned Program:

- **(U)** Complete prototype Terrain Information Exploitation System (TIES) hardware and initiate software development for tactical generation of terrain data
- **(U)** Ascertair the utility of 3-D "electronic sand table" displays by exercising the in-house Terrain Visualization Test Bed System
- **(U)** Complete Environmental Design Guidance for Evaluation (EDGE) expert systems modules to assess climatic/battlefield environment impacts on the design and operation of combat systems
- **(U)** Develop an intervisibility focused automated terrain analysis capability to support brigade operations

(U) FY 1991 Planned Program:

- **(U)** Demonstrate an improved Simulator Network (SIMNET) data base generation concept, integrating terrain and weather effects and simplifing construction of terrain data bases
- **(U)** Complete evaluation of multispectral exploitation capabilities for applications by Army intelligence and topographic units

(U) Project AH71 — Atmospheric Investigations: Develop weather decision aids for the commander by applying advanced computer techniques; incorporate new technology in meteorological sensor design; develop data fusion techniques to utilize data from advanced sensors in decision aids to enhance combat power on the battlefield. Demonstrate under PE #0603734A, Military Engineering, Advanced Technology. Realistically model atmospheric effects on target acquisition, mobility, lethality, and survivability to provide weather limitations for design and operation of smart weapons, improved wargame realism and tactics and improved intelligence preparation of the battlefield. Information required on terrain impacts on atmospheric phenomena is provided under Project A855.

(U) FY 1989 Accomplishments:

- **(U)** Completed proof-of-concept for the Integrated Meteorological System (IMETS)
- **(U)** Completed a study on interferometric doppler imaging windfinding techniques vs conventional atmospheric profiler methods
- **(U)** Developed weather effects tactical decision aids for implementation on the All Source Analysis System (ASAS), Maneuver Control System (MCS), and IMETS
- **(U)** Generalized models of turbulence and wind shear hazards for Army aviation operations
- **(U)** Integrated terrain-influenced wind algorithms into the data fusion process for 3-D gridding

(U) FY 1990 Planned Program:

- **(U)** Evaluate acoustic propagation models vs Army requirements
- **(U)** Complete meteorological sensor package to remotely monitor key atmospheric parameters on the battlefield
- **(U)** Develop methodology to integrate meteorological satellite data into 3-D meteorological fusion models
- **(U)** Develop prognostic, terrain-influenced wind model to predict the effects of terrain features on near surface winds
- **(U)** Perform joint laboratories cooperative program trade off analysis of Global Positioning System (GPS) radiosondes options
- **(U)** Develop minimum/optimum meteorological data requirements for acoustic models
- **(U)** Collect target acquisition data during NATO BEST TWO test in France
- **(U)** Demonstrate IMETS concept in Europe

Program Element: **#0602784A**

PE Title: **Military Engineering Technology** Budget Activity: **#1**

(U) FY 1991 Planned Program:

- **(U)** Develop nowcasting mesoscale meteorological model for target area
- **(U)** Prepare weather decision aid for Army aviation routing
- **(U)** Develop terrain-influenced chemical dispersion decision aid
- **(U)** Perform field evaluation of system specific acoustic models
- **(U)** Develop 4-D data fusion capability for meteorological parameters at battlefield scales

(U) Project AT40 — Mobility and Weapons Effects Technology: The research conducted in this project directly responds to the countermine recommendations in the National Defense Act for Fiscal Year 1989, and provides the Army with technologies for standoff detection of minefields; explosive mine neutralization; evaluation of smart mine effectiveness; rapid construction and repair of lines of communication; survivability against the effects of advanced conventional weapons and terrorist weapons threats; camouflage, concealment and deception techniques for fixed facilities; and, determination of operational mobility envelopes for vehicles and vehicle mounted weapons systems. Technologies will be demonstrated in PE #0603734A (Military Engineering Advanced Technology) and PE #0603606A (Landmine Warfare & Barrier Advanced Technology) for subsequent transfer to combat or materiel developers.

(U) FY 1989 Accomplishments:

- **(U)** Developed software and prototype hardware for remote standoff detection of minefields in preparation for transition to PE #0603606A (Countermine and Barrier Development) for demonstration
- **(U)** Developed enhanced capabilities to protect critical fixed facilities from advanced conventional weapons
- **(U)** Completed development of models to implement engineer mobility and countermobility functions into Army Combat Simulation models as a part of the Army Model Improvement Program
- **(U)** Developed more effective methods to establish and maintain roads, airfields, railways, and ports within all theaters of operations
- **(U)** Initiated numerical model studies of wind and wave conditions at potential Logistics-Over-the-Shore (LOTS) sites to provide criteria for selection of optimum sites
- **(U)** Completed field test validation of near-surface ground shock and in-structure shock prediction codes
- **(U)** Completed high-velocity tests of kinetic energy projectiles impacting layered rock-rubble/concrete targets
- **(U)** Developed concept for use of dual, liquid explosive line charges for improved breaching of minefields containing both pressure and non-pressure activated mines
- **(U)** Developed guidance for protection from small arms and shoulder-fired rockets during terrorist attacks

(U) FY 1990 Planned Program:

- **(U)** Develop advanced model to predict the effectiveness of obstacles/barriers
- **(U)** Develop software and methodologies to integrate the Remote Minefield Detection System (REMIDS) with a down-link and processing terminal in preparation for demonstration in PE #0603606A, Landmine Warfare and Barrier Advanced Technology
- **(U)** Provide sea-state climate data products for field use in LOTS planning
- **(U)** Develop hose deployment technique for dual liquid line charge minefield breaching system
- **(U)** Develop automated mobility network system for predicting flow rates of friendly and threat armored and mechanized infantry formations

Program Element: **#0602784A**
PE Title: **Military Engineering Technology** Budget Activity: **#1**

- **(U)** Demonstrate Obstacle Planner Software at the National Training Center
- **(U)** Evaluate fighting positions in Soviet Artillery Effects Test
- **(U)** Develop cost-effective hardening techniques to increase survivability of critical class III storage facilities in Central Europe
- **(U)** Develop design criteria for protective overlays to defeat high-velocity munitions

(U) FY 1991 Planned Program:

- **(U)** Develop smart munition performance prediction methodology based on critical target background factors
- **(U)** Complete first-generation Engineer Functional Area Model to upgrade engineer play in models used in the Army Combat Simulation Models
- **(U)** Develop mobility tactical decision aids that consider the combined effects of on- and off-road travel and obstacle breaching
- **(U)** Develop concepts and materials for camouflage of critical fixed facilities against airborne radar systems
- **(U)** Initiate comprehensive model studies of potential LOTS sites
- **(U)** Develop expedient battlefield protective structures to defeat advanced weapon threats
- **(U)** Validate tactical mobility network planning model
- **(U)** Complete development of tactical decision aids that will assist in rapid planning and construction of advanced barrier systems
- **(U)** Complete development of riverbank standoff bridge demolition technique
- **(U)** Develop guidance for blast window design for protection from terrorist attack
- **(U)** Develop simplified first-principle cratering/ground shock codes for simulating close-in effects from conventional weapon detonations
- **(U)** Continue tests and analyses to devise effective antipenetration shields against advanced high-velocity projectiles

(U) Project AT41 — Military Facilities Engineering Technology: The research in this project is focused on developing improved technologies for the planning, programming, design, construction, operation and maintenance of facilities which are essential to the training and readiness missions of the Army. Advanced materials, ceramics, mechanics, systems theory, artificial intelligence, robotics, and microelectronics technologies are developed for application to all phases of the facility life cycle. Product development emphasizes satisfying Army facility needs at the most affordable cost.

(U) FY 1989 Accomplishments:

- **(U)** Developed Scale-Resistant coatings for heat exchangers to reduce maintenance costs
- **(U)** Developed site planning and facility concept design guides for more effective integration of physical security into Army facilities
- **(U)** Completed corrosion mitigation and management system for gas and water distribution systems to avoid major replacement cost
- **(U)** Developed mixed metal oxide coatings to extend the life of anodes used in corrosion protection systems
- **(U)** Completed a system for managing the maintenance of Built-up roofs to improve planning and avoid major repairs
- **(U)** Developed Electromagnetic Pulse/Electromagnetic Interference (EMP/EMI) design criteria for Command, Control, Communications and Intelligence (C3I) facilities

Program Element: **#0602784A**

PE Title: **Military Engineering Technology** Budget Activity: **#1**

(U) FY 1990 Planned Program:

- (U) Complete a 3D Architectural modeling system for improving the cost/quality and responsiveness of military facility design to the Army mission
- (U) Complete expert system to improve the facility acquisition process
- (U) Complete artificial intelligence based system with sensors to improve quality assurance inspections on construction projects
- (U) Develop improved procedures for evaluating and managing contractor claims during construction to reduce cost and delays
- (U) Complete design criteria for acceptance testing of corrosion control systems
- (U) Provide condition indexes for asphalt concrete roads and streets to improve the usefulness of the pavement maintenance system

(U) FY 1991 Planned Program:

- (U) Develop performance specifications to make alternative construction methods available for use in Military Construction, Army (MCA) construction contracts
- (U) Complete integration of master planning and space utilization models to improve Directorate of Engineering and Housing (DEH) planning activities
- (U) Develop robotic system to inspect for corrosion in inaccessible locations such as pipes
- (U) Develop civil/site design and analysis modules for Corps' computer-aided design and drafting (CADD) system

(U) Project AT42 — Cold Regions Engineering Technology. This project is the only DOD technology based program devoted to the development of the knowledge base and engineering principles needed to sustain an effective war fighting force in the cold regions of the world including combat support, combat engineering and base/facility construction, operation and maintenance. Facility issues address strategic facilities and military installations in the Artic, Alaska, the northern tier of the United States, Europe, Japan and Korea. Combat support includes technology to assist the materiel development community in design, test and evaluation of equipment that must function in cold regions and winter conditions, as well as logistics and survivability issues. Combat engineering includes mobility/countermobility and mine warfare problems faced by the Army in winter and high latitude environments. This project is essential to counter the current threat of numerical and operational advantages in winter and cold conditions.

(U) FY 1989 Accomplishments:

- (U) Conducted wind tunnel experiments on Mount Washington and developed concepts for reducing icing on aircraft and communications antennas
- (U) Conducted field experiments and obtained data on the performance of smoke obscurants in winter environment
- (U) Airborne, satellite and ground based sensing techniques were evaluated for rapid detection of unfrozen water sources in winter. Concepts were evaluated for operation of field water supply systems at low temperatures
- (U) Cost effective foundation design concepts were developed for stabilizing permafrost. These concepts are being considered for the Over the Horizon Radar System to be constructed in Alaska. Pile load testing criteria were developed that should insure more reliable designs

(U) FY 1990 Planned Program:

- (U) Complete coding of shock wave attenuation tests to predict the impact of snow on explosive mine neutralization concepts
- (U) Develop and evaluate concepts for chemical decontamination on the winter battlefield

Program Element: #0602784A
PE Title: **Military Engineering Technology** Budget Activity: #1

- (U) Develop criteria for considering the impact of winter conditions on the performance and design of seismic/acoustic sensors used in smart mine systems
- (U) Develop information for evaluating the impact of winter conditions on smart munitions

(U) FY 1991 Planned Program:

- (U) Develop low cost material alternatives for pavement base courses which will not be susceptible to frost damage and potholes
- (U) Develop models for predicting the fate and persistence of chemical agents on the winter battlefield
- (U) Complete tests of vehicle mobility on thawing soil and begin development of alogrithms for inclusion in Army mobility model

(U) Project AT45 — Energy Technology Applied to Military Facilities: The research conducted in this project provides the technology for providing energy efficient facilities, adapting new energy source technologies to military facilities, reducing dependence on non-renewable petroleum fuels, and improving the efficiency of on-site heating plants. Research facilitates adaptation of new technology from industry to meet the specialized needs of the Army. Research is implemented in new construction and in upgrades of existing facilities.

(U) FY 1989 Accomplishments:

- (U) Developed guidance for improved energy efficiency at USA Materiel Command (AMC) industrial facilities
- (U) Evaluated small scale cogeneration to meet Army needs
- (U) Developed criteria for designing and constructing life-cycle cost-effective steam and high temperature hot water distribution systems
- (U) Developed standard digital controls for heating, ventilating and air conditioning systems
- (U) Completed guidelines for retrofitting existing lighting systems to conserve energy

(U) FY 1990 Planned Program:

- (U) Develop advanced remote energy metering techniques for better control of energy use
- (U) Develop procedures and software for multi-disciplinary micro-based/Computer Aided Design and Drafting (CADD) energy systems design including the interface
- (U) Develop guidance on passive solar strategies for commercial buildings
- (U) Develop criteria for making decisions to upgrade versus replace central heating plants

(U) FY 1991 Planned Program:

- (U) Develop central heat plant control system to reduce operating costs
- (U) Develop guidance for design and implementation of salt gradient solar ponds for energy collection and storage
- (U) Develop diagnostic technology to detect and compensate for malfunctions in heating, ventilating and air conditioning (HVAC) system operations
- (U) Evaluate methods for heat recovery techniques at AMC facilities
- (U) Develop a real-time building energy analysis model
- (U) Develop methods for designing heating, ventilating and air conditioning system controls for special purpose facilities

(U) Work Performed By:

A855 — Topography, Image Intelligence and Space Technology: Approximately 65 percent of the work is performed in-house by the Engineer Topographic Laboratories, Fort Belvoir, VA. Primary civilian contractors: DBA Systems, Melbourne, FL, and Earth Satellite Corp., Chevy Chase, MD.

Program Element: **#0602784A**

PE Title: **Military Engineering Technology** Budget Activity: **#1**

AH71 — Atmospheric Investigation: Approximately 79 percent of the work is performed in-house by the Atmospheric Sciences Laboratory, White Sands, NM. Primary civilian contractors: New Mexico State University, Las Cruces, NM; Sand T Corp., Hampton, VA; University of Texas, El Paso, TX.

AT40 — Eighty-two percent of the Waterways Experiment Stations work is performed in-house. Eighteen percent is performed out-of-house. Contractors: Hilton Systems, Inc., Battelle-Frankfurt.

AT41 — Military Facilities Engineering Technology: Approximately 65 percent of the work is performed in-house by the U.S. Army Construction Engineering Research Laboratory, Champaign, IL. Primary civilian contractor: University of Illinois, Urbana, IL; Arthur D. Little, Inc., Boston, MA; and Georgia Technical Institute, Atlanta, GA.

AT42 — Cold Regions Engineering Technology: Approximately 75 percent of the work is performed in-house by the Cold Regions Research and Engineering Laboratory, Hanover, NH. Primary civilian contractor: Dartmouth College, Hanover, NH.

AT45 — Energy Technology Applied to Military Facilities: Approximately 65 percent of the work is performed in-house by the U.S. Army Construction Engineering Research Laboratory, Champaign, IL. Primary civilian contractors are: University of Illinois, Urbana, IL; Arthur D. Little, Inc., Boston, MA; and the Gas Research Institute, Chicago, IL.

(U) Related Activities:

PE #0601102A, Defense Research Sciences, Projects AT22, AT23, AT24, B53A and B52C.
PE #0603734A, Military Engineering Advanced Technology, Project DT08, Combat Engineering Systems.
PE #0603730A, Project D560, Tactical Surveillance System (AD) (TIARA).
PE #0604716A, Topograhpic Systems, Project D579, Combat Terrain Information Systems, (ED) (TIARA).
PE #0604740A, Project D662, Tactical Surveillance System, (ED) (TIARA).
Cooperative programs have been established by Memorandum of Understanding dated 3 March 1987 with the Belvoir Research, Development and Engineering Center involving the following Program Elements:
PE #0602786A, Mobility Equipment Technology, Project AH20.
PE #0603606A, Countermine/Barrier Development, Project D608.
PE #0603619A, Landmine Warfare and Barrier Advanced Concepts.
In order to preclude unnecessary duplication, this research is coordinated with the following agencies annually, or more frequently as required:
U.S. Army Materiel Command.
U.S. Army Training and Doctrine Command.
U.S. Army Forces Command.
Department of Defense, Office of The Director of Defense Research and Engineering.
Defense Advanced Research Projects Agency
Defense Intelligence Agency
Defense Nuclear Agency.
Department of the Air Force.
Defense Mapping Agency.
Marine Corps.
Department of the Navy.
Joint Services Civil Engineering Research and Development Coordination Group (JSCERDCG).
NATO Panel IV, Research Study Groups (RSGs) 8, 14 and 15.
NATO Panel III, RSG 2 and 11.
NATO, Special Group of Experts on Concealment, Camouflage and Deception.

Program Element: **#0602784A**

PE Title: **Military Engineering Technology** Budget Activity: **#1**

NATO Armaments Group, Panel XII (Meteorology).
Department of the Interior.
Department of Transportation.
Department of Energy.
Central Intelligence Agency
National Bureau of Standards.
National Academy of Sciences.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602785A**

PE Title: **Manpower, Personnel and Training Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A2AL Admin & Mgmt-Army Research Institute (ARI)	7105	- 0 -	- 0 -	—	—
A790 Human Performance Effectiveness & Simulation	5637	4276	4316	Cont	Cont
A791 Manpower, Personnel & Training	4635	12528	13015	Cont	Cont
PE TOTAL	17377	16804	17331		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The objective of this program is to provide a scientifically sound basis for maximizing soldier and unit performance by determining empirically: (1) how the soldier's workload can be "shifted from the head to the hardware" in the design of new weapon systems, (2) information which must be available to system designers to ensure compatible man-machine systems, (3) simulator and training device design features necessary to ensure effective training at minimal cost, and (4) how behavioral science methods can be used to improve the recruiting, selection, and retention of quality soldiers in an environment characterized by a dwindling supply of military age adults and an increasing demand for technically qualified labor. Accomplishments transition to Program Element 0603007A for advanced technology development. This Program Element (PE) also provides funds for overall administration and management of Army Research, Development, Test and Evaluation (RDTE,A) laboratories. The costs include salary, travel, equipment, and general support of civilian management personnel and their administrative support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A2AL — Administration and Management for the Army Research Institute. These resources were transferred to Project A791, this PE, as a zero-sum transfer.

(U) Project A790 — Human Performance Effectiveness and Simulation: Work under this project experimentally and empirically determines: (1) the most effective means for integrating human decision makers and automated information technology in new Army systems, (2) the contributions of human factors, manpower, personnel, and training variables to weapon system performance and unit effectiveness, and (3) the minimum design requirements for simulators/training devices that will achieve effective training at the lowest cost.

(U) FY 1989 Accomplishments:

- **(U)** Developed a prototype model for assessing stress and fatigue effects on combat unit performance
- **(U)** Developed methods for determining the human factors causes of accidents in Army aviation
- **(U)** Developed an intelligence and electronic warfare (IEW) processing and utility evaluation model for division-level intelligence support
- **(U)** Developed a prototype model for assessing impact of soldier errors on total system performance

Program Element: **#0602785A**

PE Title: **Manpower, Personnel and Training Technology** Budget Activity: **#1**

- (U) Developed preliminary performance measurement and feedback system for armor systems utilizing state-of-the-art simulation network (SIMNET) technology

(U) FY 1990 Planned Program:

- (U) Develop prototype risk-awareness estimation techniques for reducing accidents in "live fire" artillery training exercises
- (U) Develop an improved prototype tactical battle staff training technology
- (U) Develop preliminary graphic procedures for more effective exchange of tactical planning data within a command and control system
- (U) Develop joint U.S./Canada flight simulator testbed
- (U) Develop artificial intelligence (AI)-based techniques to assist military linguists acquire and sustain job-relevant foreign language skills
- (U) Develop and evaluate preliminary crew/team/unit tank gunnery training and testing strategies

(U) FY 1991 Planned Program:

- (U) Develop prototype methods for predicting weapon system and unit performance degradation due to soldier stress, sleep loss and fatigue, crew turnover, and levels of personnel experience
- (U) Determine crew selection criteria that can potentially reduce Army aviation accidents caused by human error
- (U) Determine collective staff skill requirements for the Army Tactical Command and Control System
- (U) Empirically determine minimum visual fidelity requirements for effective flight simulator training
- (U) Develop preliminary rules for deciding what training should be "embedded" in weapons systems

(U) Project A791 — Manpower, Personnel & Training. The objectives of this project are to provide the scientific basis for: (1) improved methods for force structure planning, selection testing, and leader development, (2) training methods to cost-effectively provide high technology skills for soldiers in both the Active Army and the Reserve Component, (3) integrated methods of estimating manpower levels and soldier skills required by new Army weapon systems, and (4) methods for assessing and improving unit skill acquisition and performance.

(U) FY 1989 Accomplishments:

- (U) Developed a comprehensive enlisted force database of accessions during the All Volunteer Force era
- (U) Developed methodology to estimate the effects on retention of changes in pay, bonuses, retirement benefits and other forms of compensation for first and second reenlistment for active and reserve enlisted personnel
- (U) Refined and evaluated new methods of job analysis and new procedures for setting performance standards for enlisted Military Occupational Specialties
- (U) Completed first data collection to assess retention and career decision-making among junior officers
- (U) Empirically determined effects of spouse dissatisfaction, branch preferences, and workload on junior officer career plans

Program Element: **#0602785A**

PE Title: **Manpower, Personnel and Training Technology** Budget Activity: **#1**

(U) FY 1990 Planned Program:

- **(U)** Develop preliminary model of collective skill acquisition and retention based on task characteristics and performance requirements
- **(U)** Design automated tools to aid training program developers
- **(U)** Develop a preliminary, behaviorally sound model that can be used to simulate the impact of personnel policies and incentives on the enlisted force structure
- **(U)** Build a comprehensive enlisted and officer database to track career paths of soldiers entering John F. Kennedy Special Warfare Center, for future research and development
- **(U)** Develop preliminary model of enlisted retention intentions and subsequent behavior, using results from Recruit Experience Tracking Survey
- **(U)** Develop preliminary models of skill acquisition and retention for complex cognitive tasks

(U) FY 1991 Planned Program:

- **(U)** Develop and test skill acquisition and retention models for complex skills
- **(U)** Develop methods for estimating required frequency of refresher training in units, by type of task, to assure skill retention
- **(U)** Develop methodology to generate job performance prediction equations and selection standards
- **(U)** Complete evaluation of new methodologies for executive development
- **(U)** Build and test models of the interaction among first-term Army career experiences, career performance, and retention

(U) Work Performed By: Primary contractors are: American Institutes for Research, Washington, DC; Fu Associates, Ltd., Arlington, VA; PAR Technology Corporation, New Hartford, NY; Perceptronics, Inc., Woodland Hills, CA; Systems Research and Applications Corporation, Arlington, VA. The in-house developing organization is the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Alexandria, VA.

(U) Related Activities: Results of this project transition to Advanced Development in PE #0603007A (Human Factors, Personnel and Training Advanced Technology). Potential for duplication of effort is avoided through an annual Science and Technology Program Review chaired by a representative of the Office of the Secretary of Defense. Coordination is furthered through Department of Defense (DOD) Topical Reviews, participation on the DOD Human Factors Engineering Technical Group, and the DOD/NASA Simulation Technology Coordination Panel. This PE is further coordinated with the Army Project Manager for Training Devices (PM TRADE), the Army Human Engineering Laboratory (HEL), and with personnel research and development organizations of the other Services: the Air Force Human Resources Laboratory (AFHRL), the Navy Personnel Research and Development Center (NPRDC), and the Naval Training Systems Center (NTSC).

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Project Agreement between the United States Department of the Army and the Canadian Department of Regional and Industrial Expansion for Army Aviation Combat Training Simulator, United States-Canada Cost Shared Development Project, 29 April 1987.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602786A**

PE Title: **Logistics Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A1GL	Admin & Mgmt — Belvoir Research, Development and Engineering Center				
	5980	- 0 -	- 0 -	—	—
A1SL	Admin & Mgmt — Natick Research, Development and Engineering Center				
	7845	- 0 -	- 0 -	—	—
A427	Tactical Rigid Wall Shelter Exploratory Development				
	3223	5123	5331	Cont	Cont
AH20	Mobility Equipment Technology				
	10359	13386	13553	Cont	Cont
AH98	Clothing & Equipment Technology				
	6229	10624	10259	Cont	Cont
AH99	Joint Services Food/System Technology				
	5735	4270	4400	Cont	Cont
D283	Airdrop Advanced Technology				
	2043	2259	2368	Cont	Cont
PE TOTAL	41343	35516	35811		

B. (U) BRIEF DESCRIPTION OF ELEMENT: A number of major and high probability developments that relate specifically to the battlefields of tomorrow will place unusual demands on future Army logistics systems. In order to achieve the logistics efficiency that will be required, there must be associated technological developments in logistics equipment and systems (and, where possible, in supplies) to make them smaller, lighter, more reliable and durable, more survivable, less manpower intensive, more mobile and more responsive. Technology efforts on clothing and equipment and on tactical rigid wall shelters provide enhanced individual soldier protection from both combat threats and from the natural environment. The Joint Services Food/System Technology program supports all military services as well as the Defense Logistics Agency with research and development of advanced military food products and feeding systems. Similar work on advanced airdrop technology supports all Services' requirements for dropping larger combat and logistics loads while improving delivery accuracy, minimizing vulnerability of aircraft and reducing life cycle costs. Moving men and equipment in support of the ground Army is the focus of investigation into mobility equipment technology. This includes renewed emphasis on landmine detection and neutralization, improved mobility through more rapidly deployable, lighter tactical bridging, improved warehousing and supply distribution, and low-signature, high efficiency mobile electric power sources. This Program Element (PE) also provides funds for overall administration and management of RDTE,A laboratories. The costs include salary, travel, equipment, and general support of civilian management personnel and their administrative support staffs. Funds previously in A1GL and A1SL have been placed into FY 1990 6.2 project lines accounting for the increase in AH20 (from A1GL) and AH98 and A427 (from A1SL). The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

Program Element: **#0602786A**
PE Title: **Logistics Technology** Budget Activity: **#1**

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A1GL — Administration and Management for the Belvoir Research, Development and Engineering Center. Effective FY 1990 these resources were transferred to Project AH20, this PE, as a zero sum transfer.

(U) Project A1SL — Administration and Management for the Natick Research, Development and Engineering Center. Effective FY 1990, these resources were transferred to Projects AH98 and A427, this PE, as a zero sum transfer.

(U) Project A427 — Tactical Rigid Wall Shelter: This project covers exploratory development for lighter, more survivable rigid-walled shelters and chemically/biologically (CB) protected soft-walled shelters. Thrust areas include nuclear hardening of lightweight rigid shelters with incorporation of composite laminates for improved ballistic protection; material improvements to counter more effectively electro-magnetic interference/electro-magnetic pulse (EMI/EMP) threats; and advanced materials, fabrication techniques and power systems for CB shelters.

(U) FY 1989 Accomplishments:

- **(U)** Completed fabrication of prototype nuclear hardenedHigh Mobility Multipurpose Wheel Vehicle (HMMWV) shelter and participated in the Defense Nuclear Agency (DNA) simulated nuclear blast Miser Gold at White Sands, NM
- **(U)** Evaluated EMI shielding of composite shelter panels for improved protection of communications, command, control and intelligence systems

(U) FY 1990 Planned Program:

- **(U)** Evaluate simulated nuclear blast/thermal test data of prototype nuclear hardened HMMWV Shelter to assess overall performance
- **(U)** Correlate experimental results of EMI shelter panels to assess adequacy for predicting full shelter EMI performance
- **(U)** Develop novel door/penetration shielding concepts to enhance overall shelter EMI shielding effectiveness

(U) FY 1991 Planned Program:

- **(U)** Evaluate concepts of shelter walls for integrated nuclear/ballistic threat protection to identify approaches that minimize weight and cost
- **(U)** Experimentally determine effectiveness of novel door/penetration EM shielding concepts to compare with conventional methods
- **(U)** Apply computational electrodynamic techniques to study performance of conventional and composite shelter EM shielding

(U) Project AH20 — Mobility Equipment Technology: This exploratory development program addresses the critical need for advanced Combat Support and Combat Service Support equipment and materiel. The project is directed toward providing the technology to help solve deficiencies in the Army mission areas of Engineer-Mine Warfare, Combat Service Support, and Intelligence and Electronic Warfare. It includes the task efforts in the following fields: countersurveillance, deception, survivability, countermine, bridging, logistic supply and support, materials, fuels and lubricants, mobile electric power, environmental control, corrosion, and radiation (health physics).

COUNTERMINE

(U) FY 1989 Accomplishments:

- **(U)** Expanded tests of reactive materials against broad range of mine main explosives to provide for neutralization of mines
- **(U)** Completed accoustic research

Program Element: **#0602786A**
PE Title: **Logistics Technology** Budget Activity: **#1**

- **(U)** Defined mine response to explosives and penetrators
- **(U)** Initiated waveguide and crossed dipole antenna research

(U) FY 1990 Planned Program:

- **(U)** Initiate a joint Exploratory Development/Non-system Advanced Development (6.2/6.3a) program for reactive munitions, wide area neutralization device (high power microwave)
- **(U)** Conduct Brassboard demo of reactive materials
- **(U)** Continue close-in detection activities in support of accoustic/seismic, unintentional emissions, x-ray photon backscatter, separated aperture and balanced bridge

(U) FY 1991 Planned Program:

- **(U)** Complete brassboard demo of competing technologies in support of improved vehicle mounted detector and hand held detector for close-in detection
- **(U)** Continue joint development for an integrated breaching system
- **(U)** Initiate brassbcard demo planning

BRIDGING

(U) FY 1989 Accomplishments:

- **(U)** Fabricated test sections of composite decking and initiated structural testing
- **(U)** Completed adhesive bonding studies and prepared detailed adhesives specification for structural connections
- **(U)** Fabricated sections of light vehicle/footbridge

(U) FY 1990 Planned Program:

- **(U)** Complete testing of composite bridge deck and transition to ongoing support bridge technology demonstrator
- **(U)** Initiate design studies of light weight composite launch mechanism components for future bridging systems
- **(U)** Conduct feasibility testing of light vehicle/footbridge

(U) FY 1991 Planned Program:

- **(U)** Conduct tests of composite roadway matting
- **(U)** Initiate fabrication of selected components of lightweight launch mechanism

COUNTERSURVEILLANCE/DECEPTION

(U) FY 1989 Accomplishments:

- **(U)** Validated laboratory capability to accurately predict vehicle radar cross-section and reduction due to camouflage
- **(U)** Developed generic infrared suppression technology for insertion into camouflage nets in production
- **(U)** Demonstrated coating for infrared suppression of hot surfaces

(U) FY 1990 Planned Program:

- **(U)** Demonstrate infrared suppressive coating applied directly to tactical equipment
- **(U)** Evaluate effectiveness of emissivity patterning on nets to match snow background
- **(U)** Evaluate various designs of multispectral camouflage systems incorporating visual, radar, and thermal infrared capabilities

(U) FY 1991 Planned Program:

- **(U)** Demonstrate unique multispectral lightweight camouflage materials with deception devices

Program Element: **#0602786A**
PE Title: **Logistics Technology** Budget Activity: **#1**

- **(U)** Demonstrate infrared supression capability for tents in arctic backgrounds

FUELS, LUBRICANTS AND CORROSION PREVENTATIVES

(U) FY 1989 Accomplishments:

- **(U)** Completed development of procedures for predicting fuel-related nozzle/injector fouling tendencies
- **(U)** Completed development of laboratory demonstrator model of the Constant Volume Combustion Apparatus which will define cetane qualities of ground fuels
- **(U)** Completed laboratory testing of engine oils designed for use with diesel fuels of varying fuel sulfur levels
- **(U)** Completed survey on adequacy of standard military antifreeze (MIL-A-46153) and initial assessments as to its performance in high temperature — aluminum contact environments

(U) FY 1990 Planned Program:

- **(U)** Establish in-service use limits for ground vehicle/equipment hydraulic fluids
- **(U)** Publish field expedient fuels handbook to extend use of available/alternative fuels
- **(U)** Develop engine lubricant strategy identifying FY 1993 as critical year in lubricants utilization for military vehicles/equipment
- **(U)** Complete efforts for standardizing on one hydraulic fluid for all combat/tactical vehicles and equipment
- **(U)** Complete cooperative program with USAF on the potential for recycling waste antifreeze

(U) FY 1991 Planned Program:

- **(U)** Complete consolidation of tactical, arctic, and preservation requirements allowing single multipurpose engine oil for all ground vehicles
- **(U)** Complete development of improved military antifreeze to allow higher temperature operation and extended/recycled use applications
- **(U)** Complete development of initial requirements for high heat rejection diesel fuel for use in minimal-cooled advanced design engines
- **(U)** Complete development of improved Chemical Agent Resistant Coatings (CARC)

ELECTRIC POWER

(U) FY 1989 Accomplishments:

- **(U)** Investigated technologies to reduce standby losses in pulse power generators as a viable energy source for electrio gun/directed energy weapons
- **(U)** Obtained prototype of selected components of 20KW in-line vehicle generator. This size generator eliminates the requirement for trailer mounted generators and substantially improves tactical mobility
- **(U)** Investigated availability of small diesel engines to power generators

(U) FY 1990 Planned Program:

- **(U)** Integrate technologies into pulse power demonstrator
- **(U)** Finalize in-line generator and vehicle interface
- **(U)** Validate via bench test availability of small diesel engines to power small generators

(U) FY 1991 Planned Program:

- **(U)** Complete laboratory analysis of In-Line Generator integrated into vehicle driveline
- **(U)** Fabricate/assemble brassboard model of personal power source (10 pounds or less) for missions batteries cannot perform

Program Element: **#0602786A**
PE Title: **Logistics Technology** Budget Activity: **#1**

- (U) Further develop components critical to mobile, continuous duty pulsed power

SUPPLY DISTRIBUTION

(U) FY 1989 Accomplishments:

- (U) Evaluated universal self deployable cargo handling concepts
- (U) Completed Rough Terrain, Self Deployable concepts in universal cargo handler

(U) FY 1990 Planned Program:

- (U) Demonstrate real-time cargo reconition and engagement of a wide class of cargo pallets using enhanced mechanical handling equipment

(U) FY 1991 Planned Program:

- (U) Evaluate current state of the art and advanced technologies for automated field storage and retrieval of material to support unit load systems and improve supply control

(U) Project AH98 — Clothing and Equipment Technology: Exploratory development designed to improve soldier performance and survivability on the modern day battlefield through significantly improved materials and new design applications for combat clothing, personal equipment, field support equipment, and tentage. Areas of emphasis include: material development to improve chemical/biological (C/B), ballistic, flame and nuclear thermal protection; enhanced countersurveillance/camouflage for the individual soldier; directed energy protection for soldier survivability, including eye protection against tuneable lasers; materials/concepts for protection in arctic/desert environments; and improvements to lighten the soldier's load.

(U) FY 1989 Accomplishments:

- (U) Evaluated/characterized waterproof breathable membranes which have been loaded with chemical agent detoxification materials
- (U) Completed lightweight ultra high molecular weight polyethylene (Spectra) helmet development
- (U) Constructed prototype device for advanced laser/ballistic eye protection and investigated microlens arrays for notional laser eye protection

(U) FY 1990 Planned Program:

- (U) Fabricate scaled-up laminates of membranes loaded with detoxification materials for demo of Chemical/biological (CB) protective uniforms
- (U) Apply technology and fabricate prototype microlense array for advanced laser eye protection concepts
- (U) Conduct risk assessment for various levels of conflict to provide design criteria for Soldier Integrated Protective Ensemble (SIPE) Advanced Technology Transition Demonstration (ATTD) in FY 1992
- (U) Produce prototype microclimate cooling equipment (MCE) utilizing a variety of miniaturized power sources and thermodynamic cooling cycles. MCE will alleviate soldier heat stress and improve performance
- (U) Identify alternative hard surface materials for novel ballistic threats and through materials/design engineering, produce a lightweight personnel armor for the SIPE tech demo

(U) FY 1991 Planned Program:

- (U) Commence testing of prototype laser/ballistic eye armor for protection against lasers of different frequencies
- (U) Evaluate prototypes of microclimate cooling equipment using a variety of power sources and thermodynamic cooling cycles

Program Element: **#0602786A**
PE Title: **Logistics Technology** Budget Activity: **#1**

- **(U)** Complete investigation of co-extruded materials for chemical protective suit applications to provide lightweight, multiple barrier materials
- **(U)** Incorporate advanced ordered polymers into fabrics and composites for increased ballistic protection for the individual soldier

(U) Project AH99 — Joint Service Food/System Technology: This DOD program addresses the food and food system developmental efforts to support the four Military Services and the Defense Logistics Agency. Thrust areas involve the exploratory development of combat rations, packaging, field food service equipment and combat food service systems which enhance the survivability, sustainability, and supportability of the Armed Forces on the battlefield.

(U) FY 1989 Accomplishments:

- **(U)** Accelerated aFY 1992 Office of the Surgeon General (OTSG) program for elimination of highly saturated fats used for milk products for troop issue at overseas locations
- **(U)** Completed development of 56 new dental liquid products for a five-day hospital menu providing enhanced nutrition to field and garrison hospital patients with mouth/throat injuries
- **(U)** Developed first prototype of carbonated beverage tablet to reduce logistical and maintenance requirements aboard navy vessels. Current carbonated beverage system is extremely labor intensive and logistically burdensome
- **(U)** Developed and produced a consolidated combat feeding polymeric traycan. Successful completion of developmental effort will broaden industrial base, reduce production costs, and provide capability for downsizing to support remote site feeding
- **(U)** Completed design of prototype food service system for Air Force Rail Garrison Mobile Missile System to provide feeding support to missile crews deployed for extended periods of time, helping to insure optimum crew performance through balanced nutrition and overall ration acceptance

(U) FY 1990 Planned Program:

- **(U)** Complete exploratory development of Marine Corps self-heating capability for operational rations providing the individual Marine with the ability to heat an Meal-Ready-To-Eat (MRE) while on-the-move thus decreasing preparation time, and increasing ration acceptability and consumption
- **(U)** Complete accelerated development and adoption of a Joint Service go-to-war/assault ration providing long shelf-life (>10 years) and compactness, as well as high troop acceptance. Ration will be utilized as a pre-positioned war reserve stock ration, eliminating the costs and acceptability problems associated with rotation of MREs
- **(U)** Complete packaging studies and accelerated shelf life testing of new polymeric traycan. Transition to advanced development for large scale field testing
- **(U)** Explore future subsystem (Mobile Ration Preparation and Serving System) to provide prepared meals to dispersed/dismounted combat troops in a manner consistent with the Army 21 concept-highly mobile system, no preparation time, no dedicated food service staff

(U) FY 1991 Planned Program:

- **(U)** Complete exploratory development of Army/Marine Corps Cold Weather Feeding System significantly improving extremely cold weather food services operations, as well as insuring that hot, nutritious meals are available. System will utilize highly mobile heat-on-the-move group feeding food serivce equipment
- **(U)** Complete exploratory development of the feeding system to support the Air Force Rail Garrison Missile System and transition to the Air Force for implementation in the overall Rail Garrison program

Program Element: **#0602786A**
PE Titie: **Logistics Technology** Budget Activity: **#1**

- **(U)** Complete program on fat substitutes for reconstructed milk products and transition to Defense Logistics Agency for implementation
- **(U)** Complete development and field testing of carbonated beverage product for Naval feeding and transition to new items program (6.3b)

(U) Project D283 — Airdrop Advanced Technology: This project involves exploratory development to enhance personnel and cargo airdrop capabilities. Areas of emphasis include: parachute technology for improved performance and high speed/low altitude extraction; soft landing system development; advanced rigging/derigging technology; airdrop simulation and high speed airdrop systems technologies. Efforts will result in increased personnel safety and reduced personnel, aircraft, and cargo vulnerability.

(U) FY 1989 Accomplishments:

- **(U)** Evaluated Flexible Wing flight characteristics utilizing small model canopies released fromRemote Piloted Vehicles (RPVs) for more accurate delivery of larger cargo loads
- **(U)** Conducted experiments on airbags with controlled venting and conducted analysis of air bags with air injection to achieve the capability to drive loads off airdrop platforms thereby reducing derigging time
- **(U)** Explored utilization of advanced composite materials for manufacturing of airdrop hardware with greater strength and lighter weight components
- **(U)** Developed and successfully demonstrated method for improved opening of clustered parachutes to improve the reliability of delivering loads too heavy for a single parachute

(U) FY 1990 Planned Program:

- **(U)** Fabricate and test parachutes to demonstrate feasibility of high speed (250Knot) airdrop of cargo for reduced aircraft vulnerability
- **(U)** Conduct experiments of flexible fabric wing models to improve glide slope of baseline full-size design
- **(U)** Explore advanced concepts for efficient clustering of parachutes to improve opening reliability and minimize damage during opening
- **(U)** Determine magnitude of electrostatic charges in parachutes to assess importance of problem during opening process

(U) FY 1991 Planned Program:

- **(U)** To reduce the cost and time required for full scale parachute testing, evaluate parachute scaling parameters and determine canopy material effects on those parameters
- **(U)** Construct and test prototype composite platform to assess feasibility and desirability of composites for airdrop applications
- **(U)** Complete evaluation of flexible wing baseline design glide slope to improve gliding offset delivery capability

(U) Work Performed By: In-house efforts accomplished by Natick Research, Development and Engineering Center, Natick, MA and Belvoir Research, Development, and Engineering Center, Ft Belvoir, VA. The primary contractors performing these programs are: Grumman Corp., Bethpage, NY; Engineering, Inc., Hampton, VA; Allied Signal, Inc,, Morristown, NJ; Albany International, Dedham, MA; IITRI, Chicago, IL; Chicago Aerial, Barrington, IL; Georgia Institute of Technology, Atlanta, GA; Stanford Research Institute, Menlo Park, CA; Hughes Aircraft, El Segundo, CA; National Academy of Science, Washington, DC; Caterpillar, Peoria, IL; Deere, Moline, IL; and Southwest Research Institute, San Antonio, TX.

Program Element: **#0602786A**
PE Title: **Logistics Technology** Budget Activity: **#1**

(U) Related Activities:

Program Element #0601102A (Defense Research Sciences)
Program Element #0603001A (Logistics Advanced Technology)
Program Element #0603102A (Materials and Structures Advanced Technology).
Program Element #0603606A (Land Warfare and Barrier Advanced Technology).
Program Element #0602716A (Military Engineering Technology)
Program Element #0603747A (Soldier Support and Survivability)
Program Element #0603804A (Logistics & Engineering Equipment Advanced Development)
Program Element #0603619A (Landmine & Barrier Systems)
Program Element #0604270A (Electronic Warfare Development)
Program Element #0604804A (Logistics & Engineering Equipment Advanced Development)
Program Element #0604713A (Combat Feeding, Clothing and Equipment)
Program Element #0604718A (Physical Security)
Program Element #0604808A (Landmine Warfare/Barrier Engineering Development)
There is no unnecessary duplication of effort within DOD.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0602787A**
PE Title: **Medical Technology** Budget Activity: **#1**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A3AL	Admin & Mgmt — Institute of Chemical Defense (ICD)				
	1655	- 0 -	- 0 -	—	—
A3BL	Admin & Mgmt — U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID)				
	1711	- 0 -	- 0 -	—	—
A3CL	Admin & Mgmt — Walter Reed Army Institute of Research (WRAIR)				
	11404	- 0 -	- 0 -	—	—
A3DL	Admin & Mgmt — Institute of Surgical Research (ISR)				
	1515	- 0 -	- 0 -	—	—
A3EL	Admin & Mgmt — Letterman Army Institute of Research (LAIR)				
	2297	- 0 -	- 0 -	—	—
A3FL	Admin & Mgmt — Institute of Dental Research (IDR)				
	746	- 0 -	- 0 -	—	—
A3GL	Admin & Mgmt — Army Research Institute of Environmental Medicine (ARIEM)				
	1661	- 0 -	- 0 -	—	—
A3HL	Admin & Mgmt — Army Aeromedical Research Lab (AARL)				
	1839	- 0 -	- 0 -	—	—
A3JL	Admin & Mgmt — U.S. Army Biomedical Research & Development Lab (USABRDL)				
	1027	- 0 -	- 0 -	—	—
A825	Combat Maxillofacial Injury				
	2285	2367	2559	Cont	Cont
A870	DOD Medical Defense Against Infectious Diseases				
	11451	22117	23284	Cont	Cont
A871	Medical Biological Defense—Exploratory Development				
	24060	19126	18578	Cont	Cont
A874	Combat Casualty Care Technology				
	8162	10113	10735	Cont	Cont
A875	Medical Chemical Defense—Exploratory Development				
	20868	20840	20425	Cont	Cont
A878	Health Hazards of Military Materiel				
	8069	10340	11270	Cont	Cont
A879	Medical Factors Enhancing Soldier Effectiveness				
	5611	9506	10051	Cont	Cont
PE TOTAL	104361	94409	96902		

Projects A3BL, A3CL, A870, and A871 were formerly managed under PE #0602770A (Military Disease Hazards Technology).

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element funds exploratory development (ED) in Department of Defense (DOD) medical defense against chemical agents, medical defense against biological threats, medical protection against naturally occurring diseases of military importance, and combat dentistry, as well as ED for Department of Army care of combat casualties, health hazard assessment of military materiel, and medical factors enhancing soldier effectiveness. The primary goal of medical research and development is to improve the survivability of U.S. forces on the conventional and integrated battlefields. Under this PE is the

Program Element: **#0602787A**

PE Title: **Medical Technology** Budget Activity: **#1**

core DOD technology base to develop methods and materials for medical chemical defense ED in areas of medical chemical threat protection and antidote/drugs, personnel/casualty decontamination, medical management of chemical casualties, and combat effectiveness/sustainability; research for medical biological defense and the prevention of diseases research including vaccine ED, prophylactic and therapeutic drug ED, arthropod vector repellent ED and the diagnosis/identification of naturally-occurring infectious diseases and/or biological threats; prevention and treatment of combat maxillofacial (face and neck) injuries, and the ED of equipment and materials required to provide essential dental treatment on the battlefield; combat casualty care ED addressing the investigations of trauma and burns due to weapons, shock resulting from blood loss and infection, blood preservation and potential blood substitutes for battlefield care, and the ED of combat medical materiel; and research focusing on the health hazards of military materiel and medical factors to sustain or enhance soldier performance. Requirements are identified in the Joint Chemical-Biological Effects Data Requirements (JCEDAR) of the Joint Chemical Warfare/Chemical/Biological Defense Research, Development Acquisition (CW/CBD RDA) Plan, Mission Area Analysis (MAA), Long Range Research, Development, and Acquisition Plan (LRRDAP), Operational and Organizational (O&O) Plans, Letters of Agreement (LOA), and Letter Requirements (LR). This PE also provides funds for overall administration and management of RDTE,A laboratories. The costs include salary, travel, equipment, and general support of civilian management personnel and their administrative support staffs. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A3AL — Administration and Management for the Institute of Chemical Defense. Effective FY 1990, these resources were transferred to PEs and Projects #0602787/A875 and 0601102/BS11 as a zero sum transfer within the appropriation.

(U) Project A3BL — Administration and Management for the US Army Medical Research Institute of Infectious Diseases. Effective FY 1990, these resources were transferred to this PE, Project A871, as a zero sum transfer within the appropriation. Project A3BL was formerly managed under PE #0602770A (Military Disease Hazards Technology).

(U) Project A3CL — Administration and Management for the Walter Reed Army Institute of Research (WRAIR). Effective FY 1990, these resources were transferred to this PE, Projects A870; A871; A875; A878; A879; and PE #0601102, Projects BS11; BS13; BS14; BS15; and BS16 as a zero sum transfer within the appropriation. Project A3CL was formerly managed under PE #0602770A (Military Disease Hazards Technology).

(U) Project A3DL — Administration and Management for the Institute of Surgical Research. Effective FY 1990, these resources were transferred to this PE, Project A874, and PE #0601102, Project BS14, as a zero sum transfer within the appropriation.

(U) Project A3EL — Administration and Management for the Letterman Army Institute of Research. Effective FY 1990, these resources were transferred to this PE, Project A874 as a zero sum transfer within the appropriation.

(U) Project A3FL — Administration and Management for the Institute of Dental Research. Effective FY 1990, these resources were transferred to this PE, Project A825, and PE #0601102, Project BS16, as a zero sum transfer within the appropriation.

(U) Project A3GL — Administration and Management for the Research Institute of Environmental Medicine. Effective FY 1990, these resources were transferred to this PE, Project A879, as a zero sum transfer within the appropriation.

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PE Title: **Medical Technology** Budget Activity: **#1**

(U) Project A3HL — Administration and Management for the Army Aeromedical Research Lab. Effective FY 1990, these resources were transferred to this PE, Project A879, as a zero sum transfer within the appropriation.

(U) Project A3JL — Administration and Management for the U.S. Army Biomedical Research and Development Lab. Effective FY 1990, these resources were transferred to this PE, Project A878, as a zero sum transfer within the appropriation.

(U) Project A825 — Combat Maxillofacial Injury: This project is the core Department of Defense exploratory development technology base for Combat Dentistry. Its major thrusts are development of new/improved methods and materials for rapid simplified treatment of face and neck wounds and for providing field dental treatment.

(U) FY 1989 Accomplishments:

- **(U)** Optimization of the micro-encapsalution process of antibiotics
- **(U)** A biodegradable bone graft material was optimized in terms particle size
- **(U)** A biodegradable bone fixation device was found effective for the treatment of fractures in a pre-clinical model

(U) FY 1990 Planned Program:

- **(U)** Evaluate improved polymers for bone repair
- **(U)** Further investigation of biodegradable bone fixation device
- **(U)** Collect additional efficacy data on microencapsulated antibiotics

(U) FY 1991 Planned Program:

- **(U)** Screen several candidate formulations of microencapsulated antibiotics for maximal efficacy
- **(U)** Completion of studies of the use of biodegradable splinting devices
- **(U)** Study efficacy of improved antimicrobial impregnated dressings

(U) Project A870 — DOD Medical Defense Against Infectious Diseases: This project funds exploratory development of medical countermeasures to naturally occurring infectious diseases of mission aborting potential. Work performed in laboratories and among troop populations is directed to the prevention, diagnosis and treatment of viral, bacterial and parasitic diseases. Project A870 was formerly managed under PE #0602770A (Military Disease Hazards Technology).

(U) FY 1989 Accomplishments:

- **(U)** Demonstrated that the calcium antagonist penfluridol reversed resistance of P. falciparum to mefloquine, halofantrine and artemisinin in vitro; this finding may lead to an effective regimen for treating malaria in areas where parasite resistance to common antimalarial drugs has been reported
- **(U)** Screened over 800 compounds for antiparasitic activity in several in vitro and in vivo systems; Plasmodium falciparum-in vitro (300 tested, 28 active), P. berghei- mouse (100 tested, 20 active), and visceral leishmaniasis- hamster (over 430 tested, 13 active); these efforts are essential to developing new drugs against parasites of military relevance
- **(U)** Demonstrated that ribavirin inhibits the growth of hepatitis A virus in cell culture, offering the possibility of chemotherapy for this debilitating disease
- **(U)** Demonstrated that baculovirus expressed E glycoprotein of Japanese B encephalitis virus protects mice against lethal challenge and stimulates neutralizing antibody, providing a possible basis for a recombinant flavivirus vaccine against this disease

Program Element: **#0602787A**
PE Title: **Medical Technology** Budget Activity: **#1**

- **(U)** Demonstrated the efficacy of a series of phenyl-substituted piperazines as candidate prophylactic agents against Schistosoma mansoni in mice; schistosomiasis remains a threat to deployment in Northern and Central Africa and in Southeast Asia
- **(U)** Developed a sensitive diagnostic Deoxyribonucleic Acid (DNA) probe for rickettsia suitable for group and species detection (capable of detecting one rickettsia/1000 infected cells); rickettsial diseases are highly endemic in crowded populations around the world and have significantly impacted upon military operations in previous wars

(U) FY 1990 Planned Program:

- **(U)** Evaluate experimental immunogens for malaria and other agents
- **(U)** Continue exploration of usefulness of cytokines
- **(U)** Continue synthesis of antiparasitic drugs
- **(U)** Continue efforts at developing a scrub typhus vaccine

(U) FY 1991 Planned Program:

- **(U)** Advance the infectious disease drug development program with studies on drug metabolism, modes of actions, resistance, molecular biology of infectious agents and their toxins, and the general chemical and cellular mechanisms operative in the immune response
- **(U)** Continue evaluation of the potential of liposomes in drug and vaccine delivery and in immunoregulation
- **(U)** Continue evaluation of the non-specific immune protection afforded by cytokines
- **(U)** Continue to evaluate militarily important infectious disease immunogens designed to accentuate or inhibit various aspects of the immune response

(U) Project A871 — Medical Biological Defense — Exploratory Development: This project funds exploratory research on the development of vaccines and drugs to provide an effective medical defense against known and potential biological agents including viruses, bacteria, and biological toxins. By employing biotechnology, systems will be designed to rapidly identify, diagnose, prevent and treat disease due to biological agents and toxins. Project A871 was formerly managed under PE #0602770A (Military Disease Hazards Technology).

(U) FY 1989 Accomplishments:

- **(U)** Developed enzyme-linked immunosorbent assay (ELISA) methods, based on both monoclonal and polyclonal antibodies, for identification of several non-protein, low molecular weight toxins in clinical samples
- **(U)** Demonstrated that several experimental live vaccine candidates, and candidate recombinant vaccines expressing the protective antigen component of anthrax toxin, were safe and effective; that if the recombinant vaccines were used in combination with an immune enhancer, protection against lethal challenge in experimental models could be provided with only one dose, instead of multiple doses required with the current vaccine
- **(U)** Discovered that calcium is essental for toxicity of the lethal factor component of anthrax toxin, and that compounds that block the calcuim channel protect cells from toxic injury when exposed to the toxin
- **(U)** Evaluated all cumulative antiviral testing data obtained to date and identified over 200 compounds with activity warranting additional screening and development
- **(U)** Determined that the Asian "tiger" mosquito, Aedes albopictus, which recently appeared in the U.S., is capable of transmitting Venezuelan equine encephalitis
- **(U)** Synthesized analogs of tetrodotoxin (from puffer fish) and saxitoxin (marine dinoflagellate) for evaluation as potential vaccine candidates
- **(U)** Discovered the physiological parameters of microcystin, an algal hepatotoxin

Program Element: **#0602787A**
PE Title: **Medical Technology** Budget Activity: **#1**

- **(U)** Developed procedures for the detection of metabolites of T-2 mycotoxin (fungal), some of which have equipotent toxicity, in urine
- **(U)** Demonstrated further the feasibility of oral and respiratory immunization using a live, attenuated vaccine candidate strain of Rift Valley fever virus

(U) FY 1990 Planned Program:

- **(U)** Conduct restructuring of Chemical and Biological Defense programs by transferring the management of selected existing and planned resources and programs from the medical chemical defense research program to the medical biological defense research program. The restructuring actions capitalize on unique technical resources in the neural sciences, which were carefully cultivated, organized and employed in the effort to improve medical defense against the nerve agents, by redirecting these assets to the biological defense program, where they can be utilized for an accelerated program in medical defense against neurotoxic substances of biological origin in response to proliferation of threat biological warfare capabilities
- **(U)** Evaluate appropriate regimens to prevent or protect against disease caused by aerosols of toxins
- **(U)** Develop and evaluate a filovirus antigen and antibody rapid identification system
- **(U)** Refine studies on countermeasures to post-synaptic neurotoxins based on results of previous studies
- **(U)** Continue development of drugs and identification systems for algal toxins
- **(U)** Optimize rapid identification assay for rickettsia
- **(U)** Advance studies on ionophores
- **(U)** Test six antiviral compounds for preclinical toxicology from previous virus screens

(U) FY 1991 Planned Program:

- **(U)** Produce antigens and antibodies by conventional as well as molecular biological techniques as laboratory reagents for the diagnosis and identification of nairoviruses and arboviruses
- **(U)** Explore use of synthetic peptides as antigens in rapid diagnostic tests
- **(U)** Continue drug development and improve identification methodologies for the ionophores
- **(U)** Further exploit developing technologies leading to production of novel vaccine candidates for Q fever and anthrax
- **(U)** Test developed therapeutic or preventive modalities in model systems employing defined toxins and metabolites

(U) Project A874 — Combat Casualty Care Technology: This program funds the core technology base to develop concepts, techniques and material for the treatment and return-to-duty of soldiers wounded in combat. This project addresses the investigation of weapons-induced trauma and burns, and shock due to blood loss. It also funds technologies for blood substitutes and blood preservation.

(U) FY 1989 Accomplishments:

- **(U)** Pre-clinical showed the lack of toxicity and the efficacy of a red blood cell preservative to extend the shelf life of frozen blood post-thaw
- **(U)** A model was developed to study the pathophysiology of penetrating head injuries and ultimately to develop improved therapeutic regimens
- **(U)** The regulatory effects were elucidated for interferon and other endogenous substances and their effect on the body's immune response to prevent infections following trauma

Program Element: **#0602787A**
PE Title: **Medical Technology** Budget Activity: **#1**

- (U) Completion of equipment to support an experiment to be conducted on the Space Shuttle dealing with the healing process in microgravity

(U) FY 1990 Planned Program:

- (U) Examine the interaction between hemorrhage and anesthetics and analgesics appropriate for use in a combat environment
- (U) Clinical trials of a red blood cell preservative to extend the shelf life of frozen blood post-thaw
- (U) Conduct efficacy studies of new drugs effective in promoting wound healing
- (U) Assess the ability of selected drugs to protect the kidney during hemorrhagic shock

(U) FY 1991 Planned Program:

- (U) Evaluate new technologies for battlefield treatment of wounds
- (U) Evaluate new technologies for treatment of burns
- (U) Evaluate new technologies for battlefield blood and fluid replacement

(U) Project A875 — Medical Chemical Defense — Exploratory Development: This exploratory development project emphasizes the prevention of chemical casualties through application of drugs for treatment of the toxic processes of nerve, blister, and blood agents. A majority of the resources applied to this project support exploratory development of prophylaxes and pretreatments, antidotes, decontaminants, and therapeutic compounds that will counteract the lethal, physical, and behavioral toxicity of chemical agents. The remainder supports development of medical chemical defense materiel that insures adequate patient care, field resuscitation, and patient management procedures.

(U) FY 1989 Accomplishments:

- (U) Exploited technology to precisely identify the effects of chemical agents and/or potential medical countermeasures to them
- (U) Continued screening compounds as potential pretreatments, antidotes, or topical skin protectants against chemical agents
- (U) Continued computer assisted drug modeling and initial synthesis of drugs to improve medical countermeasures to chemical agents
- (U) Completed research to develop a family of medical management materiel for use in a chemical environment
- (U) Completed analysis of specific chemical threats to determine operational health and performance risks associated with exposure
- (U) Conducted restructuring of Chemical and Biological Defense programs by transferring the management of selected existing and planned resources and programs from the medical chemical defense research program to the medical biological defense research program. The restructuring actions capitalize on unique technical resources in the neural sciences, which were carefully cultivated, organized and employed in the effort to improve medical defense against the nerve agents, by redirecting these assets to the biological defense program, where they can be utilized for an accelerated program in medical defense against neurotoxic substances of biological origin in response to proliferation of threat BW capabilities

(U) FY 1990 Planned Program:

- (U) Expand work on medical countermeasures against emerging threats
- (U) Identify new and better drugs to counter vesicant and cyanide threat
- (U) Continue efforts to identify safe and effective topical skin protectants for chemical agents

Program Element: **#0602787A**
PE Title: **Medical Technology** Budget Activity: **#1**

- **(U)** Continue performance assessment methodology work at a maintenance level so data base is maintained, methods kept current and data quality assured

(U) FY 1991 Planned Program:

- **(U)** Expand work on medical countermeasures against emerging threats
- **(U)** Continue efforts to identify new and better drugs to counter vesicant and cyanide threat
- **(U)** Continue efforts to identify an effective topical skin protectant for chemical agents
- **(U)** Continue performance assessment methodology work at a maintenance level so data base is maintained, methods kept current, and data quality assured

(U) Project D878 — Health Hazards of Military Materiel: Objective is to sustain warfighting capability by reducing health hazards in the military environment. Emphasis is on identification of health hazards inherent in the engineering design of weapons systems, or associated with Army operations and training. Specific hazards include: steady-state noise, vibration and impacts associated with operation of armored vehicles, helicopters and other systems; blast overpressure and impulse noise generated by weapons systems; toxic hazards from combustion products and exposure to chemical compounds; directed energy sources (laser and microwave); and environmental stress imposed by operating in protective clothing and/or equipment.

(U) FY 1989 Accomplishments:

- **(U)** Expanded the laboratory and field investigations of laser effects on tactical performance of soldiers
- **(U)** Initiated evaluation of blast overpressure and non-auditory effects in man
- **(U)** Investigated eye damage (retinal pathology) due to laser exposure
- **(U)** Continued research into mechanical and toxic hazards of Army systems

(U) FY 1990 Planned Program:

- **(U)** Evaluate hearing protection and communication capabilities for new generation aviator and tracked vehicle helmets
- **(U)** Evaluate new concepts for expansion of laser eye protection to additional critical wavelengths and reduction of performance decrements
- **(U)** Continue research into mechanical and toxic hazards of military systems
- **(U)** Continue research on non-auditory effects of blast overpressure

(U) FY 1991 Planned Program:

- **(U)** Initiate studies on auditory and non-auditory effects of blast overpressure in enclosed spaces using living systems
- **(U)** Explore protective techniques for eye protection from frequency agile laser systems
- **(U)** Utilize battle simulation techniques to determine effects of laser exposure on troop performance
- **(U)** Continue research into mechanical and toxic hazards of military systems

(U) Project A879 — Medical Factors Enhancing Soldier Effectiveness: This project addresses the physiological and psychological factors underlying cognitive and physical performance requirements imposed by military systems and combat operations. The primary emphasis is to prevent combat casualties, ameliorate performance degradation, and sustain unit effectiveness under varying operational environments. Neuropsychiatric and physiological investigations are conducted to identify and quantify environmental stresses, including heat, cold, altitude, isolation, and dehydration. Research is also conducted on sleep and alertness as they pertain to soldiers' work/rest cycles in military operations.

Program Element: **#0602787A**
PE Title: **Medical Technology** Budget Activity: **#1**

(U) FY 1989 Accomplishments:

- **(U)** Studies on the prevention and treatment of combat psychiatric casualties were conducted and focused on field research during major military training operations
- **(U)** Continued studies on sleep and alertness
- **(U)** Studied factors that may help reduce training injuries during soldiers' basic and unit training

(U) FY 1990 Planned Program:

- **(U)** Continue research of high terrestrial elevation disabilities and the efficacy of pharmacological intervention
- **(U)** Continue research efforts on environmental stresses
- **(U)** Continue programs investigating physical fitness requirements, their evaluation and relationship to job performance

(U) FY 1991 Planned Program:

- **(U)** Continue research efforts on nutritional and pharmacological strategies to enhance psychological and military task performance
- **(U)** Continue studies on military performance in environmental extremes
- **(U)** Continue studies on prevention of psychiatric casualties
- **(U)** Continue investigation on soldier performance during continuous and sustained operations
- **(U)** Continue research on exposure to high terrestrial elevations

(U) Work Performed By:

A825 — Institute of Dental Research, Washington, D.C. The two contractors are: Thermedics, Inc., Woburn, MA and Southern Research Institute, Birmingham, AL.

A870 — Walter Reed Army Institute of Research, along with field units in Thailand, Malaysia, Brazil, Kenya, and Korea, the U.S. Army Medical Research Institute of Infectious Diseases, and the U.S. Army Biomedical Research and Development Laboratory perform in-house Army research. The remainder is performed by U.S. Navy field units and by extramural non-profit organizations, universities, and industries. The five major contractors are the University of Georgia, Athens, GA; Sloan Kettering Institute, New York, NY; University of Miami, Miami, FL; Gorgas Memorial Institute of Tropical Medicine, and Preventive Medicine, Inc., Rockville, MD; and Franklin Research Center, Philadelphia, PA.

A871 — The U.S. Army Medical Research Institute of Infectious Diseases, the Walter Reed Army Institute of Research, the U.S. Army Medical Research Institute for Chemical Defense, and the U.S. Army Aeromedical Research Laboratory perform research in-house. The remainder is performed by extramural non-profit organizations, universities, and industries. The major contractors are the University of Miami, Miami, FL; State University of New York, Albany, NY; Southern Research Institute, Birmingham, AL; Scripps Clinic and Research Foundation, La Jolla, CA; and the University of South Carolina, Columbia, SC.

A874 — Letterman Army Institute of Research, Presidio of San Francisco, CA; Institute of Surgical Research, Fort Sam Houston, Texas; Walter Reed Army Institute of Research, Washington, D.C.; U.S. Army Biomedical Research and Development Laboratory, Fort Detrick, MD. The top five contractors are: University of Massachusetts, Worcester, MA; Medical College of Virginia, Charlottesville, VA; University of California at San Diego, CA; Louisiana State Medical Center, New Orleans, LA; Uniformed Services University for the Health Sciences, Bethesda, MD.

Program Element: **#0602787A**
PE Title: **Medical Technology** Budget Activity: **#1**

A875 — In-house research is conducted at the U.S. Army Medical Research Institute of Chemical Defense, Aberdeen Proving Ground, MD; the U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL; the Walter Reed Army Institute of Research, Washington, D.C.; laboratories under the direction of the Naval Medical Research and Development Command, Washington, D.C.; and other government agencies. The remaining research is conducted under contract. Major contractors include: Research Triangle Institute, Research Triangle Park, NC; SRI, Menlo Park, CA; Medical College of Virginia, Richmond, VA; Univ of Michigan, Ann Arbor, MI; and John Hopkins University, Baltimore, MD.

A878 — The U.S. Army Research Institute of Environmental Medicine, Natick MA; U.S. Army Biomedical Research and Development Lab, Ft. Detrick, MD; U.S. Army Aeromedical Research Laboratory, Ft. Rucker AL; Letterman Army Institute of Research, San Francisco, CA; and the Walter Reed Army Institute of Research, Washington, DC. The top five contractors are: EG&G Mason Research Institute, Worcester, MA; ERCI Facilities, Fairfax, VA; Catholic University, Washington, DC; JAYCOR, San Diego, CA; and Los Alamos National Laboratory, Los Alamos, NM.

A879 — The U.S. Army Research Institute of Environmental Medicine, Natick, MA; U.S. Army Aeromedical Research Laboratory, Ft. Rucker, AL; and the Walter Reed Army Institute of Research, Washington DC., The top five contractors are: Konigsberg Instruments, Inc., Pasadena, CA; Universal Energy Systems, Inc., Dayton OH; the University of Minnesota, Duluth, MN; the University of Colorado Health Sciences Center, Denver, CO; and the University of Wisconsin, Madison, WI.

(U) Related Activities:

PE #0601102A, Defense Research Sciences
PE #0602720A, Environmental Quality Technology (DA Proj 835 only)
PE #0603002A, Medical Advanced Technology
PE #0603807A, Medical Systems Advanced Development
PE #0604807A, Medical Materiel/Medical Defense Equipment — Engineering Development

There is no unnecessary duplication of efforts in the Army or DOD programs. Duplication of effort within the Army is avoided through centralized management at the U.S. Army Medical Research and Development Command. This effort is coordinated annually, or more frequently as required, with: Department of Defense, Office of the Deputy Under Secretary of Defense for Research and Advanced Technology; Joint Technology Coordinating Groups of the Armed Services Biomedical Research Evaluation Management Committee; Joint Services Container Steering Group; DOD Executive Agent for Land-Based Water Resources; Program Advisory Group for Bulk Petroleum Fuels Distribution; World and Pan American Health Organizations. Research efforts are also coordinated with Quadripartite, NATO and other cooperative nations through meetings and data exchange agreements.

(U) Other Appropriation Funds: ($ in Thousands) Procurement of completed products is provided for in Other Procurement, Army (OPA), or Operation and Maintenance, Army (OMA) or passed to other procuring agencies as appropriate.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603001A**
PE Title: **Logistics Advanced Technology** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D150 Fuels & Lubricants	1941	2784	2847	Cont	Cont
D242 Airdrop Equipment	1343	1538	1559	Cont	Cont
D244 ATE Language Utilization and Standardization	492	- 0 -	- 0 -		
D543 Ammunition Logistics	3809	4425	3976	Cont	Cont
D594 Metrology and Calibration	655	604	681	Cont	Cont
DJ28 Test Measurement Technology Dev	2126	968	- 0 -	Cont	Cont
PE TOTAL	10366	10319	9063		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program supports development of technology and materiel essential to support and sustain wartime operations and peacetime readiness from both a strategic and tactical point of view. This program funds projects outside of weapon system developments, and its purpose is to develop, demonstrate, and transfer technologies to reduce the logistics burden on the battlefield and improve Logistics System performance. It is necessary because logistics support technology has been unable to keep pace with weapons systems technology. It includes diverse projects linked by broad applications benefitting whole categories of weapons systems and resulting in high return on investment. The Fuels and Lubricants program supports the DOD in development of all petroleum, oil, and lubricants (POL) for ground vehicles and equipment and Army helicopters. Among the program's objectives are a single battlefield fuel by 1995 and reduction of specific lubricants from 50 to three or four. Enhancements to airdrop equipment are required for dropping 60,000 lbs. of cargo from lower altitudes and at higher speed, increasing survivability of aircraft and crews and increasing the probability that materials delivered will land in a usable condition. Metrology and Calibration funds the development of new calibration standards, hardware, and techniques to support increasingly sophisticated Army weapons and Army Test, Measurement and Diagnostic Equipment (TMDE). Automatic Test Equipment (ATE) Language has been integrated into project DJ28, Test Measurement Technology. This integration achieves consistency with the DOD program. The program will reduce operations and support (O&S) costs of weapon systems by increasing the capability to rapidly diagnose and predict failures and by making automatic testing programming faster and more efficient through the use of expert system methodology and standardization of Test Program Sets (TPS). Ammunition Logistics supports weapon system rearm, ammunition management and accountability, explosive ordnance disposal, and exploits emerging technologies and productivity enhancers aimed at quantum improvements to the global logistics support system. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

Program Element: #0603001A
PE Title: **Logistics Advanced Technology** Budget Activity: #2

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D150 — Fuels and Lubricants: This Technology Demonstration program consists primarily of field validation testing of new mobility fuels, alternative fuels, fuel blends, lubricants, greases, and fluids for vehicles and advanced propulsion systems prior to their procurement and introduction into the military supply system. The effort supports an annual $1.8 billion fuel and lubricant procurement for the DOD by the Defense Logistics Agency. Program thrusts are in 3 major areas: combat mobility fuels, lubricants and fluids, and methanol (and other alternative fuels) demonstrations.

(U) FY 1989 Accomplishments:

- (U) Completed initial operational validation testing of JP-8 in ground vehicles/equipment
- (U) Completed final report on methanol-fueled administrative vehicle demonstration testing
- (U) Completed validation of single-package additive stabilizers for diesel fuel
- (U) Completed formulation of fuel simulants for qualifying elastomer tank materials
- (U) Initiated development of accelerated fuel-elastomer testing methodologies
- (U) Completed development of fuel lubricity test for low viscosity fuels

(U) FY 1990 Planned Program:

- (U) Complete JP-8 demonstration program
- (U) Complete initial design for Portable Lubricant Quality Monitor
- (U) Complete final storage stability assessment of NATO F-57 commercial quality gasolines
- (U) Establish interim resolution of filtration-time problem of military jet fuels involving improved filter/separator (F/S) technologies
- (U) Complete development of test fuels for qualification of elastomer/tank materials
- (U) Complete interim accelerated fuel-elastomer testing methodology

(U) FY 1991 Planned Program:

- (U) Complete operational validation testing of JP-8 in ground diesel-fueled vehicles/equipment confirming acceptability for JP-8
- (U) Complete initial design considerations for Portable Combustion Quality Monitor
- (U) Complete fabrication of experimental Portable Lubricant Quality Monitor

(U) Project D242 — Airdrop Equipment: Demonstration of high speed/low altitude airdrop delivery systems for personnel and cargo. Personnel systems will reduce vulnerability during descent. Cargo systems will provide for full utilization of C-17 capability (capacity/air speed) while reducing aircraft and airdrop cargo vulnerability. Both systems will minimize assembly time on the ground by reducing drop zone dispersion.

(U) FY 1989 Accomplishments:

- (U) Constructed and evaluated candidate parachute for Personnel Air Infiltration Device (PAID) to allow transition to full scale development. System will permit personnel air delivery from altitude of 300 feet reducing drop zone dispersion.
- (U) Designed and fabricated candidate parachute releases with the flexibility to accommodate load ranges of 500-60000 pounds. New releases will reduce cargo damage in the drop zone.

(U) FY 1990 Planned Program:

- (U) Develop a high-speed, Low Altitude Container Delivery System for the C-17 aircraft to reduce aircraft and cargo vulnerability.
- (U) Award contract for evaluation of a promising concept of a low altitude Advanced Personnel Recovery System.

Program Element: **#0603001A**
PE Title: **Logistics Advanced Technology** Budget Activity: **#2**

(U) FY 1991 Planned Program:

- **(U)** Demonstrate High Speed Mass Assault Personnel Parachute utilizing actual live airdrop scenarios
- **(U)** Complete development of Low Altitude Container Delivery System for the C-17 and transition to 6.4
- **(U)** Complete evaluation of Advanced Personnel Recovery System and transition to tactical programs (6.4)

(U) Project D244 — Automatic Test Equipment (ATE) Language Standardization: Program restructured into Project DJ28, Test Measurement and Technology Development.

(U) FY 1989 Accomplishments: See FY 1989 Accomplishments for Project DJ28

(U) FY 1990 Planned Program: See FY 1990 Planned Program for Project DJ28

(U) FY 1991 Planned Program: See FY 1991 Planned Program for Project DJ28

(U) Project D543 — Ammunition Logistics: Ammunition (AMMO) Logistics satisfies a critical Army need to support anc sustain wartime operations and peacetime readiness from both strategic and tactical points of view. Projected improvements will enhance weapon system rearm, ammunition management and accountability, Explosive Ordnance Disposal (EOD), and Materials Handling Equipment (MHE), and will exploit emerging technologies and productivity enhancers aimed at quantum improvements to our global logistics support system.

(U) FY 1989 Accomplishments:

- **(U)** Completed concept development and selection for a prototype Ammunition Handling System (CTASS) for the future combat vehicle armament system capable of resupplying large quantities of ammo in a totally integrated weapon/ammo/logistics system
- **(U)** Completed design and initiated fabrication of an Artillery Rearm Module (ARM) for 155mm Field Artillery Projectiles
- **(U)** Completed initial demonstration of Palletized Loading System (PLS) special Ammo Container (AMCON) and Hardware Interface Kit (HIK) for standard containers. HIK will demonstrate ability of a PLS to directly handle standard commercial containers without a flatrack thus improving User operational flexibility
- **(U)** Completed the technical demonstration of the remote water/abrasive jet cutter to improve EOD operations. Initiated the Automated Information Retrieval and Expert System (AIRES) follow-on enhancement to improve EOD soldier safety
- **(U)** Completed Future Armor Rearm System (FARS) concept development, and initiated design of a module in synchronization with Future Tank Program
- **(U)** Initiated definition of the Standard Army Ammunition System-AMMO Transfer Point (SAAS-ATP). This Management Information System (MIS) will improve user ammo management issue and inventory capabilities on the battlefield

(U) FY 1990 Planned Program:

- **(U)** Complete fabrication of Combat Telescoped Ammunition Supply System (CTASS)
- **(U)** Fabricate FARS module and chassis and initiate testing
- **(U)** Complete technical demonstration of ARM for projectile handling to improve rearm operations for the future howitzer
- **(U)** Complete technical demonstration of AIRES EOD enhancement and initiate development of a laser tool to improve EOD operations and safety
- **(U)** Initiate Forward Area Rearm Point (FARP) Materiel Handling Equipment (MHE) demonstration to speed rearm for Apache and Light Helicopter Experimental (LHX) Helicopters

Program Element: #0603001A
PE Title: **Logistics Advanced Technology** Budget Activity #2

- (U) Initiate demonstration of PLS compatible rack with Air Force cargo aircraft to improve interconnectivity and strategic/tactical interfaces with PLS
- (U) Initiate a program to evaluate/improve missile logistic resupply operations and improve payload efficiency of user resupply vehicles. Efforts will investigate the development of a Multi-Use Missile Container (MUMC) for current/future systems
- (U) Award contract to develop prototype hardware and software for Standard Army Ammunition System-AMMO Transfer Point (SASS-ATP)

(U) FY 1991 Planned Program:

- (U) Initiate development of automated propellant handling technologies (Uni-charge liquid propellant, and Standard Solid Propellant)
- (U) Complete system integration and testing of SAAS-ATP
- (U) Complete PLS/cargo aircraft technical demonstration to enhance overall PLS/Logistics System Compatibility
- (U) Complete EOD Laser Tool technical demonstration and initiate Electronic Countermeasure System to improve EOD safety and battlefield capability. This system will provide protection from command detonated explosive devices and could also jam electronic signals for munitions and improvised explosive devices. Currently no such device exist for EOD operations
- (U) Complete testing and system demonstration of FARS with future U.S. tank system
- (U) Design and fabricate prototype Material Handling Equipment (MHE) hardware to improve helicopter rearm operations at the Forward Area Rearm Point (FARP)
- (U) Complete testing and demonstration of Combined Telescoped Ammunition Supply System (CTASS) transition to Future Infantry Fighting Vehicle (FIFV) Advanced Technology Transition Demonstration (ATTD)
- (U) Fabricate and test Multi-Use Missile Container (MUMC) prototypes for improved missile resupply

(U) Project D594 — Metrology and Calibration. The purpose of this project is to develop essential calibration systems to support Army Test, Measurement and Diagnostic Equipment (TMDE) includes the development of primary and se[illegible]ry standards and measurements hardware where improvement is needed to support new te[illegible]ges being introduced by the Army. Project includes development of calibration and repa[illegible]pment prototypes and measurement technology for the field Army, area calibration and repair centers, Army test ranges and proving grounds, research and development centers, and the Army primary standards laboratory. All Army metrology and calibration R&D projects are closely coordinated with the other services to avoid duplication of effort. Areas of special concern, where standards are inadequate or nonexistent include millimeter/microwave and electro-optics technologies which are heavily applied in Army weapon systems either currently under development or already deployed. Systems benefiting include Single Channel Objective Tactical Terminal (SCOTT), Sense and Destroy Armor Projectile (SADARM), Multipurpose Lightweight Missile Terminally Guided Warhead (MLRS-TGW), Fiber Optic Guided-Missile (FOG-M), and others.

(U) FY 1989 Accomplishments:

- (U) Initiated work on direct reading microwave frequency to 60 GHz to support systems including SCOTT, SADARM, etc
- (U) Completed testing on improved detector for microwave systems for increased accuracy of microwave measurement
- (U) Initiated development of national optical standard at 6 microns providing support to emerging fiber optic technology in weapons systems
- (U) Completed aerosol generator for gas mask work

Program Element: **#0603001A**
PE Title: **Logistics Advanced Technology** Budget Activity: **#2**

(U) FY 1990 Planned Program:

- **(U)** Transfer fiber optics detector technology into practical calibration systems for Army communications
- **(U)** Initiate development of 3-5 and 8-14 micron optical detector standards to support electro-optic weapons and communications equipment
- **(U)** Initiate testing of laser beam profile standard to characterize laser range finders and additional laser devices
- **(U)** Complete development of microwave calibration services to 60 GHz to provide full calibration support for Army microwave systems
- **(U)** Complete development of peak pulse power microwave to 60 GHz to support systems including SADARM and MLRS-TGW

(U) FY 1991 Planned Program:

- **(U)** Complete 3-5 micron imaging radiometer development to improve capability of Army Primary Laboratories
- **(U)** Assemble national laser beam profile standard

(U) Project DJ28 — Test Measurements Technology Development: Efforts are to demonstrate technology for increases to Army weapons systems reliability and mission availability by improving the speed, accuracy and reliability of the weapon failure diagnosis as well as failure prognosis. Will exploit technologies such as expert systems, laser vibration, and new test bus. Demonstration of new test techniques where required utilizing Army-wide technology expertise.

(U) FY 1989 Accomplishments:

- **(U)** Continued to incorporate diagnostics requirements in support of the maintenance concepts for future weapons systems
- **(U)** Procured a laser engine analyzer for Red River Army Depot to provide a diagnostic capability for engines and gear boxes to demonstrate suitability of this diagnostic hardware
- **(U)** Initiated an Army Aviator Night Vision Imaging System measurement capability in the field and at the primary laboratory level to permit testing of night vision goggles using a standard calibrateable tester
- **(U)** Initiated tech demo of an expert diagnostic system for use on the AN/TPQ-37 Firefinder Receiver and Exciter group. The system will permit depot personnel to diagnose backplane wiring problems which otherwise can only be resolved by contractor personnel
- **(U)** Demonstrated the transferability of the element test and maintenance bus developed under the Very High Speed Integrated Circuit (VHSIC) program to weapon systems for increased diagnostic capability, increased mission availability and decreased Operation and Support (O&S) costs
- **(U)** Initiated tech demo of a portable compact information delivery system which can host the contents of a weapon or communications system's organizational technical manuals. Will integrate an off-the-shelf hardware system with state-of-the-art available technologies such as artificial intelligence, displays and software/hardware compaction techniques. Will simplify use and effectiveness of the organizational level manuals

Program Element: #0603001A
PE Title: **Logistics Advanced Technology** Budget Activity #2

(U) FY 1990 Planned Program:
- (U) Minimum funds allocated for payroll

(U) FY 1991 Planned Program:
- (U) Unfunded

(U) Work Performed By: In-house efforts will be accomplished by Belvoir Research Development and Engineering Center, Ft Belvoir, VA; Project Manager Ammunition Logistics, Picatinny Arsenal, NJ; Communications-Electronics Command, Fort Monmouth, NJ; Tank Automotive Command, Warren, MI; Electronic Technology and Devices Lab, Ft Monmouth, NJ; Test Measurement Diagnostic Equipment Support Group, Huntsville, AL; Armament Research Development and Engineering Center, Picatinny Arsenal, NJ; Project Manager Test Measurement Diagnostic Equipment, Ft. Monmouth, NJ; Materials Technology Lab, Watertown, MA; Human Engineering Lab, Aberdeen, MD; Ballistics Research Lab, Aberdeen, MD; Natick Research Development and Engineering Center, Natick, MA; Tooele Army Depot, Tooele, UT; Southwest Research Institute, San Antonio, TX; National Institute of Standards and Technology, Gaithersburg, MD. Major contractors are Giordano Associates, Inc., Sparta, NJ; Urdan Industries, Ltd., Israel; Vitronics, Inc., Eatontown, NJ; Advanced Technologies Research, Laurel, MD; American Coastal Industries, Renova, PA; Armament Systems International, Aberdeen, MD; Metric Systems Corp., Ft Walton Beach, FL; Western Design Corp., Irvine, CA and Armold Corp, Roanoke Rapids, NC.

(U) Related Activities:
Program Element #0601002A (Defense Research Sciences)
Program Element #0602624A (Weapons and Munitions Technology)
Program Element #0602786A (Logistics Technology)
Program Element #0603004A (Weapons and Munitions Advanced Technology)
Program Element #0604604A (Medium Tactical Vehicles)
Program Element #0604746A (Automatic Test Equipment Development)
Program Element #0603804A (Logistics and Engineering Equipment Advanced Development)
Program Element #0604746A (Automatic Test Equipment Development)
Program Element #0604804A (Logistics and Engineering Equipment Engineering Development)
Activities coordinated with other Government services and agencies. There is no unnecessary duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable

(U) International Cooperative Agreements: Not Applicable

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603002A**

PE Title: **Medical Advanced Technology** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D807	Industrial Base/Medical Biological Defense Vaccines and Drugs				
	16477	14226	12920	Cont	Cont
D810	Industrial Base/Infectious Disease Vaccines and Drugs				
	2785	3322	3106	Cont	Cont
D819	Field Medical Protection and Human Performance Enhancement — Non-Systems Advanced Development				
	1289	807	2026	Cont	Cont
D840	Combat Injury Management				
	1528	1620	2113	Cont	Cont
D995	Medical Chemical Defense Life Support Materiel — Non-Systems Advanced Development				
	9638	14186	14644	Cont	Cont
PE TOTAL	31717	34161	34809		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element funds non-system advanced development for the DoD Core Vaccine and Drug Program as well as for development of field medical protective devices and combat injury management. These latter two projects focus on diagnostic imaging devices and clinical studies of combat casualty care treatment modalities. Under this program, materials for ballistic and laser eye protection, and for nutrition and soldier performance enhancement are also developed. The DoD Core Vaccine and Drug program—an ATTD equivalent—provides, in accordance with Food and Drug Administration (FDA) regulations, drugs and vaccines for development which are effective protectants, treatments and antidotes against biological agent threats, military disease threats and chemical agent threats. Pilot and standard lots of candidate pharmaceutical-grade drugs, antidotes and vaccines are produced. Medical biological and chemical defense development consists of prophylaxes, pretreatments, antidotes and therapeutics; personnel and patient decontamination; medical management of casualties and sustainment of combat effectiveness. The primary goal of this program is to provide, with minimum adverse effects, maximum soldier survivability and sustainability on the integrated battlefield. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D807 — Industrial Base/Medical Biological Defense Vaccines and Drugs Research conducted in this project focuses on advanced development of safe and effective prophylactic and/or postexposure therapy for soldiers exposed to biological threat agents. Development of the capability to detect the use of and/or to diagnose exposure to biological agents is of utmost concern. To complete the defensive effort, a broad range of technologies involved in the targeting and delivery of drugs and vaccines is evaluated.

(U) FY 1989 Accomplishments:

- **(U)** Designed and tested several laboratory models for Crimean-Congo hemorrhagic fever in order to discover an adequate model for further development and testing of prophylactic and therapeutic measures.

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PE Title: **Medical Advanced Technology** Budget Activity #2

- (U) Designed a radioimmunoassay for rapid diagnosis of saxitoxin (red tide) poisoning and successfully tested it in clinical samples obtained from a naturally-occurring case
- (U) Produced a monoclonal anti-idiotype antibody against the T-2 mycotoxin (fungal) monoclonal antibody and used this antibody to protect mice against T-2 intoxication in the first successful demonstration of this approach with low molecular weight toxins
- (U) Evaluated the kinetics, magnitude and specificities of antibody responses to vaccinia virus in soldier volunteers (after their routine smallpox vaccinations) in support of efforts to develop a new vaccinia immune globulin for treatment of disseminated vaccinia
- (U) Completed preclinical safety testing of a live attenuated Rift Valley fever virus candidate vaccine, and demonstrated that the vaccine was protective against development of clinical disease after challenge with the naturally-occurring virus
- (U) Successfully field-tested rapid diagnostic techniques including recently developed nucleic acid probes, for acute cases of Rift Valley fever in an African outbreak
- (U) Compared human and mouse adapted strains of recombinant vaccinia viruses for their ability to immunize mice against Hantaan virus proteins, and found them comparable

(U) FY 1990 Planned Program:

- (U) Produce a live, nonvirulent vaccine strain of anthrax
- (U) Produce a candidate Q fever recombinant vaccine pilot test lot
- (U) Continue testing of the recombinant Rift Valley fever vaccine
- (U) Continue evaluations of monoclonal antibodies for diagnostic and detection systems

(U) FY 1991 Planned Program:

- (U) Evaluate efficacy of candidate anthrax vaccines
- (U) Transition the recombinant Rift Valley fever vaccine to advanced development (6.3b)
- (U) Test efficacy of candidate recombinant Q fever vaccine and immunomodulators
- (U) Develop in vitro methodology for successful production of human monoclonal antibodies with antiviral properties

(U) Project D810 — Industrial Base/Infectious Disease Vaccines and Drugs. This project funds preclinical development of vaccines and drugs effective against militarily significant infectious diseases affecting mobilization and deployment. These drugs and vaccines result from research in 6.2 on the following diseases: diarrheal diseases, meningitis, infectious hepatitis, typhus fevers, dengue fever, leishmaniasis, and malaria. This project was funded for the first time in FY 1987.

(U) FY 1989 Accomplishments:

- (U) Demonstrated reversal of chloroquine resistance in *Plasmodium falciparum* (malaria)-infected Aotus monkeys by a combination therapy of chloroquine and desipramine, in efforts to develop countermeasures against drug resistant malaria in deployable locales around the world
- (U) Evaluated post infection sera from humans and experimentally infected rabbits and determined that the immunodominant antigen of *Campylobacter jejuni* is flagellin, providing a basis for a vaccine against diarrhea due to *Campylobacter*
- (U) Demonstrated boosting of immunity to a potential malaria (falciparum) vaccine (R32NS181) containing 81 amino acids of a nonstructural protein of influenza A virus using the adjuvant DETOX; this finding suggests that the enhancement of the human immune system by nonspecific means may be critical to the success of a malaria vaccine.
- (U) Completed preclinical safety testing in monkeys of a new hybrid candidate vaccine against diarrheal diseases, currently the leading cause of lost-duty time during deployments; the hybrid is a construct of *Escherichia coli* (K-12)/*Shigella flexneri* (serotype 2a) with aromatic (*aro D*) attenuation to make it safer.

Program Element: **#0603002A**
PE Title: **Medical Advanced Technology** Budget Activity: **#2**

- **(U)** Demonstrated that by encapsulating a synthetic malaria peptide, R32tet32, in (synthetic lipid spheres), that rabbits and monkeys showed increased titer and duration of antibodies, thus opening an avenue for exploration of other malarial vaccines, as well as for synthetic cloned protein antigens of other infectious disease agents; this encapsulated malaria peptide vaccine will be transitioned for safety testing at a Maryland medical school.
- **(U)** Completed a comparative efficacy study of analogs of the Chinese herb qinghaosu (for severe and complicated malaria), arteether and artmether, in a malaria-Aotus monkey model and found them to be equally effective.

(U) FY 1990 Planned Program:

- **(U)** Continue preclinical testing of antiviral vaccine candidates
- **(U)** Evaluate safety and efficacy of antiviral drugs for tropical diseases
- **(U)** Evaluate safety and efficacy of antiparasitic drugs and vaccines

(U) FY 1991 Planned Program:

- **(U)** Conduct preclinical safety trials of candidate drugs and vaccines
- **(U)** Continue studies on novel means of drug and vaccine delivery, such as microencapsulation, for the targeting of drugs to particular cell types or various infectious disease antigens to appropriate components of the immune system

(U) Project D819 — Field Medical Protection and Human Performance Enhancement — Non-Systems Advanced Development: This project supports research and development related to laser eye protective visors for Army aviators and laser/ballistic eyewear for field soldiers, research on sleep and alertness during continuous/sustained operational scenarios, research on methods to enhance soldier performance, and research on Army nutrition systems.

(U) FY 1989 Accomplishments:

- **(U)** Evaluated methods to sustain soldier performance in continuous and sustained operations
- **(U)** Conducted a cold weather ration study
- **(U)** Conducted studies to protect the skin against high energy laser bioeffects

(U) FY 1990 Planned Program:

- **(U)** Evaluate a feeding system for desert operations
- **(U)** Expand skin bioeffects efforts and initiate studies on protection from agile laser sources
- **(U)** Continue evaluating methods to sustain soldier performance in continuous and sustained operations
- **(U)** Incorporate additional two wave length protection into existing laser protective eye wear.

(U) FY 1991 Planned Program:

- **(U)** Evaluate effect of prototype agile laser eye protective devices on soldier performance
- **(U)** Develop nutritional approaches for optimizing military performance during sustained operations
- **(U)** Continue fundamental studies on protective technologies for current and emerging laser threats

(U) Project D840 — Combat Injury Management: This project funds advanced development prototypes of non-system items for management of shock, trauma, and resuscitation, including preclinical testing of large standard lots of candidate compounds, or of equipment, to obtain data necessary for Food and Drug Administration approval for human use.

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(U) FY 1989 Accomplishments:

- (U) Tested efficacy and safety of stroma free hemoglobin (SFH) in a laboratory post-shock model
- (U) A prototype model was constructed of a device that will indicate the depth of a burn wound
- (U) Osteogenin, an endogenous substance, was isolated and shown to have significant ability to stimulate the growth of new bone

(U) FY 1990 Planned Program:

- (U) Design a prototype system to automate the removal of preservatives from thawed frozen blood.
- (U) Pre-clinical testing of a synthetic skin graft material
- (U) Transition the lightweight X-ray system to development

(U) FY 1991 Planned Program:

- (U) Conduct preclinical tests of new drugs for managing hemorrhagic shock
- (U) Complete technical testing of field ultrasound imaging system
- (U) Conduct non-system advanced development of Automated blood cell washing technology
- (U) Complete non-system advanced development of improved therapies for penetrating head injuries
- (U) Conduct non-system advanced development of a drug to promote skin regeneration

(U) Project D995 — Medical Chemical Defense Life Support Materiel: This non-system development project supports the investigation of new antidotes and pretreatment drugs that protect against chemical agents. Analytical and stability studies are performed on advanced pretreatment/treatment compounds. This program also supports the development of prototypes and breadboard models for the development of medical chemical defense devices and materiel. Included is the integration (into one technical demonstration) of all elements of the individual soldier's protective systems for threat agents and battlefield hazards; the Soldier Integrated Protective Ensemble (SIPE) ATTD. This is a cooperative program between the US Army Natick RD&E Center and USA Medical Research and Development Command.

(U) FY 1989 Accomplishments:

- (U) Completed pre-clinical toxicological and pharmacological studies on a second generation nerve agent pretreatment
- (U) Continued evaluation of candidate cyanide pretreatment compounds
- (U) Conducted studies on an enhanced nerve agent antidote with anticonvulsant properties
- (U) Continued final feasibility testing of the performance assessment methodology for predicting militarily significant performance decrements caused by pretreatments and antidotes

(U) FY 1990 Planned Program:

- (U) Conduct pre-clinical pharmacological and toxicological studies on new medical countermeasures to chemical agents to support Food and Drug Administration (FDA) requirements
- (U) Develop drug assays for use in studies required for development of identified medical countermeasures to chemical agents
- (U) Conduct concept development of SIPE integrated protective system to provide balanced protection against multiple battlefield threats. Procure candidate components
- (U) Synthesize scaled-up quantities of candidate chemical agent drugs for preclinical test and evaluation

Program Element: **#0603002A**
PE Title: **Medical Advanced Technology** Budget Activity: **#2**

- **(U)** Complete final feasibility testing of the performance assessment methodology for predicting militarily significant performance decrements caused by pretreatments and antidotes

(U) FY 1991 Planned Program:

- **(U)** Conduct pre-clinical pharmacological and toxicological studies on new medical counter measures to chemical warfare agents (e.g. cyanide pretreatment) to comply with FDA regulations
- **(U)** Develop drug assays required for development of identified medical countermeasures to chemical agents
- **(U)** Synthesize scaled-up quantities of candidate chemical agent drugs for test and evaluation
- **(U)** Develop technology demonstration plan for SIPE integrated protective system to include definition of demonstration performance parameters, development of the demonstration scenario and evaluation of human performance MANPRINT
- **(U)** Fabricate system components for FY 1992 Soldier Integrated Protective Ensemble technology demonstration

(U) Work Performed By:

D810 — Walter Reed Army Institute of Research, Washington, D.C. Naval Medical Research Institute, Bethesda, MD, the remainder is performed by extramural contractors (nonprofit organizations, universities, and industries). The top five contractors are the National Academy of Sciences, Washington, D.C., Herner and Company, Arlington, VA, Research Triangle Institute, Research Triangle Park, NC, SRI International, Menlo Park, CA, and Huntingdon Research Centre, Huntingdon, Cambridgeshire, England

D840 — Letterman Army Institute of Research, Presidio of San Francisco, CA, Institute of Surgical Research, Fort Sam Houston, Texas, Institute of Dental Research, Washington, D.C., U.S. Army Biomedical Research and Development Laboratory, Fort Detrick, MD, Uniformed Services University of Health Sciences, Bethesda, MD, Institute of Dental Research, Washington, D.C., University of Washington, Seattle, WA, University of Wisconsin, Milwaukee, WI

D819 — Walter Reed Army Institute of Research, Washington DC, U.S. Army Research Institute of Environmental Medicine, Natick, MA, Letterman Army Institute of Research, Presidio of San Francisco, CA, Louisiana State University and the Naval Air Development Center, Warminster, PA.

D807 — US Army Medical Research Institute of Infectious Diseases, Ft. Detrick, MD, Naval Medical Research Institute, Bethesda, MD, Walter Reed Army Institute of Research and U.S. Army Medical Research Institute for Chemical Defense; the remainder is performed by extramural contractors (nonprofit organizations, universities, and industries). The top five contractors are the Southern Research Institute, Birmingham, AL; Utah State University, Logan, UT; Technassociates, Rockville, MD; the National Academy of Sciences, Washington D.C.; and the Naval Research Laboratory, Washington, D.C.

D995 — In-house research is performed by Walter Reed Army Institute of Research, Washington, D.C.; U.S. Army Medical Research Institute of Chemical Defense, Aberdeen Proving Ground, MD, U.S. Army Aeromedical Research Laboratory, Ft. Rucker, AL; U.S. Army Research Institute of Environmental Medicine, and Natick Research, Development and Engineering Center, Natick MA; Naval Medical Research Institute, Bethesda, MD; Uniformed Services University of Health Sciences, Bethesda, MD; U.S. Air Force laboratories; and various other government laboratories. The five top contractors are: Associate Consultants, Washington, DC; Ash

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Stevens, Detroit, MI; University of California San Francisco, CA; Herner and Co., Arlington, VA; Eagle-Picher, Lenexa, KS

(U) Related Activities:

Program Element #0601102A, Defense Research Sciences
Program Element #0602720A, Enviromental Quality Technology (DA Proj 835 only)
Program Element #0602787A, Medical Technology
Program Element #0603807A, Medical Systems Advanced Development
Program Element #0604807A, Medical Materiel/Medical Defense Equipment — Engineering Development

There is no unnecessary duplication of efforts in the Army or DOD programs. Duplication of effort within the Army is avoided through centralized management at the U.S. Army Medical Research and Development Command. This effort is coordinated annually, or more frequently as required, with: Department of Defense, Office of the Deputy Under Secretary of Defense for Research and Advanced Technology; Joint Technology Coordinating Groups of the Armed Services Biomedical Research Evaluation Management Committee; Joint Services Container Steering Group; DOD Executive Agent for Land-Based Water Resources; Program Advisory Group for Bulk Petroleum Fuels Distribution; World and Pan American Health Organizations. Research efforts are also coordinated with Quadripartite, NATO and other cooperative nations through meetings and data exchange agreements.

(U) Other Appropriation Funds: ($ in Thousands) Procurement of completed products is provided for in Other Procurement, Army (OPA) or Operation and Maintenance, Army (OMA) or passed to other procuring agencies as appriate.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0603003A
PE Title: **Aviation Advanced Technology** Budget Activity #2

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D312 Nap of-the-Earth Aviation and Navigation Equipment	429	· 0 ·	· 0 ·	· 0 ·	15618
D313 Research Aircraft Systems	1789	1195	1299	Cont	Cont
D435 Aircraft Weapons	3903	6253	6031	Cont	Cont
D436 Rotary Wing Controls & Rotors	4024	7593	9682	Cont	Cont
D447 Aircraft Demonstration Engines	6530	4529	7124	Cont	Cont
DB34 Rotorcraft System Integration Simulator (RSIS)	3570	3094	3005	Cont	Cont
DB39 Flight Simulators Components	1094	854	866	Cont	Cont
DB41 Advanced Structures	1059	· 0 ·	· 0 ·	· 0 ·	· 0 ·
DB72 Aircraft Propulsion Components	3966	4109	2506	· 0 ·	86767
DB97 Aircraft Avionics Equipment	5580	3887	4200	Cont	Cont
PE TOTAL	31944	31514	34713		

B. (U) BRIEF DESCRIPTION OF ELEMENT: Modern Army aircraft face an awesome array of air defense threats which include optically and radar-equipped 23mm and 30mm air defense guns, SA-11, -13, -14 and -15 infrared and radar-guided missiles; and potential nuclear/biological/chemical and laser threats directed and delivered from both the ground and air vehicles. As a result, the aircraft must possess improved mobility, agility, firepower, and inherent features to include durability and sustainability for extended periods of combat at an affordable cost. Army aircraft must be durable, damage tolerant, easy to repair and maintain, and possess the highest level of availability possible. The application of fiber-optic technology to flight control components, and advanced rotor technology to existing and proposed rotor systems, as well as the development of advanced weapons and fire control, advanced engines and drive trains, advanced simulation technology and advanced avionics are the keys to providing reliable, survivable Army aircraft essential to the future integrated battlefield. This Program Element (PE) provides for the advanced development, integration, and demonstration of full-scale advanced technology components and subsystems. Emphasis is placed on ballistically tolerant material; electronic hardware to enable day/night, adverse weather aviation operations (avionics); advanced propulsion systems (engine and drive train) for improved mobility, agility, reduced weight/cost and fuel consumption; and advanced flight controls for reduced weight and cost, improved survivability, and reduced pilot workload, and initial training requirements. The efforts to be accomplished under this PE will be a significant part of the technology base for establishing criteria and specifications for block improvements to the existing fleet as well as providing the needed technology for the next generation Army aircraft of the mid-to-late 1990s and beyond. Selected near term advances may be applied to aircraft such as the UH-60 Blackhawk and AH-64 Apache as block improvements. This program provides the technology thrusts that are essential if Army aviation is to continue to effectively contribute to the Air-Land Battle of the 1990s and into the 21st century. Major thrusts of this program are the demonstration of an integrated cockpit utilizing advanced simulation technology;

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PE Title: **Aviation Advanced Technology** Budget Activity: **#2**

advanced flight controls, improved handling qualities, avionics, weaponization, and power plants, all of which are required to improve aircraft effectiveness and survivability. This PE also supports the Integrated High Performance Turbine Engine Technology (IHPTET) Program Department of Defense (DOD), National Aeronautics & Space Administration (NASA) and Defense Advanced Research Projects Agency (DARPA) initiative to support the development of technology for aircraft and missile power plants. The goal of this program is to demonstrate technology around the turn of the century which would double current propulsion system capability for a wide range of potential aircraft and missile applications. These demonstration programs represent investments in technology to maximize Army aviation's future capability to perform its combat mission. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D312 — Nap-of-the-Earth Aviation and Navigation Equipment: The objective of this project is to evaluate the use of voice interactive technology for performing communications, navigation and target handover functions tc reduce crew workload and maximize the pilot's visual attention outside the cockpit. Evaluation will be made in two Concept Evaluation Programs (CEP) by the Aviation Test Board at Fort Rucker, Alabama

(U) FY 1989 Accomplishments:

- (U) Trained crew for CEP 2 test to be conducted under Project DB97 in FY 1989
- (U) Terminated project and incorporated results into the Automated Battle Management Center (ABMC) in Project DB97 of this PE in support of CEP 2

(U) FY 1990 Planned Program: None

(U) FY 1991 Planned Program: None

(U) Project D313 — Research Aircraft Systems: This program provides Army support to a joint research program conducted with the National Aeronautics and Space Administration (NASA). Operational support is given in the area of advanced research in rotary winged aircraft

(U) FY 1989 Accomplishments:

- (U) Continued structural and balance development of the Large Rotor Test Apparatus (LRTA); initiated motor procurement. When the LRTA is operational in FY 1991, the LRTA will be used to wind tunnel test large scale, if not full scale, helicopter rotor blades
- (U) Conducted a comprehensive airloads and acoustics testing of the UH-60

(U) FY 1990 Planned Program:

- (U) Complete structural and balance development of the LRTA and continue motor development
- (U) Complete comprehensive airloads and acoustics testing of the UH-60. Data will be used to assist in aircraft accident investigations and in product improvement program evaluations for UH-60 size helicopters

(U) FY 1991 Planned Program:

- (U) Complete and integrate Motor development for the LRTA
- (U) Initiate development of an advanced variable stability research helicopter as a means of providing rotorcraft greater maneuverability

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PE Title: **Aviation Advanced Technology** Budget Activity: **#2**

(U) Project D435 — Aircraft Weapons: This project provides for the advanced development of aircraft weaponization technologies utilizing an integrated system approach to address the voids and deficiencies identified in the Army Aviation Mission Area Analysis and the US Army Training and Doctrine Command (TRADOC) Battlefield Development Plan (BDP)

(U) FY 1989 Accomplishments:

- (U) Conducted Air-to-Air (ATA) fire control flight test evaluation. Results of this demonstration coupled with the Integrated ATA Weapon (INTAAW) program provided the technology required for accurate automatic cannon fire in both ATA and air-to-ground applications. Data from these demonstrations will be a significant input to the ATA Mission Equipment Package/Weapons Development (AAMWD) Technology Demonstration (TD)
- (U) Completed the Hydra 70 flechette warhead demonstration. Data will be used in the AAMWD TD and made available to Army aircraft project managers
- (U) Completed the AAMWD TD formulation

(U) FY 1990 Planned Program:

- (U) Initiate the AAMWD TD trade-off analysis
- (U) Continue the INTAAW Demonstration preparation activities

(U) FY 1991 Planned Program:

- (U) Complete the AAMWD TD analysis and initiate detail design. Complete the AAMWD TD in FY 1994. Complete the INTAAW Demonstration and input data input into the AAMWD TD

(U) Project D436 — Rotary Wing Controls and Rotors: The objective of this project is to develop and demonstrate rotary wing rotors and control technology to provide enhanced helicopter control capability, increased maneuverability and agility, with reduced vibration, maintenance and vulnerability. Provides for rotor capable of high thrust/movement. Provides for the development of simulation capability to evaluate combined aircraft, control, and crew performance, (Crew Station R&D Facility, CSRDF).

(U) FY 1989 Accomplishments:

- (U) Performed simulations to establish aircraft/crew integration measures of effectiveness
- (U) Completed flight testing of the optical Integrated Inertial Sensor Assembly (IISA) aboard the Advanced Digital/Optical Control System (ADOCS) aircraft
- (U) Completed the fiber optic position transducer program testing
- (U) Conducted preliminary assessment of advanced rotor concepts and combat requirements for High Maneuverable/Agility Rotor Control System (HIMARCS)
- (U) Established a program for a Rotorcraft Pilots Associate (RPA) Advanced Technology Transition Demonstration (ATTD) which utilizes data from the Day/Night/Adverse Weather Pilotage (D/NAPS) TD
- (U) Began program planning of the Rotorcraft Pilot's Associate (RPA) ATTD

(U) FY 1990 Planned Program:

- (U) Perform full-combat mission simulations
- (U) Complete joint Army/NASA/Air Force Simulator motion sickness research
- (U) Conduct evaluation of the advanced rotor/control study results
- (U) Complete the mission/functional analysis and the preliminary design for the D/NAPS TD

(U) FY 1991 Planned Program:

- (U) Integrate the Crew Station Research and Development Facility (fixed base simulator) with the Rotorcraft System Integration Simulator (motion base simulator)

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PE Title: **Aviation Advanced Technology** Budget Activity #2

- (U) Initiate the detailed design, full mission simulation and ground based integration for the D/NAPS TD
- (U) Conduct an evaluation of the rotor/controls available for HIMARCS and design guides for the integration of HIMARCS type technology on Army rotorcraft

(U) Project D447 — Aircraft Demonstration Engines The objective of this project is to competitively perform design, fabrication, and test of advanced technology engines and integrated components to validate achievable improved performance levels for engineering development for current and future DOD aircraft emphasizing Army unique requirements

(U) FY 1989 Accomplishments:

- (U) Completed the Multi-Purpose Small Power Unit (MPSPU) advanced development
- (U) Completed the preliminary design of the Joint (Army Navy, AF) Turbine Advanced Gas Generator (JTAGG) program and initiated the JTAGG hardware development program
- (U) Published final report on ground and flight tests of adaptive fuel control

(U) FY 1990 Planned Program:

- (U) Conduct user and depot maintainability demonstrations for the Multipurpose Small Power Unit (MPSPU)
- (U) Complete MPSPU program
- (U) Complete JTAGG component design and initiate fabrication
- (U) Initiate initial JTAGG compressor tests

(U) FY 1991 Planned Program:

- (U) Complete initial gas generator design for JTAGG and conduct in-service review
- (U) Complete initial JTAGG component tests
- (U) Revisions of JTAGG component designs initiated
- (U) Complete assembly of JTAGG gas generator and initiate testing

(U) Project DB34 — Rotorcraft System Integration Simulator (RSIS): This project provides for development of an advanced rotary winged aircraft simulator facility by expanding the capabilities of the NASA Vertical Motion Simulator (VMS) in order to reduce costs and development time on new rotorcraft.

(U) FY 1989 Accomplishments:

- (U) Completed the development of the Advanced Cab and Visual System and initiated integration on the advance Vertical Motion System
- (U) Initiated the upgrade of the motion systems visual field-of-view to upgrade the total Vertical Motion Simulator
- (U) Continued development of the AH-64 math model and developed the extended visual system data base for simulation

(U) FY 1990 Planned Program:

- (U) Continue the visual system improvements and development of the extended visual system data base
- (U) Complete enhancement of the attack helicopter high fidelity simulation capability

(U) FY 1991 Planned Program:

- (U) Complete development of the extended field-of-regard system for the motion simulator
- (U) Integrate the enhanced integrate simulation capabilities with the Crew Station Research and Development Facility

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PE Title: **Aviation Advanced Technology** Budget Activity: **#2**

(U) Project DB39 — Flight Simulator Components: This project provides for the development and demonstration of advanced flight simulation techniques and components for incorporation into the design of future simulators and for improving training capabilities of current simulators.

(U) FY 1989 Accomplishments:

- (U) Completed incorporation of Ada computer language on the Army flight simulator for demonstration and evaluation of real time simulation in the Ada programming environment

(U) FY 1990 Planned Program:

- (U) Initiate Technology development for a system to rapidly reconfigure computer generated imagery. The system could be used to improve proficiency of Army aviators and combat vehicle crews

(U) FY 1991 Planned Program:

- (U) Establish an initial rapidly reconfigurable data base capability together with standard transform enabling users to access a tri-service standard simulator data base

(U) Project DB41 — Advanced Structures: The objective of this project is to develop and demonstrate the application of new materials and design configurations to rotorcraft structures to include the airframe, rotor systems and related structural components. Through these applications, reduced cost and weight of structural components can be achieved while improving related military characteristics such as reliability, maintainability, and survivability

(U) FY 1989 Accomplishments:

- (U) Completed the Advanced Composite Airframe Program (ACAP) Avionics flight test evaluation
- (U) Completed the final reports and evaluation of ACAP militarization test

(U) FY 1990 Planned Program: None

(U) FY 1991 Planned Program: None

(U) Project DB72 — Aircraft Propulsion Concepts: This project provides for improved propulsion components (including drive systems, thrust devices, transmissions, and test rigs) to increase self-deployability, increase range, improve payloads, and increase Air-to-Air agility of Army aircraft

(U) FY 1989 Accomplishments:

- (U) Completed the component design for the Advanced Rotorcraft Transmission Program

(U) FY 1990 Planned Program:

- (U) Initiate the fabrication and testing of components for the Advanced Rotorcraft Transmission Program for reduced vibration and noise
- (U) Complete wind tunnel tests of vectored thrust ducted propeller (VTDP) component research for compound helicopter auxiliary thrust

(U) FY 1991 Planned Program:

- (U) Conduct the full scale testing of transmission components for the Advanced Rotorcraft Transmission Program

(U) Project DB97 — Aircraft Avionics Equipment: This project supports a phased series of advanced, integrated avionics engineering and troop/technology demonstrations. Evolving concepts in avionics, to include high levels of automation and cockpit integration, to be merged and demonstrated in specially integrated avionics/electronics aircraft

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PE Title: **Aviation Advanced Technology** Budget Activity **# 2**

(U) FY 1989 Accomplishments:

- **(U)** Planning completed, hardware purchased, and software prepared for the NUH-60 STAR testbed aircraft in preparation for Integrated Communications Navigation, Identification Avionics (ICNIA) Advanced Development Model (ADM) flight test. ICNIA ADM delivered and Army advanced development effort of ICNIA completed. ICNIA ADM flight test initiated. ICNIA ADM flight test program will be completed in FY 1990
- **(U)** Initial flight testing of the Advance Digital System Heads-Up Displays, SITAN Navigation Algorithm, Emitter Locator, Digital Map Generator operator interface and data loader/mission planner performed as part of Concept Formulation Process (CEP) 2 test support. CEP 2 completed in FY 1989
- **(U)** Functional requirements defined and design completed for a Command and Control (C^2) Tactical Aviation Command (TAC) Post
- **(U)** Conducted a Congressionally directed study of risk reduction efforts associated with the application of the common Integrated Electronic Warfare System (INEWS) system to the Light Helicopter Experimental (LHX) platform

(U) FY 1990 Planned Program:

- **(U)** Complete CEP 3 in a JOH-58C. Will provide the company commander with a digitally based, tactical situation/map display, integrated with an improved digital data transmission system for aviation command and control
- **(U)** Complete bench testing of C^2 or TAC Post hardware and software. Install hardware in a UH-60 testbed aircraft. Initiate flight testing of TAC Post system
- **(U)** Conduct and complete ICNIA ADM flight test including assessment of reconfiguration modes, integration into multi-processing architecture, voice control, level automation, and USAF antennas will be conducted and completed. Technology will then be made available to the Light Helicopter Family (LHX) PM for use in LHX development

(U) FY 1991 Planned Program:

- **(U)** Integrate the Battalion Tactical Operations Center (TOC) with Battalion TAC Post in a UH-60 test bed aircraft to ensure that the ground C^2 component (TOC) and the aviation C^2 component (TAC) are compatible
- **(U)** Initiated CEP 4 initiated to evaluate aviation command and control concepts at the battalion level and below
- **(U)** Awarded contract for a miniature airborne Global Positioning System (GPS) which will be an order of magnitude lower in size, weight, and cost than a conventional airborne GPS receiver. Miniature GPS will be made available when developed in FY 1994 to the AH-64 Apache and UH-60 Blackhawk PMs for potential use on those aircraft

(U) Work Performed By: Contractual efforts are performed by: General Electric Simulation and Training and Control System Department, Daytona Beach, FL; and Honeywell Training and Control Systems Operations, West Covina, CA; Franklin Research Center, Philadelphia, PA; Feinstein Construction, San Francisco, CA; General Electric Company, Lynn, MS; Pratt & Whitney Aircraft, West Palm Beach, FL; TRW, San Diego, CA; ITT, Nutley, NJ; Texas Instruments, Dallas, TX; Bell Helicopter Textron, Fort Worth, TX; Boeing Helicopter Company, Philadelphia, PA; Sikorsky Aircraft, Stratford, CT; General Dynamics, Pomona, CA; McDonnell Douglas Helicopters, Mesa, AZ; Honeywell, Minneapolis, MN; and Grumman Aerospace Corp., Bethpage, NY. In-house developers of the technology under this program element include: Project Manager, Training Devices, Orlando, FL; and US Army Aviation Systems Command, St. Louis, MO; Avionics R&D Activity, Ft. Monmouth, NJ; Aviation Research & Technology Activity, Moffett Field, CA; Aerostructures Directorate, Hampton, VA; Aeroflightdynamics Directorate, Moffett Field, CA; Propulsion Directorate,

Program Element: **#0603003A**

PE Title: **Aviation Advanced Technology** Budget Activity: **#2**

Cleveland, OH; and the Aviation Applied Technology Directorate, Ft. Eustis, VA. Work related activities is also performed by the National Aeronautics and Space Administration (NASA).

(U) Related Activities: Close liaison is maintained with other Services, other Army laboratories, and industry to ensure that there is no duplication of effort. As part of that coordination, the Army participates on and with the following groups, organizations, and programs: the Department of Defense Tri-Service Joint Technical Coordination Group for Munitions Development; Acoustical Society of American Standards, Committee on Acoustics and Noise; Air Standardization Coordination Committee, Working Party 10; Advisory Group for Aerospace Research and Development; the Military Agency for Standardization, Aircraft Instruments and Aircrew Stations Working Group, North Atlantic Treaty Organization Air Armament Working Party, the Joint Integrated Avionics Working Group (JAWG), Integrated Communications Navigation, Identification Avionics, the Integrated High Performance Turbine Engine Technology (IHPTET), and the Air Standardization Coordinating Committee of NATO. This participation enables the gathering of technical information and assets in determining the joint use and standardization of airborne weaponization items. The Army Development Committee (AMRAD), an organization within the Office of the Secretary of Defense, functions to establish Joint Service requirements and the development of air munitions. Related concept exploration is conducted under PE #0602211A (Aviation Technology) and full scale development under PE #0604801A (Aviation Engineering Development) and PE #0604202A (Aircraft Weapons). An important element of the coordination on-going is the Memorandum of Agreement (MOA) which exists with the Air Force between the US Avionics R&D Activity (AVRADA) and Air Force Wright Aeronautical Laboratories. Under that MOA, AVRADA is responsible for participation as an active member in the Integrated Communications, Navigation and Identification Avionics Program (ICNIA).

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0603004A

PE Title: **Weapons and Munitions Advanced Technology**

Budget Activity: #2

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D155	Liquid Propellant Guns/Ammunition Systems				
	15468	11260	7026	- 0 -	
D223	Combat Vehicle Anti-Armor				
	16449	10642	5665	Cont	Cont
D439	Advanced Armaments Tech Demonstrations				
	42703	40166	8029	Cont	Cont
DL09	Advanced Field Artillery System (AFAS) Tech Demo				
	3114	14563	12751	Cont	Cont
PE TOTAL	77734	76631	33471		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The overall objective of this Program Element (PE) is to demonstrate technology maturity for application to advanced munition and weapon major systems or subsystems that will increase battlefield lethality and effectiveness. The effort is subdivided into the following three categories: (1) Gun Propulsion, (2) Combat Vehicle Anti-Armor Munitions, and (3) Smart and Conventional Munitions including fuzing and related weapon platform components. The key objectives of gun propulsion efforts are to greatly enhance lethality by providing increased range, higher muzzle velocities, reduced logistics burden, and improved producibility and survivability. Advanced technologies to be pursued include Liquid Propellant (LP), the insensitive UNICHARGE, Electromagnetic/Electrothermal (EM/ET) Propulsion, the Advanced Tank Cannon (ATAC) Main Armament System, Multi-Option Fuze for Artillery (MOFA), and Insensitive Munitions for the Bradley Fighting Vehicle (BFV). The objective of the LP effort is to demonstrate the capability of liquid propellant systems to provide enhanced field artillery cannon performance at extended ranges and increased survivability, while reducing logistics burdens associated with conventional solid propellant systems. This program provides technology development and demonstration of a brassboard 155mm Regenerative Liquid Propellant (RLPG) gun/ammunition system. The insensitive UNICHARGE also for potential field artillery application will provide the following advantages: (1) be compatible with automated loading and firing; (2) interface with ammunition resupply and loading; (3) reduce complexity and enhance on-board stowage capacity; (4) simplify zoning with equal modules; (5) reduce propellant vulnerability; (6) reduce costs of load, assemble, and pack (LAP) and simplify logistics; and (7) eliminate the waste of unused propellant. EM/ET Propulsion offers the potential of hypervelocity ($>$ 2km/sec) to increase probability of hit and kill, increased survivability, and reduced logistics burden. Technical progress in these programs will provide the basis for an FY92 decision on the technology to be used in the cannon for the Advanced Field Artillery System (AFAS). The ATAC program offers improved lethality by increased operational capability. Combat vehicle anti-armor munition efforts support the Army Close Combat Mission Area by increasing the lethality of direct and indirect fire anti-tank systems with improved warheads and projectiles. The objectives are to develop and demonstrate the capability to defeat threat armor with kinetic energy projectiles and shaped charge warheads. The objective will be achieved by (1) exploiting emerging shaped charge and kinetic energy projectile technology in high performance anti-armor munitions; (2) demonstrating enhanced lethality munitions in full-scale ballistic tests against advanced armors; (3) providing design guidelines to the user community for advanced technology anti-armor weapons/munitions. (The majority of these activities will be performed within the context of the Joint Defense Advanced Research Project Agency (DARPA)/Army/USMC Armor/Anti-Armor Program). Conventional munition technology will be demonstrated to obtain increases in lethality, range, increased survivability, and improved rate of fire. In addition, cannon, fire control, and automated ammunition handling and loading components subsystems will be demonstrated to provide faster, more accurate firing for artillery, anti-armor, and gun air defense munitions as

Program Element: **#0603004A**

PE Title: **Weapons and Munitions Advanced Technology** Budget Activity: **#2**

well as the Bradley Fighting Vehicle. Funding in this PE also includes efforts in support of the ATAC Main Armament System demonstration responding to FY 1989 Congressional language for MIAI Block III development. In FY 1990 and FY 1991 threat materiel acquisition/exploitation has been programed in Program Element #0605709A/DC28 and will be executed upon authorization/appropriation. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D155 — Liquid Propellant (LP) Guns/Ammunition Systems: The objective of the Liquid Propellant (LP) effort is to demonstrate the capability of liquid propellant systems to provide enhanced weapon performance at extended ranges and increased survivability, while reducing logistics burdens associated with conventional solid propellant systems. This program provides technology development and demonstration of a brassboard 155mm Regenerative Liquid Propellant (RLPG) gun/ammunition system. In a preliminary life cycle evaluation of Liquid Propellants conducted by Army Agencies, many system benefits were identified and included the following: (1) in production, critical raw materials are not required; (2) environmentally undesirable by-products are not generated; (3) since the proposed production process is easily automated using commercially available equipment, the costs of both facility and propellant are significantly less than comparable solid propellants; (4) liquid propellants require less volume in storage and transportation; (5) current liquid propellant candidates are not easily ignited by accident or by munition impact and do not release energy rapidly under such conditions; (6) autoloader design will be simplified; (7) rate of fire increases since only the projectile will be handled mechanically; (8) potential ballistic improvements; (9) soft launch for acceleration sensitive projectiles.

(U) FY 1989 Accomplishments:

- **(U)** Finalized design and initiate fabrication of 2nd Generation 155mm RLPG
- **(U)** Conducted safety/vulnerability test of packaged LP
- **(U)** Continued LP logistics studies
- **(U)** Demonstrated maximum charge in 1st Generation 155mm RLPG

(U) FY 1990 Planned Program:

- **(U)** Complete fabrication of 2nd Generation 155mm Regenerative Liquid Propellant Gun (RLPG)
- **(U)** Initiate fabrication of Liquid Propellant (LP) Hydroxyl Ammonium Nitrate (HAN) modular cell
- **(U)** Complete logistics studies

(U) FY 1991 Planned Program:

- **(U)** Demonstrate LP (HAN) production by modular cell process
- **(U)** Conduct Liquid Propellant technology demonstrations of 155mm hardstand-mount RLPG vs 155mm Unicharge demonstration for downselect for Advanced Field Artillery System (AFAS) Advanced Technology Transition Demonstration (ATTD)
- **(U)** Burst fire 155mm 2nd Generation RLPG
- **(U)** Demonstrate maximum range capability

(U) Project D223 — Combat Vehicle Anti-Armor: This project exploits anti-armor concepts and technologies and demonstrates enhanced lethality, anti-armor chemical, and kinetic energy penetrator munitions capable of defeating projected threat armored vehicles. This project, along with funds

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PE Title: **Weapons and Munitions Advanced Technology** Budget Activity: #2

in PE #0603005A/D221, constitutes the Army's contribution to the joint Defense Advanced Research Project Agency (DARPA)/Army/Marine Corps Armor/Anti-Armor Program (A3).

(U) FY 1989 Accomplishments:

- (U) Provided funding to DARPA per Joint A3 Memorandum of Understanding (MOU)

(U) FY 1990 Planned Program:

- (U) Provide funding to DARPA per Joint A3 MOU

(U) FY 1991 Planned Program:

- (U) Provide funding to DARPA per Joint A3 MOU
- (U) Initiate development of advanced top attack warheads
- (U) Initiate development of multi-target lethal mechanism for long range smart weapons
- (U) Transition technologies from Joint A3 program

(U) Project Project D439 — Advanced Armaments Technology Demonstrations: This project provides for technology demonstrations of high payoff armament components to include warheads, fuzes and munitions, and weapon platforms. The Advanced Tank Cannon (ATAC) Main Armament System will provide a "leap ahead-stay ahead capability" that will defeat current and future Soviet tanks. Congress provided $17.234 million in FY 1989 to support the ATAC Main Armament System. The remaining resources in FY 1989 were in support of a classified program. In FY 1990 Low Vulnerability Ammunition (LOVA) propellant for XM919 25MM Kinetic Energy (KE) ammunition will be demonstrated and transitioned to a Bradley Fighting Vehicle Product Improvement Program. Insensitive energetic materials for Shaped Charge (SC) and Explosively Formed Penetrator (EEP) warheads will be developed for demonstration in FY 1993 leading to product improvements of: Tube-Launched Optically-Tracked, Wire-Guided Missile (TOW), Hellfire, Non-Line of Sight-Fiber Optic Guided Missile (NLOS-FOGM), Sense and Destroy Armor Projectile (SADARM), Advanced Anti Tank Weapons Systems-Medium (AAWS-M), and Smart Target Activated Fire and Forget (STAFF). Multi-Option Fuze, Artillery (MOFA) will be developed and demonstrated in FY 1992. MOFA will provide all required functions for present (hand set) as well as future automated (autoset) artillery.

(U) FY 1989 Accomplishments:

- (U) ATAC Main Armament
  - Finalized propulsion system design and completed armament system mockup
  - Designed and fabricated stabilization and ballistic modifications for fire control computer and loader transfer mechanism
  - Integrated automatic muzzle reference system, modified/developed software to: improve ballistics solutions; allow fire control to communicate with the automatic loader; and provide for automatic return of breech to loading position
  - Modified M1/M1A1 tank turret for integration of gun system components
  - Initiated design of two piece cartridge including propellant, ignition system, cartridge case, and integrated Kinetic Energy (KE) warhead
- (U) Autonomous Precision Guided Projectile
  - Provided Army contribution to NATO MOU for cooperative development under Nunn amendment
  - Continued component development and projectile integration, and transitioned program to proof-of-principle

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(U) FY 1990 Planned Program:

- **(U)** ATAC Main Armament
  - Install ATAC cannon/mount/fire control/auto loader in modified tank turret
  - Complete design and fabrication of two-piece cartridge
  - Perform firing tests at Aberdeen Proving Arsenal, MD on the Modified M1/M1A1 tank turret. Firing tests will include hardstand, static firing, and firing on-the-move
- **(U)** XM919-25mm Kinetic Energy (KE) Ammunition
  - Conduct sensitivity and sympathetic detonation tests of Low Vulnerability Ammunition (LOVA) propellant
  - Transition to Bradley Fighting Vehicles Product Improvement Proposal (PIP)
- **(U)** Very High Speed Integrated Circuit (VHSIC) Tank Fire Control Demonstration Hardware
  - Develop and evaluate concepts, perform trade-off studies on micro processor design approach
  - Initiate detail design of major components and order long lead items
  - Develop test and evaluation criteria for test program
- **(U)** Insensitive Munitions Demo for Shaped Charge and Explosively Formed Penetrators
  - Screen insensitive munition explosive candidates
  - Study feasibility of loading anti-armor warheads with PAX-2 and other candidates
  - Initiate development of improved insensitive munition test methods

(U) FY 1991 Planned Program:

- **(U)** ATAC Main Armament
  - Complete data analysis of FY 1990 test firing
  - Complete Milestone I/II In-Process Review (IPR)
- **(U)** VHSIC Tank Fire Control Demonstration
  - Complete turret interface design study and establish interface specifications
  - Complete all design efforts
  - Initiate fabrication of micro processor
- **(U)** Multi Option Fuze — Artillery (MOFA)
  - Design demonstration hardware
  - Order long lead items and establish test criteria for FY1992 demonstration
- **(U)** Insensitive Munitions Demo for Shaped Charge and Explosively Formed Penetrator Warheads
  - Loading anti-armor warheads for performance and vulnerability testing
  - Initiate performance and vulnerability testing
  - Complete development of improved insensitive munitions test methods

(U) Project DL09 — Advanced Field Artillery Systems (AFAS) Technology: This project provides for technology development of new gun propulsion techniques and develops new technology for artillery weapons. The Advanced Field Artillery System (AFAS) is a self-propelled 155mm howitzer with improved survivability that will meet and survive the "year 2000" Soviet counter-battery threat. This new self-propelled howitzer will have a 3 to 6 times higher firing rate than the current system and will out gun Soviet cannon artillery with a maximum range extended 33 percent from the current 30KM to 40KM. Gun propulsion technology for AFAS will be selected from candidate unicharge, liquid propellant, and electro-thermal approaches in FY 1991-1992. New electric gun technology will provide 30 to 40 percent increase to muzzle velocities for major caliber direct fire systems and 50 percent decrease in time-of-flight for air defense cannon fired munitions. Shorter

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times of flight will provide major increase in probability of kill for air defense munitions. Liquid propellant offers the promise of increased performance at reduced logistical costs. Development of the artillery unicharge system will provide a basis for 3 to 4 fold increase in firing rates and 30 percent increase in range. The insensitive propellent will provide a major increase in self propelled howitzer survivability.

(U) FY 1989 Accomplishments:

- (U) Classified program

(U) FY 1990 Planned Program:

- (U) Advanced Field Artillery System (AFAS)
  - Develop and evaluate concepts for an AFAS Advanced Technology Transition Demonstration (ATTD) to include both the self-propelled howitzer and Future Armored Resupply Vehicle for Ammunition (FARV-A)
  - Initiate test planning and determine test criteria for the FY 1994 ATTD test program at APG, MD and Fort Sill, OK
- (U) Unicharge
  - Fabricate and initiate firing tests of an insensitive propellant configuration
  - Initiate vulnerability testing
  - Complete ballistic tests to verify zoning requirements
  - Initiate tests to validate cannon wear and flash reduction features
- (U) EM/ET Gun Technology
  - For FY 1990 the Congress has added $10.00 M to the Electromagnetic/Electrothermal (ET/EM) program
  - A substantial portion of the funds provided ($6.2 M) will be applied to pursuing electrothermal-chemical (ETC) technology demonstration for direct fire weapon system applications
  - The remaining funds ($3.8 M) will be used to supplement the electromagnetic railgun technology development program

(U) FY 1991 Planned Program:

- (U) Advanced Field Artillery System (AFAS)
  - Perform firing tests to evaluate Regenerative Liquid Propellant (LP) and unicharge solid propellent technologies and pick the gun propulsion technology for the AFAS Advanced Technology Transition Demonstration (ATTD)
  - Develop and complete concept evaluation for self propelled howitzer, initiate major component design and order long lead items for gun mount, automatic loader, cannon, and on board fire control
  - Finalize ATTD test plan for Aberdeen Proving Ground and Fort Sill
- (U) Electromagnetic/Electrothermal (EM/ET) Gun Technology
  - Initiate design and fabrication of 15 megajoule (MJ) mobile demonstrator
  - Initiate 15 MJ anti-armor projectile design and fabrication
  - Integrate component technologies from Balanced Technology Initiative (BTI)/Defense Advanced Research Project Agency (DARPA) Hypervelocity Guided Air Defense Projectile program
- (U) Unicharge
  - Fabricate unicharge cartridges for the firing test in the Advanced Field Artillery System (AFAS) ATTD program

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- Analyze test results comparing unicharge to Regenerative Liquid Propellant
- Evaluate unicharge design with respect to meeting insensitive munition objectives and minimum flash and wear criteria

(U) Work Performed By: In-house efforts will be accomplished by Armaments Research Development and Engineering Center, Picatinny Arsenal, NJ and the US Army Ballistics Research Laboratory, Aberdeen Proving Ground, MD. Major contractors include General Electric, Pittsfield, MA; Bell Aerospace Textron, Niagara Falls, NY; Thiokol Corp, Elkton, MD; Honeywell, Minneapolis, MN; and Southwest Research Institute, San Antonio, TX. NATO APGM competitors include Honeywell; Hughes; Martin-Marietta; Raytheon; and General Dynamics. Contractual efforts for Project D223 are accomplished through DARPA contractors.

(U) Related Activities:
Program Element #0601102D (Defense Research Sciences)
Program Element #0602618A (Ballistics Technology)
Program Element #0602624A (Weapons and Munitions Technology)
PE #0603005A (Combat Vehicle and Automotive Advanced Technology).
DARPA/Army Electromagnetic Gun Memorandum of Understanding (MOU) DARPA/Army/Marine Corps Armor/Anti-Armor (MOU). There is no unnecessary duplication of efforts within DOD.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Memorandum of Understanding for 155mm Autonomous Precision Guided Munition (APGM) between US and seven nations.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603005A**

PE Title: **Combat Vehicle and Automotive Advanced Technology** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D221 Combat Vehicle Survivability	13735	20021	7895	Cont	Cont
D440 Advanced Combat Vehicle Technology	14183	64404	132482	Cont	Cont
D441 Combat Vehicle Propulsion Technology	19476	24615	19835	Cont	Cont
D444 Combat Vehicle Track, Wheel and Suspension	3271	5074	5809	Cont	Cont
D497 Combat Vehicle Electronics	11150	5153	10740	Cont	Cont
PE TOTAL	61815	119267	176761		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program supports our national objective to achieve and maintain a credible ground combat force capable of carrying out our worldwide missions by providing for a dynamic, continuous modernization process to improve our war-fighting capabilities, and to allow us to more rapidly transition technology to systems applications. It supports the Army's near, mid, and far term objectives to redress conventional warfighting deficiencies by demonstrating maturity of technologies to improve combat vehicle lethality, survivability, fightability, mobility, and sustainability. Technologies funded by this program include: survivability, mobility, vehicle electrical and electronic systems, and the integration of these and other advanced technologies for combat vehicle applications through full-scale mock-ups, computer simulation, and hardware technology demonstrations. Two key demonstrations are the Component Advanced Technology Test Bed (CATTB) and the Common Chassis Advanced Technology Transition Demonstration (CCATTD). Via the CATTB, critical advanced technologies and components for the Block III tank and other combat vehicles will be demonstrated early, using a surrogate chassis. This test bed will provide valuable insights to both the government and industry to assist in making smart choices on technologies selected for insertion into systems, and to aid in planning for future upgrades. The CCATTD is central to the objectives of improving warfighting capabilities, minimizing program costs and technical risks, improving supportability, and shortening development time of the next generation of combat vehicles. This effort will demonstrate the degree to which common components and chassis can accomodate diverse mission modules, and it will yield preliminary design, systems engineering and integration analysis, fabrication, component maturation and demonstration of heavy chassis that will be selected for the Block III Tank as well as for other systems that constitute the Army's next generation heavy force. The projects funded in this Program Element (PE) are central to, and essential for, the success of the Army's Heavy Force Modernization (HFM) Program. They respond to the 1985 Defense Science Board (DSB) Summer Study on Armor Anti-Armor competition, as well as to the DSB summer study on Technology Base Management which advocated the use of ATTDs to more rapidly transition technology. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

Program Element: **#0603005A**

PE Title: **Combat Vehicle and Automotive Advanced Technology** Budget Activity: **#2**

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D221 — Combat Vehicle Survivability: This project provides technology to protect U.S. combat vehicles against increasingly lethal threats. It exploits advanced armor concepts and technology emanating from other programs, and demonstrates full-scale armor structures integrating those concepts and technologies into combat vehicles. This is the only Army project funding full-scale demonstration and integration of armor technology for future combat vehicles and for upgrade of fielded vehicles. This project also includes other essential elements of survivability, such as signature reduction, countermeasures, and fire suppression. It provides increased survivability for existing and new vehicles through development and integration of: (1) Identification Friend or Foe (IFF) technologies to reduce fatricide, (2) threat warning receivers to improve survivability against advanced target acquisition and munition guidance systems; (3) Artificial Intelligence Data Management System Software and Crew Interface; and (4) countermeasure reactions such as a programmable dispenser, active armor and semi-automatic counterfire systems. Several joint Department of Army (DA)/Department of Defense (DOD) programs, most notably the joint Defense Advanced Research Projects Agency (DARPA)/Army/US Marine Corps (USMC) Armor Anti-Armor program, are being supported to provide improved survivability.

(U) FY 1989 Accomplishments:

- (U) All funds were committed to support DARPA/Army/USMC Armor/Anti-Armor program

(U) FY 1990 Planned Program:

- (U) 53 per cent of project funds committed to support DARPA/Army/USMC Armor/Anti-Armor Program
- (U) Design heavy frontal armor module attachment systems for Block III tank and other Heavy Force Modernization applications
- (U) Evaluate compartmenting techniques relative to advanced tank cannon system, ammunition, autoloader and ammunition transfer mechanism for enhanced survivability

(U) FY 1991 Planned Program:

- (U) 44 per cent of project funds committed to support DARPA/Army/USMC Armor/Anti-Armor Program
- (U) Conduct demonstrations at full scale of armor modules and attachments systems on ballistic sections for Block III tank and other heavy vehicle applications

(U) Project D440 — Advanced Combat Vehicle Technology: This program constitutes a critical step in defining and demonstrating integratability and maturity of combat vehicle technologies for the next generation of combat vehicles and for product improvements to current fleets of vehicles. The objective is to demonstrate innovative future combat vehicle configurations, technologies, and integration techniques through full-scale mock-ups, computer simulation, and hardware technology demonstration. The Component Advanced Technology Test Bed (CATTB) will demonstrate technologies that are critical to the next tank and also applicable to the future infantry fighting vehicle, self-propelled artillery system, and engineer countermobility vehicle. Technologies to be demonstrated in the test bed include: an advanced tank cannon, autoloader, fire control, ammunition, advanced target acquisition system, advanced countermeasures, advanced vehicle propulsion, advanced track and suspension, a standard vehicle electronics architecture, and advanced vehicle controls and displays. Component technologies, competitively selected, will be integrated into a surrogate chassis to demonstrate technical feasibility, maturity, and capability enhancements. The Common Chassis Advanced Technology Transition Demonstration (CCATTD) is a key part of the Army's modernization strategy to assess the benefits and degree to which commonality between vehicles can be achieved, to field a more capable combat force as rapidly as possible to meet the threat, and to achieve early, meaningful industry involvement in this modernization

Program Element: #0603005A

PE Title: **Combat Vehicle and Automotive Advanced Technology** Budget Activity #2

program. The CCATTD will consist of two competitive contracts to conduct preliminary design, systems engineering and analysis, fabrication, component maturation and demonstration of heavy chassis that will be selected for the Block III Tank and other heavy combat vehicles

(U) FY 1989 Accomplishments:

- (U) Three Concept Exploration/Definition contractors provided their Best Technical Approach (BTA) for Heavy Force Modernization (HFM), each concluded the HFM concept is feasible and that more cost effective, improved warfighting capabilities can be achieved through this concept
- (U) CATTB Chassis (Modified M1A1) Structure was delivered
- (U) Completed CATTB Turret Structure design
- (U) Received baseline CATTB Subsystem Technology Interface Control documents
- (U) Issued Request for Proposals (RFP) For CCATTD

(U) FY 1990 Planned Program:

- (U) Fabricate and Integrate Software and Hardware such as Vehicle Electronics (VETRONICS), Propulsion, Track, Suspension and Countermeasures into the CATTB
- (U) Evaluate industry responses to the CCATTD RFP
- (U) Initiate CCATTD (two competitive contracts), subsequent to Defense Acquisition Board (DAB) Program Review and report to Congress

(U) FY 1991 Planned Program:

- (U) Integrate Advanced Tank Cannon System, Autoloader and Fire Control into CATTB
- (U) Conduct CATTB demonstration to evaluate improved operational potential and technological maturity
- (U) Complete CCATTD fabrication, continue component maturation, and prepare for FY92 demonstration

(U) Project D441 — Combat Vehicle Propulsion Technology: The objective of this project is to develop engines, transmissions and other propulsion-related components to meet Army ground combat mobility goals for future vehicles. The principal activity in this project is the Advanced Integrated Propulsion System (AIPS) program. This program is a two contractor hardware demonstration effort and will produce a laboratory demonstration in FY 1990. The two competing systems (one diesel and one turbine) include engine, transmission, controls, air cleaning, cooling, auxiliary power source, batteries, signature suppression, and fuel systems. Both propulsion systems utilize advanced designs and technologies stressing the military attributes of low volume, high performance, improved fuel economy, and improved supportability. The program also emphasizes containment of procurement and life cycle costs. The AIPS goals are to deliver approximately 10 percent more power in half the volume with fuel economy improvement of 50 percent over the current M1A1 power pack. Operation and support cost goals are a 50 percent reduction from the M1A1.

(U) FY 1989 Accomplishments:

- (U) Assembled and tested the first full set of AIPS engines (diesel and turbine)
- (U) Completed multi-fuel and air cleaner tests
- (U) Tested AIPS engine/transmission assemblies
- (U) Demonstrated 750 horsepower (75% power) on both competing AIPS

(U) FY 1990 Planned Program:

- (U) Complete laboratory 100% power demonstrations of AIPS diesel and turbine systems
- (U) Install first AIPS into CATTB and second AIPs in an Automotive Test Rig (ATR)

Program Element: **#0603005A**

PE Title: **Combat Vehicle and Automotive Advanced Technology** Budget Activity: **#2**

- **(U)** Conduct laboratory testing to verify AIPS performance

(U) FY 1991 Planned Program:

- **(U)** Complete vehicle performance testing of diesel and turbine AIPS
- **(U)** Initiate testing of technology improvements transitioned from 6.2 program (i.e. new recuperator technology for gas turbine engine and lubrication and insulation technology for diesel engine)

(U) Project D444 — Combat Vehicle Track, Wheel and Suspension: This project constitutes the sole Army program for the exploitation and advancement of the state-of-the-art in ground combat vehicle mobility technologies. The objective of this project is to develop and demonstrate advanced track, wheel, suspension and other chassis/running gear related components to meet Army ground combat mobility goals for future vehicles. The principal activities being pursued in this project are the development of externally mounted suspension systems and advanced replaceable pad track systems for demonstration on the Component Advanced Technology Test Bed (CATTB) in the later half of FY91. These technologies are critical to the next tank, infantry fighting vehicle, self-propelled artillery system, and engineer countermobility vehicle. They are also being pursued in line with the Army's modernization strategy to assess the benefits and degree to which commonality between vehicles can be achieved in support of the Common Chassis Advanced Technology Transition Demonstration (CCATTD) program. This project also includes other essential elements for ground combat vehicle mobility technology advancement in the areas of track rubber, computer-aided design and analysis capabilities, laboratory simulation testing, and track retention and control components. The program is structured to achieve both near-term and long-term technological advancement goals of increased track life, reduced track and suspension weight, improved vehicle mobility performance and Reliability, Availability, Maintainability and Durability (RAM-D), and reduced maintenance burden and Operating and Support (O&S) costs. The technology base advancement work is essential because there are neither commercial requirements for heavy, high-speed, all-terrain vehicles, nor an industry technology base readily adaptable to meet Army ground combat vehicle requirements.

(U) FY 1989 Accomplishments:

- **(U)** Completed the Technical Data Package (TDP) for production implementation of the FMC T-158 replaceable pad track for the Abrams Tank System
- **(U)** Completed a HAC-directed evaluation of a non-urethane based track pad material which was not superior to materials currently in use
- **(U)** Completed lockout design integration and initiated fabrication of heavy (45-70 ton) external suspension system hardware for FY91 CATTB demonstration
- **(U)** Awarded two contracts for advanced heavy (45-70 ton) vehicle replaceable pad track development for FY91 CATTB demonstration
- **(U)** Established computer-aided design analysis work station for in-house implementation of track design/analysis codes being validated at Waterways Experiment Station (WES)

(U) FY 1990 Planned Program:

- **(U)** Complete fabrication and deliver heavy (45-70 ton) external suspension system hardware for CATTB integration
- **(U)** Conduct engineering development of lightweight XT-158L and hybrid XT-166 advanced heavy (45-70 ton) tracks for FY91 CATTB demonstration
- **(U)** Award contracts for dynamic track tensioner design development and critical component engineering laboratory testing
- **(U)** Complete characterization of rubber parameters for track design/analysis codes validation and in-house implementation

Program Element: **#0603005A**

PE Title: **Combat Vehicle and Automotive Advanced Technology** Budget Activity: **#2**

(U) FY 1991 Planned Program:

- **(U)** Complete fabrication and deliver lightweight XT-158L and hybrid XT-166 advanced heavy (45-70 ton) tracks for CATTB integration and demonstration
- **(U)** Complete dynamic track tensioner hardware fabrication and initiate automotive test rig engineering evaluation in the CATTB
- **(U)** Complete validation of three-dimensional track simulation code

(U) Project D497 — Combat Vehicle Electronics (VETRONICS): The objectives of this project are to develop and demonstrate a Standard Army Vetronics Architecture (SAVA) which will enable total system integration of all electrical and electronic system components; optimize the soldier-machine interface; and integrate the vehicle into the battlefield force via a Combat Vehicle Command and Control (CVC2) system. First Generation SAVA is being applied to M1A1 Abrams Block II and will be fully applied to Block III Tank and other Heavy Force Modernization (HFM) vehicles.

(U) FY 1989 Accomplishments:

- **(U)** Performed preliminary design for a standard Army Vetronics architecture (SAVA) for the CATTB
- **(U)** Defined vehicle electronic system interfaces
- **(U)** Demonstrated expert maintenance system capabilities and artificial intelligence techniques to assist vehicle maintainers
- **(U)** Implemented crew video displays on Vetronics Crew Display Demonstrator (VCDD) for user evaluations

(U) FY 1990 Planned Program:

- **(U)** Develop standard modules for SAVA program and application of specific modules for CATTB
- **(U)** Define CATTB crew interfaces using vehicle crew display demonstrator
- **(U)** Delivery of prototype SAVA hardware and software modules for CATTB

(U) FY 1991 Planned Program:

- **(U)** Develop command and control module for CVC2 program and CATTB
- **(U)** Conduct CVC2 interoperability demonstration with West Germany
- **(U)** Installation of Vetronics System Architecture Demonstrator (VSAD) in the Vetronics Integration Center at TACOM.

(U) Work Performed By: The U.S. Army Tank-Automotive Command (TACOM), Warren, MI, is responsible for the management, development and systems integration of this program. The Program Executive officer for Heavy Force Modernization is responsible for key demonstrations such as the CATTB, CCATTD, and CMV ATTD that are essential to the success of the HFM program. Major contractors are: Cummins Engine Company, Columbus, IN; Emerson Electric, St. Louis, MO; Honeywell Corp., W. Covina, CA; FMC, San Jose, CA; General Electric, Lynn, MA; VA Polytech Institute and State University, Blacksburg, VA; General Dynamics, Sterling Heights, MI; General Dynamics Land Systems Division, Warren, MI; Texas Instruments, Dallas, TX; Gonzales, Detroit Mi; and Electrotech, Newark, N.J.

(U) Related Activities:

- **(U)** PE #0602601A (Combat Vehicle and Automotive Technology)
- **(U)** PE #0601102A (Defense Research Sciences)
- **(U)** PE #0602105A (Materials Technology)
- **(U)** PE #0603102A (Materials & Structures Advanced Technology)

Program Element: **#0603005A**

PE Title: **Combat Vehicle and Automotive Advanced Technology** Budget Activity: **#2**

- **(U)** PE #0602624A (Weapons and Munitions Technology)
- **(U)** PE #0203735A (Combat Vehicle Improvement Programs)
- **(U)** PE #0604604A (Medium Tactical Vehicles)
- **(U)** PE #0602120A (Electronic Survivability and Fuzing Technology)
- **(U)** PE #0602716A (Human Factors Engineering Technology)
- **(U)** PE #0603004A (Weapons and Munitions Advanced Technology)
- **(U)** PE #0603003A (Aviation Advanced Technology)
- **(U)** PE #0603001A (Logistics Advanced Technology)

A close relationship is maintained with industry and other Services and Government agencies to preclude duplication and take advantage of their work. Information concerning allies' technology is shared via data exchange agreements, memorandum of understanding and separate bilateral agreements. There is no unnecessary duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603006A**

PE Title: **Command, Control and Communications Advanced Technology** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D247 Tactical Command, Control & Communications Technology Integration	6871	3937	5233	Cont	Cont
D492 Space Technology Integration	- 0 -	3941	4101	Cont	Cont
PE TOTAL	6871	7878	9334		

*FY 1989 work accomplished under PE #0602784A/AH71 and PE #0602784A/A855

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Army must provide the soldier with superior quality and quantity of real-time information by applying rapidly advancing computer automated battelfield technology. The Commander's ability to snychronize battle and have rapid and complete battle status is dependent on integrated data capable communications and automated real-time software command and control applications tailored to the soldier's needs. Program provides software applications development, demonstration, communications system integration and prototype products for distributed, mobile, secure, local area (e.g. fiber optics) and fully automated spread spectrum radio networks with measures to enhance survivability, and efficiency of Army tactical command, control, communication and computer systems. Software products are developed for ease of porting to Common Hardware Systems (CHS). Program conducts key joint Service demonstrations in support of Joint Directors of Laboratories (JDL) Technology Applications and Demonstrations Panel verifying systems integration of Army Battlefield Functional Areas. Program tests and evaluates net radio, common user, and distributed communications equipment and automated spectrum management aids which have potential to solve user needs, equipment deficiencies, and provide critical future capabilities. The OMB and DOD mandated process for frequency allocation for Army Systems is funded by this PE. Program supports space experiments, demonstrations of space technology and demonstrations of applications of data derived from space payloads as potential solutions to operational needs of the Army. Program also supports integration of the various individual efforts into a single cohesive effort. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D247 — Tactical Command, Control and Communications Technology Integration: Urgent need exists to equip the Army with integrated battlefield automated systems. The Army cannot provide commanders with automated real-time information to support battlefield operations. Leveraging commercial technology products for military saves tens of millions of dollars.

(U) FY 1989 Accomplishments:

- **(U)** Demonstrated distributed Command, Control and Communications (C3) core at National Military Command Center at request of Joint Chiefs of Staff/Defense Communications Agency. This led to its adoption as a candidate rapid prototype kernel for joint command centers
- **(U)** Demonstrated Tactical Control System (TACTICS) distributed database manager at exercise WINTEX '89. This was adopted by PM, Army World Wide Military Command and Control System (WWMCCS) Information System (PM, AWIA) and permitted full WWMCCS

Program Element: **#0603006A**

PE Title: **Command, Control and Communications Advanced Technology** Budget Activity: **#2**

data flow for first time into distributed US Army Europe Tactical Command and Control System (UTACCS)

- **(U)** Demonstrated internet architecture for Battlefield Functional Areas (BFAs)
- **(U)** Completed Network Resource Server (NRS) port and integration of TACTICS-3 distributed database to CHS
- **(U)** Demonstrated packet switch function on CHS and TACTICS-3 distributed processing at AES
- **(U)** Analyzed Combat Service Support Control System automation requirements
- **(U)** Conducted distributed processing experiments with DARPA and Joint Directors of Laboratories (JDL) technology and evaluate for TACTICS enhancements
- **(U)** Implemented enhanced testbed capability at Signal Center and Combined Arms Center (CAC) for advanced C2 concept evaluations

(U) FY 1990 Planned Program:

- **(U)** Support Technology Assessment Center (TAC) with development of large screen display and command, control and communications (C3) processing functions to support interim Maneuver Control System urgent requirements and objective target system large screen display functional requirements and development
- **(U)** Serve as US Army Communications/Electronics Command (CECOM) focal point for TAC support to Future Battle Laboratory for analysis, demonstrations, and integration of terrain analysis functions into combined arms C2 integration at all tactical echelons
- **(U)** Support Common Army Tactical Command and Control Data Systems (ATCCS) Software Support Working Group (CASSWG) by enhancing and integrating Tactical Information Control System modules of soldier-machine interface, data manager, system manager, message handler, communications manager, and map graphics into CASSWG at direction of Program Executive Office (PEO), Command and Control Systems (CCS)
- **(U)** Perform Army part of JDL joint programs in areas of automated network management, advanced gateway development, multilevel secure and cooperative policy based gateways with the Air Force, and secure operating systems and communications networking with the Navy
- **(U)** Perform research and development upgrades for JDL network facilities to conduct essential directed joint C3 simulations and planned JDL experiments
- **(U)** Conduct distributed processing applications experiment running Army Secure Operating System in a distributed network environment using US Central Command multilevel secure testbed
- **(U)** Develop integrated communication testbed to establish future architecture for local access within computer assisted Command Post for next generation CHS and Mobile Subscriber Equipment (MSE) applications
- **(U)** Establish requirements for Ultra High Frequency (UHF) Electronic Counter Counter Measure (ECCM) for MSE, etc. and Extremely High Frequency (EHF) applique to SINCGARS to eliminate need for armor radio silence
- **(U)** Conduct engineering analysis of all Army communications-electronics systems requesting a statement of frequency allocation support

(U) FY 1991 Planned Program:

- **(U)** Modify existing tactical data distribution system to handle standard Maneuver Control System (MCS) transactions on basis of packet transmission
- **(U)** Demonstrate compatibility between TACTICS III and Army Secure Operating System (ASOS) in AES experiment

Program Element: **#0603006A**

PE Title: **Command, Control and Communications Advanced Technology** Budget Activity: **#2**

- (U) Test/evaluate generic software modules for data manager, system manager, message handler, communications networks, man-machine interfaces and port to CHS
- (U) Develop/test/evaluate set of joint service interoperability tools
- (U) Develop voice/data/graphics multimedia integration/presentation package for CHS
- (U) Test/evaluate common workstation software module for maneuver control and fire support and port to CHS hardware
- (U) Evaluate applicability of new multilevel secure Local Area Network (LAN) hardware integration with Army data distribution system
- (U) Test/evaluate network monitoring, multiple addressing, hold and deliver functions for CHS
- (U) Investigate state-of-the-art distributed database technologies and adapt/enhance for CHS
- (U) Integrate maneuver control, fire support, combat service support, air defense applications into distributed command and control system
- (U) Develop automated system configuration software package for CHS
- (U) Develop three dimensional software package for CHS
- (U) Conduct three dimensional software experiments with TACTICS to verify integration
- (U) Support Combined Arms Center and Signal Center in performing Concept Evaluations
- (U) Demonstrate automated Net Radio Interface (NRI) for MSE
- (U) Conduct survivable high frequency (HF) network demonstrations
- (U) Upgrade Fiber Optic Tactical Local Area Network (FOTLAN) to Fiber Distributed Data Interface (FDDI)-2 to integrate voice, data, real-time video for CP backbone communications
- (U) Award contract for ECCM applique to UHF Radio (e.g. MSE) to enhance performance in a jamming environment
- (U) Award contract for Extremely High Frequency (EHF) applique to SINCGARS to translate Very High Frequency (VHF) signal to extremely high frequency for covert armor/helicopter voice and data communication
- (U) Conduct engineering analysis of all Army communications-electronics systems requesting a statement of frequency allocation support

(U) Project D492 — Space Technology Integration: Restructured and aggregated previously separate space program activities into D492 beginning in FY 1990. FY 1988 and FY 1989 work accomplished under PE #0602784A/AH71 and PE #0602784A/A855.

(U) FY 1989 Accomplishments:

- (U) Completed two year study of incorporating Army unique requirements into Defense Meterological Satellite Study (DMSP) Block IV. Initiated evaluation of cost/benefits of each Army unique requirement
- (U) Completed flight integration of the STAR TRACKER Azimuth Attitude with the Spartan
- (U) Awarded contract for fabrication of the micro-encapsulated experiment hardware
- (U) Awarded contracts for several technological approaches to obtaining survey quality azimuth from the existing Global Positioning System (GPS)
- (U) Developed tactical decision aid software to use both real time satellite meteorological and stored terrain data to show changes in mobility, visibility, and weapon system performance caused by current weather
- (U) Used "target of opportunity" data from cooperative sources in multi spectral and Light Detection and Ranging (LIDAR) technologies to initiate a study of Army potential uses of these technologies

Program Element: **#0603006A**

PE Title: **Command, Control and Communications Advanced Technology** Budget Activity: **#2**

(U) FY 1990 Planned Program:

- **(U)** Complete fabrication and flight qualification of micro-encapsulated experiment (Funding shared with US Army Medical Research and Development Command (MRDC))
- **(U)** Initiate design of Space (micro-gravity) tissue loss experiment. (Funding shared with US Army Medical Research and Development Command (MRDC))
- **(U)** Initiate design efforts to integrate a GPS receiver into the STAR TRACKER azimuth attitude unit
- **(U)** Conduct Field demonstrations of using the GPS system to obtain survey quality azimuth
- **(U)** Continue investigations of multi-spectral and LIDAR space sensors as Army support
- **(U)** Continue development of software using real time satellite meteorological and terrain data to automate intelligence preparation of the battlefield

(U) FY 1991 Planned Program:

- **(U)** Analyze medications fabricated during initial micro-encapsulation flight and compare uniformity and purity with normally fabricated medications
- **(U)** Complete fabrication of space (micro-gravity) tissue loss experiment
- **(U)** Demonstrate automated revision of intelligence preparation of the battlefield template revision using software developed to use real time satellite meteorological and terrain data
- **(U)** Continue design of integrated STAR TRACKER GPS unit
- **(U)** Award contract for brassboard integration of GPS azimuth on artillery weapons and sensors
- **(U)** Complete multi-spectral and LIDAR space sensor investigations
- **(U)** Initiate design of space source segment with terrestial Electronic Support Measures (ESM) at division and brigade echelons

(U) Work Performed By:
Command, Control and Communications Advanced Technology In-House: Center for Command, Control and Communications Systems-US Army CECOM, Fort Monmouth, NJ. Principal contractors: SRI International, Menlo Park, CA; Bolt, Beranek and Newman, Boston, Ma.
Space Technology Integration — Each of the individual space demonstration/experiments is executed by an AMC Sub-Command, the Corps of Engineers or the Surgeon General as a function of whose mission area covers the individual effort. STAR TRACKER efforts are contracted to Applied Physics Laboratory of Johns Hopkins University with Perkin Elmer as a major sub-contractor. Other items will be awarded during FY90 with competitive solicitation. In-house developers are the Corps of Engineers Engineer Topographic Laboratories, Ft Belvoir, VA, US Army Communications Electronics Command, Ft Monmouth, NJ, Atmospheric Sciences Laboratory, White Sands, NM. Work is also performed by National Aeronautics and Space Administration (NASA).

(U) Related Activities: Activities coordinated with other Government services and agencies. There is no unnecessary duplication of effort within the Department of Defense. The program however is related to:
PE #0602782A C3 Technology
PE #0203740A Maneuver Control System
PE #0203726A Advanced Field Artillery Tactical Data System
PE #0603557A Forward Area Air Defense System
PE #0604779A Joint Interoperability of Tactical C2 Systems

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603007A**

PE Title: **Human Factors, Personnel and Training Advanced Technology** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A792 Manpower and Personnel	9142	6382	5798	Cont	Cont
A793 Human Factors in Training & Operational Effectiveness	7803	5204	5819	Cont	Cont
A794 Education & Training	6238	4077	3800	Cont	Cont
A795 Training Simulation	5798	2265	2822	Cont	Cont
A796 Human Factors Engineering in Systems Design	- 0 -	690	769	Cont	Cont
PE TOTAL	28981	18618	19008		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program focuses on advanced technology efforts in four areas of soldier performance: human factors in the design of new systems; improved, theory-based education and training techniques exploiting modern computers; research and development of design alternatives for lower cost, less complex simulators and training devices; and scientifically sound methods for recruiting, selecting and retaining personnel to better match supply and demand. The work in this program element is consistent with the Army resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A792 — Manpower & Personnel: This project develops and evaluates technology for improved methods of: 1) attracting personnel, 2) selecting the most qualified, 3) assigning them to Military Occupational Specialties (MOS) that capitalize on their aptitudes and vocational interests, and 4) retaining the best performers. It also includes a major research and development (R&D) effort to quantify the effect of family factors on readiness and retention, and building a technology for the development of executive-level Army leaders.

(U) FY 1989 Accomplishments:

- **(U)** Demonstrated refined prototype Enlisted Personnel Allocation System (EPAS) for assignment of new recruits
- **(U)** Demonstrated econometric supply models to forecast future enlistments and to simulate the effects of changes in recruiting resources, for eventual use at recruiting battalions
- **(U)** Developed cost model for the Army College Fund
- **(U)** Demonstrated utility of personal computer (PC)—based models that provide detailed manpower cost estimates at the Military Occupational Specialty (MOS) level for active, reserve and civilian personnel
- **(U)** Conducted worldwide Army family survey to quantify relationship of family factors to individual soldier retention decisions
- **(U)** Tested cognitive skills assessment techniques for use with students at National and Army War College to increase efficiency of leader development programs

Program Element: **#0603007A**

PE Title: **Human Factors, Personnel and Training Advanced Technology** Budget Activity: **#2**

(U) FY 1990 Planned Program:

- **(U)** Empirically determine and model the effects of enlistment motivation, incentives and skill-training options on enlistment and retention of quality soldiers
- **(U)** Develop manpower budget models to simulate the impact of alternative personnel policies on the Army budget
- **(U)** Demonstrate new selection test to screen out applicants with highest potential for attrition and discipline problems
- **(U)** Develop technology for assessing effectiveness of mid-level decision making performance during warfighting and crisis management situations
- **(U)** Determine quantitative relationship between family factors and soldier readiness

(U) FY 1991 Planned Program:

- **(U)** Test model of the effects of enlistment motivations, incentives and training options on enlistment and retention of quality soldiers
- **(U)** Validate model for estimating costs of alternative enlisted force structures for different contingency missions under varying levels of soldier quality and demographic characteristics
- **(U)** Develop and test new methodology to improve selection of junior non-commissioned officers (NCOs)
- **(U)** Develop and test models of (1) interrelationships among Army family career decision making, retention, and unit readiness; and (2) junior officer branch assignment and retention

(U) Project A793 — Human Factors in Training and Operational Effectiveness: As modern weapon systems become more lethal, they also become more complex to operate and maintain on the battlefield. The soldier must be systematically considered throughout the weapon system development and acquisition process. Efforts within this project will develop and evaluate: (1) improved methods for estimating human factors, manpower, personnel and training (HMPT) requirements early in the combat development and weapon system design phases, (2) improved, empirically-based, methods for assessing the impact of HMPT variables on weapon system operability and maintainability, and (3) prototype technologies for integrating soldiers into complex, information-based, weapon systems and command, control, communications and intelligence (C3I) systems.

(U) FY 1989 Accomplishments:

- **(U)** Demonstrated improved methods for identification of manpower savings available from alternative maintenance concepts for the All Source Analysis System (ASAS)
- **(U)** Developed prototypes of improved performance-based methods for estimating manpower, personnel and training (MPT) requirements for new systems

(U) FY 1990 Planned Program:

- **(U)** Develop new crew performance training/evaluation standards for the Forward Area Air Defense (FAAD) system
- **(U)** Develop methodology for including quantified soldier performance issues in weapon system requirements emerging from the Army's Concept Based requirements System (CBRS)
- **(U)** Develop improved manpower and personnel integration (MANPRINT) techniques for improved test and evaluation in the weapon system acquisition process
- **(U)** Integrate logistics model with existing manpower, personnel and training (MPT) requirements estimation method
- **(U)** Develop and evaluate new methods for crew coordination training and mission assignment to reduce aviation and ground accidents
- **(U)** Develop tactical planning graphics formats for improved C3I system performance

Program Element: **#0603007A**

PE Title: **Human Factors, Personnel and Training Advanced Technology** Budget Activity: **#2**

(U) FY 1991 Planned Program:

- **(U)** Develop empirically sound analytic method for making cost-benefit trade-offs among performance requirements, personnel availability, training requirements and equipment design
- **(U)** Determine validity of operator/maintainer work load predictors for the Advanced Field Artillery System, Forward Area Air Defense System, and Automatic Target Handoff System
- **(U)** Evaluate impact on personnel and training of different maintenance concepts for Advanced Field Artillery System and Forward Area Air Defense System Non-Line-of-sight (NLOS) component
- **(U)** Develop refined, empirically-based, Manpower and Personnel Integration (MANPRINT) components for improved reliability, availability and maintainability (RAM) analyses, battle damage assessments, and accident prevention
- **(U)** Develop brigade-corps behavioral task model and performance criteria for assessing battlestaff performance
- **(U)** Develop Field Training Exercise (FTX) "lessons learned" database for the Battle Command Training Program
- **(U)** Determine quantitative relationships among weapon system design characteristics, personnel performance and unit performance effectiveness

(U) Project A794 — Education and Training: This project will lead to theory-based training methods that produce more proficient soldiers without increase in training resources (instructors, time, facilities and travel). It will experimentally investigate alternative methods for cost-effective application of computers and related electronic technology to training, with emphasis on individual combat, technical and maintenance skills; crew, team, and unit training; and leadership and unit cohesion.

(U) FY 1989 Accomplishments:

- **(U)** Empirically determined relationship between amount of tactical training and brigade performance at the National Training Center (NTC)
- **(U)** Developed and demonstrated prototype programs for advanced rifle marksmanship
- **(U)** Designed and developed prototype techniques for more objective platoon-level performance measurement at the NTC

(U) FY 1990 Planned Program:

- **(U)** Develop instructional theory-based guidance for improving National Training Center after-action reports and take-home unit training packages
- **(U)** Develop objective measurement techniques for evaluating unit performance at the Joint Readiness Training Center (JRTC) and the Combat Maneuver Training Complex (CMTC)
- **(U)** Develop and demonstrate interactive videodisc methods for transition training

(U) FY 1991 Planned Program:

- **(U)** Develop methods and measurement techniques for use by the Army Training and Doctrine Command (TRADOC) to identify training issues and derive "lessons learned" from Joint Readiness Training Center (JRTC) data
- **(U)** Empirically determine relationships of home station training, leadership, cohesion, on unit performance in realistic simulated combat exercises at Combat Training Centers (CTC)

(U) Project A795 — Training Simulation: The need for effective simulators and training devices in units is increasing in order to avoid the high cost of using actual equipment for training and to enable the Army to "train as it will fight." The objective of this project is to provide the United States Army Training and Doctrine Command (TRADOC) and the Project Manager for Training

Program Element: **#0603007A**

PE Title: **Human Factors, Personnel and Training Advanced Technology** Budget Activity: **#2**

Devices with scientifically based recommendations for the design of lower-cost, lower-complexity simulators and training devices, focusing on aviation, armor, and maintenance.

(U) FY 1989 Accomplishments:

- (U) Developed prototype tank gunnery training program using state-of-the-art computer generated imagery
- (U) Evaluated the mix of weapons simulators and use of real ammunition for AH-1S helicopter weapons training

(U) FY 1990 Planned Program:

- (U) Design and develop prototype night vision goggle training system for reserve component units
- (U) Test empirically prototype tank gunnery training strategies, using crew and platoon training devices
- (U) Develop computer-based tools to aid training device designers in the design of training-effective simulators/training devices at the lowest possible cost

(U) FY 1991 Planned Program:

- (U) Develop prototype unit training strategies using networked combined arms simulations
- (U) Determine tasks appropriate for SIMNET (Simulation Network) training

(U) Project A796 — Human Factors Engineering in System Design: Rapid changes in technology combined with increased emphasis on the physiological and associated psychological aspects of soldier-machine interface, i.e., ensuring that Army materiel can be effectively operated by soldiers in the field, have resulted in increasing demands for human factors engineering expertise and the transfer of its technology into the materiel development and acquisition process. Toward this end, this project capitalizes on the results of human factors engineering exploratory development efforts by transitioning them into the development of, and proof of concept for, methods, models, analysis tools, techniques, design guidelines, and nonsystem specific technology demonstrators for human factors engineering integration throughout the combat development and weapon system design phases. This effort supports all mission areas and is focused primarily on addressing soldier-machine interactions.

(U) FY 1989 Accomplishments: Not Applicable

(U) FY 1990 Planned Program:

- (U) Develop a Human Factors Engineering (HFE) knowledge-based expert system which will assist the human factors engineer in the generation of HFE program requirements for weapon system specifications, statements of work, data item descriptions, and contract data requirements. This expert system will result in more accurate and timely preparation of weapon system design documentation. The Army Manpower and Personnel Integration (MANPRINT) program is geared to considering the soldier throughout the materiel acquisition process. This tool will facilitate the integration of one of the six domains of MANPRINT, i.e., human factors engineering, data into the design of an increased number of weapons systems without additional manpower costs. First application will be to Army missile and armor system development programs

(U) FY 1991 Planned Program:

- (U) Refine expert system development and expand the application of the Human Factors Engineering knowledge-based system to other Army materiel development programs. Initiate efforts to expand the system to include the other five domains of MANPRINT (manpower, personnel, training, health hazards, and safety) within the Army. Efforts will also focus on Tri-Service coordination and application to Navy and Air Force human factors elements

Program Element: **#0603007A**

PE Title: **Human Factors, Personnel and Training Advanced Technology** Budget Activity: **#2**

(U) Work Performed By: Primary contractors are: Advanced Technology, Inc., Reston, VA 22901, Allen Corporation of America, Alexandria, VA 22314; The BDM Corporation, McLean, VA 21102; Human Resource Research Organization, Alexandria, VA 22301; Litton Computer Services, Mountain View, CA; Dynamics Research Corp. Wilmington, MA 01887; Science Applications International Corp., McLean, VA 22102; Applied Science Associates, Inc. Butler, PA 16003; Micro Analysis and Design, Boulder, CO 80302; Akman Associates, Silver Spring, MD 20910; Systems Research and Applications, Arlington, VA 22201; Lica Systems, Inc., Fairfax, VA. The in-house developing organizations responsible for this program are the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Alexandria, VA 22333 and the U.S. Army Laboratory Command Human Engineering Laboratory (HEL), Aberdeen Proving Ground, MD 21005. ARI conducts projects A792, A793, A794, and A795. HEL conducts project A796.

(U) Related Activities: Exploratory development efforts related to this program transition from Program Element #0602785A (Manpower, Personnel and Training Technology) and Program Element #0602716A (Human Factors Engineering Technology). Coordination of Research and Development (R&D) to preclude unwanted duplication o' effort is accomplished with the Air Force Human Resources Laboratory and the Naval Personnel R&D Center. Coordination is also accomplished through annual Department of Defense budget and management reviews and through membership in triservice committees such as the Human Factors Technology Coordination Group, the Human Factors Test and Evaluation Subgroup, and DOD/NASA Simulation Working Group. Simulation and training device development is coordinated on a continuing basis directly with the Defense Advanced Research Projects Agency (DARPA).

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603102A**

PE Title: **Materials and Structures Advanced Technology**

Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D071 Components Scale Up	3833	1324	1444	Cont	Cont
DC08 Low Intensity Conflict	- 0 -	906	931	Cont	Cont
DJ01 Combat Engineering Components	3597	2389	2598	Cont	Cont
PE TOTALS	7430	4619	4973		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element (PE) provides scale-up and demonstration of advanced materials and structures technologies emanating from exploratory development, and is critical to transitioning technology into fielded systems for improved warfighting capability. It includes tasks concerning lightweight composite structures, corrosion control and prevention, adhesive bonding and repair, structural integrity, and advanced armor/anti-armor materials. Efforts are also directed towards utilization of high strength, lightweight components and innovative designs which will permit such capabilities as faster tactical bridge erection with fewer personnel and support equipment. These efforts serve to help lighten the force, thereby improving the Army's capability to deploy and sustain itself. This program also demonstrates advanced technologies to rapidly meet unique Low Intensity Conflict (LIC) needs in the areas of counterinfiltration, communications, and force protection. It also includes tasks leading to technology integration demonstrations of tactical deception devices directed toward fully integrated deception systems. These efforts will enhance survivability creating false targets to draw enemy fire and by misleading the enemy about U.S. intentions. The work in this program element is consistent with the Army resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army key emerging technologies and advanced techology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D071 — Components Scale-Up: This project provides scale-up and demonstrations of advanced materials and structural components emerging from laboratory analysis, exploratory designs, and small scale experiments. Tasks include lightweight composite structures, corrosion prevention and control, adhesive bonding and repair, and advanced armor/anti-armor materials.

(U) FY 1989 Accomplishments:

- **(U)** Fabricated and tested composite infantry vehicle hull prototype which could revolutionize combat vehicle design by reducing overall vehicle weight design
- **(U)** Completed tests of lightweight howitzer components
- **(U)** Evaluated materials for composite field repair kit which allows vehicle to return to battle more rapidly by performing field repair
- **(U)** Roll-out of the thick composite hull demonstrator in San Jose, CA.
- **(U)** Evaluated bonds after exposure to chemical warfare agents
- **(U)** Performed surface treatment tests on glass polyester and graphite composites

Program Element: **#0603102A**

PE Title: **Materials and Structures Advanced Technology** Budget Activity: **#2**

(U) FY 1990 Planned Program:

- **(U)** Continue composite hull fabrication and evaluation to demonstrate feasibility
- **(U)** Evaluate stress corrosion cracking/weldability of new lightweight aluminum-lithium alloys to reduce logistic and repair costs
- **(U)** Evaluate effects of chemical warfare (CW) agents on adhesives to improve survivability of combat materiel in a CW environment

(U) FY 1991 Planned Program:

- **(U)** Complete composite hull evaluation and proof of principle
- **(U)** Field composite repair kit
- **(U)** Continue update of Materials Deterioration Database to provide system designers and users environmental guidelines for materials selection and maintenance
- **(U)** Scale-up lightweight composite howitzer components to demonstrate feasibility of reduced weight and logistic burden
- **(U)** Scale-up of low cost process for producing composite ceramic armor which offers improved weight and performance characteristics but is currently cost prohibitive

(U) Project DC08 — Low Intensity Conflict: Prior to FY 1990, this work has been accomplished under project DJ01 in this PE. Increased emphasis on Low Intensity Conflict (LIC) operations was the motivation for creating a separate, identifiable project within this PE.

(U) FY 1989 Accomplishments:

- **(U)** Conducted technical demonstration of most promising commercial interfaces for multipurpose relays
- **(U)** Evaluated through a tech demo in a LIC environment small, portable surveillance radar for perimeter security for noncombatant forces deployed in LIC missions

(U) FY 1990 Planned Program:

- **(U)** Evaluate other U.S. Government agencies' surveillance and detection technologies in countraband detection for application to military LIC missions
- **(U)** Demonstrate captured enemy/threat equipment for analysis of characteristics to be incorporated into training simulators

(U) FY 1991 Planned Program:

- **(U)** Investigate and demonstrate existing technologies as alternatives to high-cost airborne platforms for intelligence gathering in LIC environments

(U) Project DJO1 — Combat Engineering Components: This project seeks to overcome inadequacies in gap/river (wet/dry) crossing capabilities, enhance the Army's ability to rapidly establish and sustain ground lines of communication, and improve survivability of tactical materiel through improved countersurveillance and deception equipment. Composite materials technology is being applied to bridge components to increase span, load class, durability, and survivability while decreasing weight, erection time, crew size, and numbers of transport vehicles. Components will also be incorporated into the next generation heavy dry support bridge (replacing the medium girder bridge, a maintenance nightmare) and a light vehicle/foot bridge for the light divisions. This project also focuses on demonstrating the capability of advanced technologies in tactical logistics to solve critical deficiencies in the Army's Logistics Over-The-Shore, materials handling, fuel handling and electric power.

(U) FY 1989 Accomplishments:

- **(U)** Evaluated characteristics of several Heavy Dry Support Bridge (HDSB) candidates for potential to meet Army requirements

Program Element: **#0603102A**

PE Title: **Materials and Structures Advanced Technology** Budget Activity: **#2**

- **(U)** Conducted tests on full scale bridge elements made of composite materials

(U) FY 1990 Planned Program:

- **(U)** Fabricate full scale composite bridge deck for evaluation on assault bridge increased capability
- **(U)** Initiate design of composite launching beam to increase gap spanning and load carrying capability of the HDSB
- **(U)** Complete in-house fabrication of full scale components for light vehicle/foot bridge and conduct structural testing of concept
- **(U)** Identify and procure all equipment needed to simulate a river crossing and prepare test plan for technology demonstration in FY 1991. Prior years tactical deception work was sponsored by customer funds (Army Development and Employment Agency).
- **(U)** Demonstrate ultralight camouflage systems with Army-wide applications

(U) FY 1991 Planned Program:

- **(U)** Conduct tests on composite bridge deck and determine suitability for military use
- **(U)** Finalize design and initiate fabrication of 46 meter composite launching beam
- **(U)** Initiate technology demonstrator of full scale components for light bridging family
- **(U)** Conduct and evaluate River Crossing Deception System in user troop demonstration

(U) Work Performed By: Project DJ01 in-house will be accomplished by Belvior RD&E Center, Ft. Belvior, VA. Work for Project D071 is accomplished in-house by the Army Materials Technology Laboratory, Watertown, MA; Army Research Office, Research Triangle Park, NC; Defense Electronic Agency, Dayton, OH; Corps of Engineers, Waltham, MA, and other Government agencies. Primary contractors are: FMC Corp., Santa Clara, CA; Alliant Computer System, Littleton, MA.

(U) Related Activities:

Program Element #0601102A (Defense Research Sciences)
Program Element #0602105A (Materials Technology)
Program Element #0602786A (Logistics Technology)
Program Element #0603005A (Combat Vehicle and Automotive Advanced Technology)
Program Element #0603804A (Logistics & Engineering Equipment Advanced Development)
Program Element #0604270A (Electronic Warfare Development)
Program Element #0604718A (Physical Security)
Program Element #0604804A (Logistics & Engineering Equipment Development)
Activities coordinated with other Government sources and agencies. There is no unnecessary duplication of effort within the Department of the Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable

(U) International Cooperative Agreements: None

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603105A**

PE Title: **Acquired Immune Deficiency Syndrome (AIDS) Research** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DH29 Medical Protection Against AIDS	26659	33500	22558	Cont	Cont
PE TOTAL	26659	33500	22558	-	-

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element funds AIDS research.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project DH29 — Medical Protection Against AIDS: This program element funds Congressionally mandated, militarily relevant AIDS research in the areas of: diagnosis, natural history, epidemiology, vaccine development and drug therapy. Research efforts are directed to answer militarily unique questions affecting manning, mobilization and deployment.

(U) FY 1989 Accomplishments:

- (U) Determined that the annual rate of incidence of new Human Immunodeficiency Virus (HIV) infections among active duty soldiers is 0.74 infections/1000/year; stable between 1985-1988
- (U) Developed new microculture technique using whole blood to detect AIDS virus (HIV-1)
- (U) Demonstrated that Soluble CD4 (SCD4) inhibits the binding of HIV-1 to CD4 positive lymphocytes at therapeutically achievable dose ranges.
- (U) Found that a molecularly cloned and expressed HIV antigen in an enzyme linked immunosorbent assay (ELISA) format for antibody detection had excellent sensitivity and specificity.
- (U) Developed an empirical model to project HIV-1 associated morbidity, mortality, and health care costs for active duty personnel and their dependents
- (U) Initiated a double blind placebo study in conjunction with the Veterans Administration (VA) to test zidovudine (AZT) in the middle stage of infection
- (U) Initiated Phase I clinical trails using the soluble protein CD4 as a vaccine
- (U) Initiated Phase II clinical trial using HIV-1 gp 160 envelope protein as an immunotherapeutic agent
- (U) Showed that a polymerase chain reaction technique for amplification and detection of HIV was superior to the culture method

(U) FY 1990 Planned Program:

- (U) Provide Polymerase Chain Reaction as routine confirmatory test for diagnosis of HIV-1
- (U) Prepare larger and more geographically specific distribution studies
- (U) Define the impact of HIV-1 upon the mobilization force
- (U) Develop a pilot educational program to prevent/reduce HIV-1 infection in the active force
- (U) Continue soluble CD4 vaccine studies and gp160 envelope protein clinical trials
- (U) Initiate a p24 antigen clinical trial

Program Element: **#0603105A**

PE Title: **Acquired Immune Deficiency Syndrome (AIDS) Research** Budget Activity: **#2**

(U) FY 1991 Planned Program:

- (U) Conduct a pilot study on HIV-1 contact tracing
- (U) Finalize the empirical model on morbidity, mortality, and fiscal costs of AIDS in active duty personnel
- (U) Have at least 50% of active duty infected personnel in at least one clinical trial
- (U) Initiate immunotherapy trials with molecularly cloned P66 protein (reverse transcriptase enzyme)
- (U) This is a continuing program

(U) Work Performed By: Research facilities of the Army (31%), Navy (11%) and Air Force (9%) collaborate in coordinated efforts. The remainder is performed by extramural non-profit organizations, universities, and industries (49 percent). The top five contractors are the Henry M. Jackson Foundation for the Advancement of Military Medicine, Bethesda, MD; New Mexico State University, Las Cruces, NM; SRA Technologies, Inc., Alexandria, VA; New England Deaconess Hospital, Boston, MA; and Pro-Cons Laboratories, Inc., Buffalo, NY.

(U) Related Activities:

Program Element #0601102A, Defense Research Sciences
Program Element #0602787A, Medical Technology
Program Element #0603002A, Medical Advanced Technology
Program Element #0603807A, Medical Systems Advanced Development
Program Element #0604807A, Medical Materiel/Medical Biological Defense Equipment Engineering Development

There is no unnecessary duplication of efforts in the Army or DOD programs. Duplication of effort within the Army is avoided through centralized management at the U.S. Army Medical Research and Development Command. This effort is coordinated annually, or more frequently as required, with: Department of Defense, Office of the Deputy Under Secretary of Defense for Research and Advanced Technology; Joint Technology Coordinating Groups of the Armed Services Biomedical Research Evaluation Management Committee; President's Commission on AIDS; National Institutes of Health; World and Pan American Health Organizations.

(U) Other Appropriation Funds: ($ in Thousands) Procurement of completed products is provided for in other Procurement, Army (OPA) or Operational Maintenance, Army (OMA), or passed to other procuring agencies as appropriate.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603270A**
PE Title: **Electronic Warfare Technology** Budget Activity: **#2**

Project A042 — Tactical EW Technology and A904 — Tactical EW Techniques were transferred to PE #0602270A. Projects A442 and A906 (Budget Activity 1) respectively, beginning in FY 1991 as a zero sum change.

Project D025 was transferred to PE #0603271A, Project DC15, (Budget Activity 2) beginning in FY 1991 as a zero sum change.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides the Technology Base (TB) funding for current and future electronic warfare (EW) systems. The efforts in EW will enable the Army to collect intelligence from enemy electronic systems and to disrupt their operations, denying the enemy their use. Soviet and western electronic counter countermeasures (ECCM) designs are examined to ensure Army EW systems remain effective in countering potential threat weapon systems. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) FY 1989 Accomplishments:

- **(U)** Completed mid-band Infrared (IR) source for AN/ALQ 144A to counter emerging heat seeking missile threats
- **(U)** Initiated improved IR decoy to defeat flare rejection hardened threat missile systems
- **(U)** Completed preliminary testing of Baseline WARLOCK Deception System at Ft. Huachuca
- **(U)** Initiated 1553B Data Bus based Integrated Aircraft Survivability Equipment (IASE) Hotbench to support Quick Reaction Capability (QRC) and planned air/ground vehicle self-protection equipment developments
- **(U)** Continued laser beamrider sensor
- **(U)** Completed electronically steerable MMW Direction Finding (DF) antenna upgrade to then miniaturized Electronic Support Measure (ESM) Direction Finding Location and Intercept (MEDFLI) System

(U) FY 1990 Planned Program:

- **(U)** Continue improved IR decoy development
- **(U)** Initiate Semi-Automatic Command-To-Line-Of-Sight (SACLOS) countermeasures development
- **(U)** Continue Tank Radar Warning Receiver effort
- **(U)** Continue IASE Hot Bench
- **(U)** Develop expert system situation awareness and response algorithms for application to PM ASE advanced technology Very High Speed Integrated Circuit (VHSIC) Radar Warning Receiver (RWR)
- **(U)** Complete Surface Acoustic Wave (SAW) channelizer upgrade to MEDFLI for improved sensitivity and pulse-on-pulse handling capability
- **(U)** Initiate low-cost phase shifter development for tactically viable electronically steerable ECM and Electronic Support Measures (ESM) antennas

Program Element: **#0603270A**
PE Title: **Electronic Warfare Technology** Budget Activity: **#2**

(U) FY 1991 Planned Program: Transferred to PE #0602270A — Proj. A442

(U) Project A1ML — Administration and Management — CECOM's Electronic Warfare Research Development Center. Effective in 1990, these resources were transferred to Project A042, this PE, as a zero sum transfer.

(U) Project A1VL — Administration and Management — CECOM's Signals Warfare Research Development Center. Effective in 1990 these resources were transferred to Project A904, this PE, as a zero sum transfer.

(U) Project A904 — Tactical EW Techniques: This exploratory development program develops the countermeasures technology and components and the control technology that the Army will use to reduce the enemy's command and control capability by disrupting its communications systems (including data links), and to protect our forces from detection.

(U) FY 1989 Accomplishments:

- **(U)** Completed characterization of victim transceivers for integration into Jammer Model Upgrades
- **(U)** Completed Efficient Jamming Strategy effort and transition to Ground Based Common Sensor
- **(U)** Incorporated into the tactical intelligence data fusion testbed the Portable ASAS Workstation, and demonstrated research results in cooperating experts systems which will transition into the All-Source Analysis System
- **(U)** Developed adaptable large scale integrated circuits for transistor power and size reduction to be transitioned to 6.3A Expendable Jammer (EXJAM) Improved Prototype development for advanced development purposes
- **(U)** Initiated parallel processing applications for processing multiple algorithms

(U) FY 1990 Planned Program:

- **(U)** Initiate Transceiver Susceptibility analysis for exploitation of victim transceiver vulnerabilities
- **(U)** Incorporate transceiver specification data into susceptibility model
- **(U)** Initiate integration waveform to approach fratricide problem
- **(U)** ECM Fratricide Techniques for additional approaches to fratricide prevention
- **(U)** Initiate Adaptable Jammer Frequency Extension to extend the power and frequency range of current amplifiers
- **(U)** Continue testing of algorithms developed in 6.1 basic research programs using parallel processing techniques
- **(U)** Complete Surface Acoustic Wave Sidelobe Reduction to increase the sensitivity of compressive receivers to transition to 6.3A EXJAM Improved Prototype Development for advanced development purposes

(U) FY 1991 Planned Program: Transferred to PE 0602270A Proj. A906

(U) Project D025 — Classified program — Transferred to PE 0603271A, Project DC15

(U) Project DK15 — Advanced Communications ECM Demonstrations: This advanced development program develops the communication countermeasures technology for the Army to use to deny the enemy effective command and control by disrupting its prime communications during critical periods of Tactical Transmission. It emphasizes specific components, hardware and software necessary to perform advanced technology transition demonstrations (ATTD).

Program Element: **#0603270A**
PE Title: **Electronic Warfare Technology** Budget Activity: **#2**

(U) FY 1989 Accomplishments:
- (U) Demonstrated Hybrid Wideband ECM prototype
- (U) Investigated Multisignal Sorting/Jamming
- (U) Investigated Minimum Signal Knowledge Jamming for ECM sub-system and "Smart Jammer"
- (U) Evaluated emitter time reduction techniques to determine feasibility of transition to palletized and expendable jammers

(U) FY 1990 Planned Program:
- (U) Investigate Own Jamming Excision Techniques for automatic look through technique to protect intercept receivers from jamming emanations
- (U) Complete Hybrid Wideband ECM transition to TACJAM-A and Ground Based Common Sensor for integration
- (U) Complete Multisignal Sorting/Jamming transition to TACJAM-A and Ground Based Common Sensor for integration
- (U) Complete Minimum Signal Knowledge Jamming transition to TACJAM-A and Ground Based Common Sensor for integration

(U) FY 1991 Planned Program:
- (U) Investigate feasibility and development of expendable jammer directive antenna arrays
- (U) Evalute candidate HF/VHF/UHF antennas, matching circuits and jammer waveforms and controls for prototype development
- (U) Transition from 6.2 efforts and conduct weaponization study for feasibility of platform for Impulse Jamming
- (U) Continue Own Jamming Excision

(U) Project DK16 — Non-Communications ECM Technology Demonstrations: This advanced development program develops and demonstrates the feasibility and effectiveness of non-communications electronic warfare hardware and software going against radar, optical, electro-optical and infrared threats.

(U) FY 1989 Accomplishments:
- (U) Completed two Apache Escort Jammer (AEJ) pods and performed electro-magnetic interference/electro-magnetic compatibility (EMI/EMC) chamber tests on Apache helicopter

(U) FY 1990 Planned Program:
- (U) Perform AEJ Concept Evaluation Program (CEP) for III Corps at China Lake
- (U) Complete High-Thruput ESM Demo using Very High Speed Integrated Circuit (VHSIC) Modular Adaptive Signal Sorter (VMASS) and VHSIC Threat Association Module (VTAM)

(U) FY 1991 Planned Program:
- (U) Complete low band AEJ array and test
- (U) Initiate integration of knowledge based expert system power management into AEJ and interface power management with aircraft multi-function display

(U) Work Performed By: In-house work: USA CECOM Center for Electronic Warfare/Research Development Center; Electronics Technology and Devices Laboratory, Fort Monmouth, NJ, USA CECOM Center for Signals Warfare, Vint Hill Farm Station, Warrenton, VA and USA Harry Diamond Laboratories, Adelphi, MD. Supporting work: Air Force Avionics Laboratory, Wright Patterson AFB, OH; Rome Air Development Center, Grifriss AFB, NY; Naval Weapons Center, China Lake, CA; Letterman Research Institute, San Francisco, CA; Pacific Missile Test Center, Point

Program Element: **#0603270A**
PE Title: **Electronic Warfare Technology** Budget Activity: **#2**

Mugu, CA; National Security Agency, Ft Meade MD. Contract work: GE/RCA Corporation, Camden, NJ; Delfen Corporation, San Jose, CA; Hughes Aircraft Corporation, Fullerton, CA; Sanders Associates, Nashua, NH; Quest Research Corporation, McLean, VA; Lockheed Electronics, Plainfield, NJ.; Georgia Tech Research Institute, Atlanta, GA; Digital Radio Corporation, Redondo Beach, CA; E-Systems, Greenville, TX; GTE Sylvania, Mountain View, CA; MACOM-PHI, Torrance, CA; Microwave Semi-conductor, Somerset, NJ; American Electronic Laboratories, Lansdale, PA; SCS Telecom, Port Washington, NY; Martin Marietta, Orlando, FL; ESL, Inc., Sunnyvale, CA.

(U) Related Activities:
Program Element: #0602270A (EW Technology)
Program Element: #0602782A (Command, Control Communications Technology)
Program Element: #0603789F (Command, Control and Communications and Intelligence Technology Development)
Program Element: #0604573N (Shipboard Electronic Warfare Improvements)
Program Element: #0604270A (Electronic Warfare Development)
Program Element: #0603745A (Tactical Electronic Support Measure (ESM) Systems)
Program Element: #0603755A (Tactical Electronic Countermeasures (ECM) Systems-Advanced Development)
Program Element: #0602131M (Marine Corps Landing Force Technology)
Program Element: #0305885G (Tactical Cryptologic Program)

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Current Memorandum of Understanding on Electro-Optical Countermeasures (EOCM) with United Kingdom. Pending MOU with Canada on MEDFLI/SILENT FOX effort, a NATO electronic support measure (ESM) payload.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603302A**

PE Title: **Joint Tactical Missile Defense Program** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D099	Intergration, Passive Defense, and C3I	16487	29834	16180	Cont	TBD
D141	PATRIOT ATM Upgrade	18376	15555	35438	138468	216000
D142	Active Defense	- 0 -	- 0 -	6581	Cont	TBD
D152	Attack Operations	- 0 -	- 0 -	4050	Cont	TBD
PE TOTAL		34863	45389	62249		

*FY90 Program being restructured

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Joint Tactical Missile Defense (JTMD) program is an Army led program designed to counter the tactical missile (TM) threat through passive measures, attack operations (counterforce), active defense, and command, control, communications and intelligence (C3I). Even after ratification of the Intermediate Nuclear Forces (INF) Treaty a significant threat still prevails. Tactical Missile Defense (TMD) is a concept for a balanced and integrated system of systems designed to counter enemy tactical missiles including both ballistic and air breathing missiles. Although this concept applies to theater level TMD operations in support of the operational and tactical levels of war, it requires the exploitation of national systems and capabilities to support theater efforts. This concept considers only the use of nonnuclear munitions in TMD to counter the Soviet missile threat. TMD systems must be capable of being integrated with existing and planned NATO counterair and fire support operations. The objective of TMD operations is to protect maneuver forces and high value fixed assets from enemy missiles employed in support of the enemy air and ground operations. These operations include missions and capabilities of all allied forces. The program is divided into near-term and long-term objectives. Both phases build on existing systems, leverage off emerging advanced technology, and are compatible with growth to full theater defense. Program emphasis is on defense against tactical missiles armed with non-nuclear warheads. The long-term program provides for an overall concept for countering the tactical missile threat. This approach will encompass all active options, passive countermeasures, offensive counterstrike measures and C3I considerations. This program element provides for analysis of requirements, operational concepts, current capabilities and emerging technologies to determine an optimum solution to the TMD threat. Development, demonstration and acquisition of selected systems will be managed by various commands/program executive officers under other program elements.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D142 — Active Defense: Near term TMD program emphasis is on active defense against Warsaw Pact tactical missiles armed with conventional warheads using modifications to the existing PATRIOT system. Concepts will be explored to develop a deployable capability suitable for employment against a threat anticipated in Third World operations. Active Defense analysis will develop asset and area defense concepts against longer term conventional and chemical threats. Active defense efforts leverage off of technologies being assessed by the Strategic Defense Initiative Organization as well as investigating independent systems and capabilities. This is not a new start, but a restructure from Project D099.

Program Element: **#0603302A**

PE Title: **Joint Tactical Missile Defense Program** Budget Activity: **#4**

(U) FY 1991 Planned Program:

- **(U)** Perform system integration to formulate and analyze asset and area defense concepts including doctrine, organization and training options and trade-off analyses between materiel solutions
- **(U)** Initiate development of preliminary warhead design using enhanced kinetic energy technology to defeat the chemical threat
- **(U)** Develop sensor requirements, launch/impact point prediction and cueing

(U) Project D152 — Attack Operations: The goal of the attack operations element is to disrupt or destroy enemy tactical missile (TM) launch capability by attacking launch platforms, supporting command and control, logistics and reconnaissance. This is not a new start, but a restructure from Project D099.

(U) FY 1991 Planned Program:

- **(U)** Continue tactical ballistic missile (TBM) detection, cueing, and targeting experiments
- **(U)** Evaluate emerging concepts and perform trade-off analyses to counter TM target set (Reconnaissance, Surveillance, and Target Acquisition, Command and Control (RSTA,C2), logistics and launchers)
- **(U)** Initiate survivable target acquisition sensor, weapons-target match and lethal engagement concept exploration

(U) Work Performed By: Industry participation will be dependent upon the results of the in-house system evaluation of all systems for the near term solution. Government agency in-house work will be performed by the U.S. Army Missile and Space Intelligence Center, Redstone Arsenal, AL; Program Executive Office, Fire Support and U.S. Army Missile Command, Redstone Arsenal, AL; U.S. Army Field Artillery School, Fort Sill, OK; U.S. Army Chemical R&D Center, Aberdeen Proving Ground, MD; Program Executive Office, Air Defense; U.S. Army Air Defense School, Fort Bliss, TX; the U.S. Army Strategic Defense Command, Huntsville, AL; and other service/government research activities. The program is being defined and developed under the direction of a DA working group for TMD.

(U) Related Activities: There is no unnecessary duplication with other Army or service/agency programs. The following are related activities.

- **(U)** Program Element #0604324A (Army Tactical Missile System)
- **(U)** Defense Advanced Research Projects Agency Programs
- **(U)** Program Element #0203801A Project D036 (PATRIOT Improvement Program)
- **(U)** Strategic Defense Initiative Organization Programs
- **(U)** Balanced Technology Initiative Programs

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable

(U) International Cooperative Agreements: Not Applicable

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603302A** Project Number: **# D099**

PE Title: **Joint Tactical Missile Defense Program** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Integration, Passive Defense, and C3I

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
	16487	29834*	16180	Cont	TBD

*FY90 Program being restructured

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project provides the integration and balancing analysis coupled with threat and vulnerability assessments to determine the appropriate levels of effort within and among the JTMD elements of active defense, passive defense, attack operations and C3I. Analytical efforts are required for NATO and Third World Theater operations. Additionally, the analysis of new and evolving warhead technology efforts are required. These analyses will be used in the development of the doctrine, strategies and force structure to properly meet the threat. In addition, the specific actions to explore passive defense and C3I will be funded under this element. The JTMD Passive Defense program integrates existing (service and DoD agencies) survivability programs to counter TM attacks, and sets an overall objective to increase survivability of critical assets (airbases, non-strategic nuclear forces, division/corps command posts, intelligence/electronic warfare (IEW) ground stations, attack helicopters and maneuver forces) by 50%. The C3I concept will provide rapid communications between intelligence assets, a fusion capability, the decision making process and operational means. Capabilities will be based on evolving Command and Control and Intelligence and Electronic Warfare Master Plans, along with the NATO Air Command and Control System.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Conducted tactical missile defense (TMD) experiments in Europe to assess current theater capability to (1) determine procedural and technical shortcomings, (2) improve theater TM targeting capabilities and procedures and (3) improve warning, cueing and targeting data timelines
- (U) Evaluated emerging sensor technology to improve detection and targeting of tactical ballistic missiles (TBMs)
- (U) Continued JTMD threat and technical evaluation and balancing program to determine optimal TMD architecture

(U) FY 1990 Planned Program:

- (U) Continue TMD European Experiments
- (U) Validate C3I simulation
- (U) Conduct C3I feasibility studies
- (U) Assess results of selected vulnerability analyses to develop and evaluate TBM survivability measures, including demonstrations and field tests as required
- (U) Continue TMD technical evaluation and balancing to determine optimal TMD architecture for NATO and Third World Theater operations
- (U) Perform chemical/terminally-guided submunition/other warhead effects analysis

Program Element: **#0603302A** Project Number: **# D099**
PE Title: **Joint Tactical Missile Defense Program** Budget Activity: **#4**

(U) FY 1991 Planned Program:

- **(U)** Perform evolving warhead technology effects analysis
- **(U)** Evaluate counter-reconnaissance, surveillance, and target acquisition (RSTA) benefits and hardening techniques
- **(U)** Continue TMD European Experiments
- **(U)** Continue C3I model enhancements and feasibility studies
- **(U)** Continue balancing analysis
- **(U)** Continue Third World Theater analysis

(U) Program Plan to Completion:

- **(U)** JTMD is a continuing program. The objective is to accomplish a cost-effective defense against the evolving TM threat

D. (U) WORK PERFORMED BY: Industry participation will be dependent upon the results of the in-house system evaluation of all systems for the near term solution. Government agency in-house work will be performed by the U.S. Army Missile and Space Intelligence Center, Redstone Arsenal, AL; Program Executive Office, Air Defense and U.S. Army Missile Command, Redstone Arsenal, AL; U.S. Army Air Defense School, Fort Bliss, TX; the U.S. Army Strategic Defense Command, Huntsville, AL; U.S. Air Force HQAF/ACBMB, Washington, DC; Army Space Program Office, Fairfax, VA; and other service/government research activities. The program is being defined and developed under the direction of a DA working group for TMD.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY: FY91 effort previously funded PATRIOT Multi Mode Seeker development. This activity transferred to Project D141. D099 now covers battle management, and command and control efforts for tactical missile defense.

F. (U) PROGRAM DOCUMENTATION:

JTMD Operational Concept	4/88

G. (U) RELATED ACTIVITIES: There is no unnecessary duplication with other Army or service/agency programs. The following are related activities.

- Defense Advanced Research Projects Agency Programs
- Strategic Defense Initiative Organization Programs
- Balanced Technology Initiative Programs

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE: Not Applicable

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603302A** Project Number: **#D141**

PE Title: **Joint Tactical Missile Defense Program** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: PATRIOT ATM Upgrade

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
PATRIOT ATM Upgrade	18376	15555	35438	138468	216000

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Threat Tactical Ballistic Missiles (TBM) with significantly improved accuracy have increased the threat against PATRIOT Air Defense sites and defended assets. This could result in the destruction of those sites and enemy air superiority once an attack is initiated. PATRIOT systems can ameliorate this deficiency through the implementation of passive countermeasures such as site hardening, emission controls and mobility, but the site must also be able to acquire, identify, track, engage and destroy incoming TBM as an element of active defense and unit survivability. PATRIOT near-term Anti-Tactical Missile (ATM) capabilities (PAC) consist of two phases: modifications to the system software (PAC-1) and modification to missile hardware (warhead and fuze assembly) (PAC-2). The PAC-1 software changes fielded in Jun 88 provide a self-defense capability. The PAC-2 changes will extend the self defense capabilities and limited corollary asset defense capabilities for PATRIOT. The Multi Mode Seeker program, a cooperative development with the FRG, expands the limited critical asset defense capabilities of PAC-2 program by incorporating an active seeker into the PATRIOT missile. The Multi Mode Seeker also includes changes to the missile auto pilot to improve data handling and improvements to signal to noise performance in the missile receiver. These system changes are needed to be able to counter TBM with low radar cross section, high terminal velocity and high angle of attack.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Three PAC-2 missile flight tests scheduled
- **(U)** PAC-2 in-process review (IPR) scheduled 1st quarter
- **(U)** Contract modification for missile production scheduled for 2d quarter

(U) FY 1990 Planned Program:

- **(U)** Complete design, code and test of PAC-2 software. Initiate flight test build updates and integration efforts
- **(U)** Three PAC-2 missile flight tests scheduled

(U) FY 1991 Planned Program:

- **(U)** Final software build release
- **(U)** Missile hazard classification testing scheduled
- **(U)** Conduct system hardware/software tests
- **(U)** First missile deliveries in 2d quarter
- **(U)** Multi Mode Seeker:
  - System requirements initiated
  - Hardware design initiated
  - System software development initiated

Program Element: **#0603302A** Project Number: **#D141**
PE Title: **Joint Tactical Missile Defense Program** Budget Activity: **#4**

D. (U) WORK PERFORMED BY: The prime contractor is Raytheon Co., Andover, MA for the ATM upgrade of PATRIOT. Government agency in-house work will be performed by the U.S. Army Missile Command Research, Development and Engineering Center, Redstone Arsenal, AL; U.S. Army Armament Research and Development Center, Picatinny Arsenal, NJ; Harry Diamond Laboratories, Adelphi, MD; Ballistic Research Laboratory, Aberdeen Proving Ground, MD; Program Executive Office, Air Defense and U.S. Army Missile Command, Redstone Arsenal, AL; U.S. Army Air Defense School, Fort Bliss, TX; the U.S. Army Strategic Defense Command Office, Huntsville, AL; and other Service/Government research activities.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not Applicable.
2. **(U) SCHEDULE CHANGES:** Not Applicable
3. **(U) COST CHANGES:** FY91 funding was increased relative to JTMD task force recommendations. Funding transfer from Project D099 to D141 associated with Multi Mode Seeker development.

F. (U) PROGRAM DOCUMENTATION:

PAC-2	
Justification for Major Systems New Start	8/82
Required Operational Capability (ROC)	11/88
Decision Coordinating Paper	12/88
MMSD	
Draft O&O Plan	3/89
Draft ROC	2/89

G. (U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Army or DOD.
PE #0203801A Project #D036 (PATRIOT)
PE #0203801A Project #D690 (HAWK)
PE #0603790D NATO Cooperative Programs
PE #0604324A (Army Tactical Missile System)

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable.

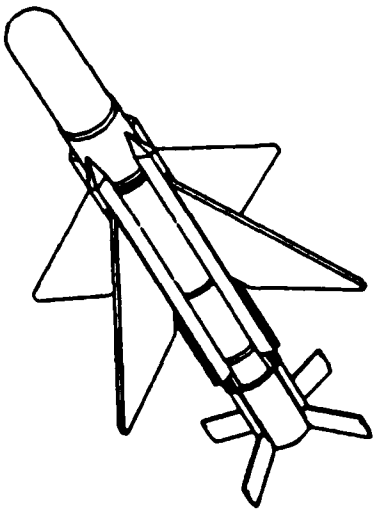
I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Multi Mode Seeker Demonstration: Extended Air Defense Memorandum of Agreement, 17 May 89; ANNEX A Multi Mode Seeker Demonstration, 17 May 89.

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
PAC-2	
Milestone I	8/82
Milestone II	6/83
PAC-2 System Definition	12/87
Milestone III	12/88
Comprehensive System Development Test	9/90
Development/Operational Test	3/91
MMSD	
Milestone I	2/89
Milestone II	2d Quarter FY91
Milestone III	4th Quarter FY94
First unit equipped	4th Quarter FY96

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603303A** Project Number: **#D216**
PE Title: **Surface-to-Surface Missile Rocket System** Budget Activity: **#4**
Project Title: **Multiple Launched Rocket System-Terminal Guidance Warhead**



POPULAR NAME: **MLRS-TGW**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		ASARC For Sys Demo Stostage (SDS) 1/89/(Con Syst Cmte)-2/89	2/90 MS IIA		MS III for Production Decision 2QFY95
Engineering Milestones		Transition to SDS 7/89	Improve Seeker 9/89	Prototype Hardware Maturation-92	
T&E Milestones		FDTE Complete	Prototype Captive Flt Test/Ballistic	Ballistic Flt Test Dispense Test Drop Test	MS Test 92-94/ IOTE-94 ADVT Flts European Captive Flt Tests
Contract Milestones		Complete CDS Feb 89; Start SDS July 89			Maturation 1 Sch 2QFY93
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		20757	13515	31640	282527 (23700)
Support Contract		9675	9721	9942	78786 (10000)
In-House Support		3521	3810	4148	32467 (4000)
GFE/ Other		1367	1400	1445	33897 (1400)
Total		35320	28446	47175	427677 (39100)

Program Element: **#0603303A** Project Number: **#D216**
PE Title: **Surface-to-Surface Missile Rocket System** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The concept of a Terminal Guidance Warhead (TGW) for the Multiple Launch Rocket System (MLRS) envisions the attack of armored targets from above using highly accurate and lethal submunitions dispensed from an MLRS rocket. There is an urgent need for an autonomous, terminal homing, indirect fire-and-forget capability to defeat hard, point targets such as armored vehicles and equipment before they are committed into the central battle, thereby reducing their presentation rate. The TGW for the MLRS will contain three submunitions packaged within the rocket warhead section. The Army is developing this warhead in cooperation with France, Germany and the United Kingdom under a memorandum of understanding dated 3 December 1983. Within this PE in FY 1989, threat materiel may be acquired and exploited to support development. In FY 1990 and FY 1991 threat materiel acquisition/exploition has been programed in PE #0605709A/DC28 and will be executed upon authorization/appropriation.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project D216 — Multiple Launched Rocket System Terminal Guidance Warhead (MLRS-TGW)

(U) FY 1989 Accomplishments:
- (U) Completed component demonstration substage
- (U) Conducted system design review (SDR)
- (U) Initiated system demonstration substage (SDS)
- (U) Continued prototype hardware system design
- (U) Initiated SDS hardware procurement and fabrication
- (U) Initiated prototype DBS software development

(U) FY 1990 Planned Program:
- (U) Continue captive prototype flight testing with Doppler Beam improved seeker
- (U) Initiate rocket ballistic flight for trajectory algorithm
- (U) Verify tactical detection algorithm
- (U) Continue hardware fabrication
- (U) Initial delivery of subsystem prototypes
- (U) Initiate subsystem assembly and test
- (U) Continue prototype software development

(U) FY 1991 Planned Program:
- (U) Complete rocket ballistic flight for trajectory algorithm
- (U) Complete prototype software development
- (U) Complete component TGW/Terminal Guidance Submunition (TGSM) system integration assembly test
- (U) Conduct TGSM subsystem environmental test
- (U) Initiate system level TGW dispense and drop tests

(U) Program Plan to Completion:
- (U) Begin maturation stage FY 1992
- (U) Milestone IIIa (low rate initial production) FY 1995

D. (U) WORK PERFORMED BY: This program is managed by the MLRS Project Manager. Development contractor for TGW is MDTT Joint Venture, Orlando, Florida. MDTT Joint Venture is comprised of Martin Marietta Corporation of the U.S.; Thomson CFS of France, Thorn EMI Electronics of the United Kingdom and Diehl GmbH of Germany. The LTV Corporation of Dallas, Texas, prime contractor for the MLRS, will integrate the TGW with the basic MLRS.

Program Element: **#0603303A** Project Number: **#D216**
PE Title: **Surface-to-Surface Missile Rocket System** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable
2. **(U) SCHEDULE CHANGES:** Not applicable
3. **(U) COST CHANGES:** Not applicable

F. (U) PROGRAM DOCUMENTATION:

Letter of Agreement	10/83
MOU Supplement Number 3 to Basic MLRS Co-development MOU	12/83
System Coordinating Paper Updated for SDS	2/89
SDS Contract Signed	7/89
Secretary of Defense Decision Memorandum	11/84
TEMP-Approved 6/84; Updated 3/89 to revised PGM: DA approved 8/89	

G. (U) RELATED ACTIVITIES: SSN: C67600 (Multiple Launch Rocket System)

H. (U) OTHER APPROPRIATION FUNDS:. ($ in Thousands) Not applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: TGW is being jointly developed under an international memorandum of understanding (MOU) dated 11 Sep 81 for the Multiple Launch Rocket System (MLRS) with Dec 83 supplement that established the TGW Program. The overall program is supervised by the Joint Steering Committee composed of flag rank national representatives of the MOU member countries (France, Germany, United Kingdom and the United States). The contractor is an international joint venture of MDTT Inc., Martin-Marietta (US), Diehl GmbH (FRG), Thomson CFS France and Thorn (UK). MDTT acts as the managing partner of the joint venture. Under the terms of the MOU the US pays 40 percent of the development costs and NATO partners pay 20 percent each.

J. (U) TEST AND EVALUATION DATA:

1. Development Test and Evaluation:

   a. Concept: Multiple Launch Rocket System/Terminal Guidance Warhead (MLRS/TGW) testing will be continued under the Single Integrated Development Test concept. Co-development and test will be conducted under the provision of the TGW MOU supplement among the United States, United Kingdom, Federal Republic of Germany, and France. The MLRS Project Manager (PM) will maintain total weapons system responsibility. The Project Management Office will manage both the US and international aspects of the test program through a formally charted MLRS Test Integration Working Group (TIWG). The TIWG integrates the testing requirements, data requirements, and specific T&E requirements from all participating organizations and countries into a combined MLRS TGW test program. International aspects of the test program management will be accomplished through the International TIWG consisting of representatives from each of the participating countries, the development contractor, and the integration contractor. The International TIWG, functioning in accordance with approved terms of reference as specified in MLRS MOU, will integrate test requirements, interchange test data and coordinate the use of test resources to achieve cost effective testing throughout the life cycle of the test program.

Program Element: **#0603303A** Project Number: **#D216**
PE Title: **Surface-to-Surface Missile Rocket System** Budget Activity: **#4**

b. Development Test and Evaluation (DT&E) —

(1)Validation Stage, Component Demonstration Substage—DT&E during this phase was designed to reduce technical risk and cost exposure by demonstrating technology maturity of components and subsystems. The program was designed to provide a logical progression of DT&E from the piece part, component, subassembly, and assembly through the subsystem level. The first phase of validation was not intended to fully develop the MLRS-TGW Component/subsystem design. Full development and verification of the engineering solutions will be accomplished during the revised system demonstration substage.

(2)Validation Stage, Revised System Demonstration Substage — DT&E during this phase will be a weapon system integration demonstration phase designed to provide component, subsystem, and system level confidence. This second phase of the validation stage will include completion of the component/subsystem engineering effort to more fully develop these items and to integrate them into a functional MLRS/TGW rocket. This data, RDTE results, and other M270 Family of Munitions operational testing will be incorporated in the operational assessment.

(3)Maturation Stage — This phase of the program will include maturation development tests with development prototypes. The maturation effort includes continued design update, hardware fabrication, and completion of engineering and environmental testing to support a low risk decision for production start (MS IIIa). The program provides for an event driven option to begin low risk initial production near the end of the maturation stage should technical/engineering progress warrant.

2. Operational Test and Evaluation: During the system demonstration substage of the validation stage, a force development, test and experimentation will be conducted to examine the command, control, communications, and intelligence system required for the employment of various MLRS munitions, to include MLRS-TGW. An initial operational test and evaluation will be conducted during the maturation stage. If required, a follow-on evaluation will be conducted during the production qualification testing to support the full-rate production decision (MS III).

3. System Characteristics: Not applicable.

4. Current Test and Evaluation Activity: Test and evaluation efforts for the revised SDS Program will begin on contract award and follow a logical progression; beginning with captive flight tests, hardware-in-the-loop testing of the seeker, sensor, submissile drop tests and culminate in fully integrated warhead dispense tests with active/inert terminal guidance submissile. The complete revised SDS phase test program is defined in the current TGW Test and Evaluation Master Plan (TEMP).

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603313A**

PE Title: **Missile and Rocket Advanced Technology** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D085 Demonstration of Advanced Radar Techniques (DART)	- 0 -	385	233	Cont	Cont
D087 Missile and Rocket Components	2449	- 0 -	- 0 -		
D206 Missile Simulation	3951	2990	2995	Cont	Cont
D271 Multi-role Survivable Radar	6959	7145	5593	Cont	Cont
PE TOTAL	13359	10520	8821		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is the only Army program for scaling up new missile and air defense radar concepts and components developed under exploratory development. This program element (PE) provides the mechanism to prove that hardware and software components developed in exploratory development demonstrate capabilities suitable for transition into materiel acquisition. This program element also provides the means to accelerate the transition of new and improved missile realtime hardware-in-the-loop simulation technology. Mission Area Analysis (MAA) deficiencies stated by the U.S. Army Training and Doctrine Command (TRADOC) require materiel development solutions for product improvements to existing systems and new systems concepts to provide: air threat detection systems with low probability of intercept and reduced vulnerability to antiradiation missile threat and electronic counter-countermeasures; cost reduction of missile components and systems; a survivable anti-armor system to meet the emerging threat; a kinetic energy penetrator to defeat heavy armor; and advanced concepts and seekers for application to direct or indirect fire missiles in the antitank role. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D085 — Demonstration of Advanced Radar Technology: This project was begun in FY 1984 in a joint NATO effort with France, Germany, Italy, The Netherlands, and United Kingdom to conduct a feasibility demonstration of advanced radar techniques for application to short range air defense. The project's main thrust is to determine ways to reduce the vulnerability of our radars to antiradiation missile (ARM) attack and to enhance performance in the presence of electronic countermeasures (ECM). A Memorandum of Agreement was signed to accomplish this program which is also formally designated as a NATO project. The U.S. is providing the antenna for the cooperatively developed research radar.

(U) FY 1989 Accomplishments: Funding for this Project was redirected to higher priority Army programs.

(U) FY 1990 Planned Program:

- **(U)** Support international field trials in The Netherlands
- **(U)** Conduct radar performance analysis and antenna maintenance during the test program

Program Element: **#0603313A**
PE Title: **Missile and Rocket Advanced Technology** Budget Activity: **#2**

(U) FY 1991 Planned Program:

- **(U)** Support national field trials in The Netherlands, France and the Federal Republic of Germany
- **(U)** Continue analysis of radar performance

(U) Project D087 — Missile and Rocket Components: Advanced Manufacturing Research will develop the capabilities for integrating state-of-the-art manufacturing systems and computers to manage the material transformation, transportation, and information exchange activities necessary for cost effective manufacturing of missile and rocket components and subsystems. These efforts will provide the capability to identify, develop, simulate, and quantifiably evaluate automated production processes for contractor implementation to ensure the reliability and affordability of weapon system and items and components through reduced setup, tooling, and labor costs. The end result is the introduction of flexible and economic automated missile manufacturing systems into contractor facilities to ensure end-item and components producibility and economic availability. The high complexity and low production quantities of missile and rocket components have not provided incentive to defense contractors to change existing production methods; therefore, a test-bed capability/facility needs to be developed to bridge the gap between the industrial base and the manufacturing technologies available.

(U) FY 1989 Accomplishments:

- **(U)** Continued development of a dynamic tensile/proof testing system for fiber optic cables
- **(U)** Continued development of technologies required to enhance the micro-circuit test unit
- **(U)** Developed, modified, and installed pattern recognition/video imaging systems into the RWHAS
- **(U)** Developed and installed modifications to expand the capabilities of the Robotized Wire Harness System (RWHAS) to include shielded cables and twisted-pairs
- **(U)** Initiated development of an Inertial Measurement Unit (IMU) for robots
- **(U)** Continued development of the RWHAS/Computer Aided Design (CAD) interface
- **(U)** Initiated development of a computer controlled laser process for controlling detector material crystal growth
- **(U)** Continued modification and expansion of the VAX based Computer Managed Process Planning (CMPP) system
- **(U)** Initiated development of a personal computer based version of CMPP
- **(U)** Continued development of technologies required to integrate Computer Integrated Manufacturing (CIM) systems and state-of-the-art automated manufacturing equipment

(U) FY 1990 Planned Program:

- **(U)** Funding for this project in FY 1990 and beyond has been redirected to higher priority Army programs

(U) FY 1991 Planned Program:

- **(U)** Funding for this project has been redirected to higher priority Army programs

(U) Project D206 — Missile Simulation: The Missile Simulation Project consists of three related efforts: (1) Advanced Simulation Center (ASC) — The US Army Missile Command (MICOM) ASC is a pioneering facility in the state-of-the-art technology for nondestructive simulation of weapon system sensors, guidance and control components, and/or flight hardware. (2) Missile Systems Simulator (MSS)—In order to extend this simulation support to advanced systems planned for 1990-2010 and to handle the workload in that timeframe, six new simulators, known collectively as the Millimeter/Microwave Simulation Facility (MMSF) are planned; (3) Battlefield Environment Future Weapon System Simulation (BEFWSS) — The effectiveness of electro-optically guided

Program Element: **#0603313A**
PE Title: **Missile and Rocket Advanced Technology** Budget Activity: **#2**

weapon systems on a realistic battlefield is evaluated by the Guidance and Control (G&C) Directorate through the use of the large scaled, computer based weapon system simulation, BEFWSS. The G&C simulation is a validated digital simulation that effectively unites the five major system performance concerns for an electro-optically (EO) guided weapon system: the battlefield environment, the Organization and Operation (O&O), the target location assets, the target signature, and the delivery system dynamics. BEFWSS is designed to simulate these major system concerns in great detail in an effort to provide an accurate evaluation of EO weapon system effectiveness under battlefield conditions. Once these tools are developed, they are utilized under separate funding to provide analysis and evaluation for specific Project Manager (PM) weapon systems.

(U) FY 1989 Accomplishments:

- (U) Radio Frequency (RF) & millimeter wave (MMW) electronic countermeasures (ECM) signal generation improvements
- (U) Incorporated real-time graphic displays into simulation facilities
- (U) Continued Versa Module Europe (VME) bus signal generation improvements
- (U) Began design of Millimeter Microwave Simulation Facility (MMSF) weapon system simulator
- (U) Initiated infrared (IR) scene projector prototype
- (U) Developed Battlefield Environment Automated Scenario Development System (BEADS), a high resolution graphics tool that allows the user to interactively digitize Red and Blue paths and to time phase Red and Blue force movement in the digitized terrain
- (U) Extended BEADS to display BEFWSS battle results. Missile trajectories, target engagements, and target reaction to the engagement will be shown. The visual presentation of battlefield action provides invaluable insights into model accuracy.
- (U) Developed high resolution interactive graphics IR target signature model Scene Generation Analysis System (SGAS). This model generates in-flight synthetic target images for input to imaging trackers

(U) FY 1990 Planned Program:

- (U) Continue Versa Module Europe (VME) bus signal generation improvements
- (U) Continue design of MMSF weapon system simulator
- (U) Continue IR scene projector prototype implementation
- (U) Provide BEFWSS capability to execute multiple six degree of freedom missile simulations
- (U) Continue the development of BEADS to include higher quality display of smoke, burning targets, and other obscurants
- (U) Continue the development of SGAS to provide real time target image generation for input to six degree of freedom models
- (U) Extend SGAS capability to include visual and near visual target images

(U) FY 1991 Planned Program:

- (U) Initiate Microwave Simulation Facility (MMSF) RF and Millimeter Wave (MMW) simulator development
- (U) Equip imaging IR scene projection laboratory in MMSF
- (U) Develop SGAS capability to convert real target images to digital images for input to missile models
- (U) Combine Battlefield Environment Future Weapon System Simulation (BEFWSS) and BEADS to allow interactive display of target scenes so the user can interactively select a target for engagement. This will be particularly useful for weapon systems such as Non Line of Sight (NLOS), Advance Anti-tank Weapon System-Medium (AAWS-M), and Kinetic Energy

Program Element: **#0603313A**

PE Title: **Missile and Rocket Advanced Technology** Budget Activity: **#2**

Missile (KEM) and to target acquisition assets such as Target Acquisition and Designation System (TADS), Mast Mounted Sight (MMS) and Unmanned Aerial Vehicle (UAV).

(U) Project D271 — Multi-Role Survivable Radar: The Multi-Role Survivable Radar (MRSR) Program is being executed in order to make available to the Army air defense radars that can continue to operate in intense electronic countermeasures and not be destroyed by anti-radiation missiles (ARMs). Effort to date involves competing different technical approaches with the major effort being performed by Raytheon Company and Westinghouse Corporation.

(U) FY 1989 Accomplishments:

- (U) Parts acquisition for MRSR completed
- (U) Hardware fabrication for MRSR continued
- (U) Hardware/software integration for MRSR started
- (U) Initial subsystem tests for MRSR completed

(U) FY 1990 Planned Program:

- (U) Hardware fabrication for MRSR will be completed
- (U) Antenna pattern tests for MRSR completed
- (U) Transmitter/receiver tests for MRSR completed
- (U) Hardware/software integration for MRSR will be completed
- (U) System tests for MRSR will be started

(U) FY 1991 Planned Program:

- (U) System tests for MRSR will be completed
- (U) MRSR delivered to MICOM
- (U) Field tests for MRSR will begin

(U) **Work Performed By:** The Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL, has the primary responsibility for execution of this program. The major contractors are Raytheon, Bedford, MA; CAS, Inc., Huntsville, AL; UAH, Huntsville, AL; Auburn University, Auburn, AL; Georgia Tech, Atlanta, Georgia; Boeing Aerospace Company, Seattle, Washington; Electronic Associates, Inc., West Long Branch, NJ; Southern Research Technologies; Alcatel; Hughes Aircraft; Campbell Engineering; LTV Aerospace and Defense Company, Dallas, Texas; Westinghouse Electric Corporation, Baltimore, MD; Morton Thiokol; Aerojet Solid Propulsion Company; Atlanta Research Corporation; and Hercules, Inc.

(U) **Related Activities:** PE #0603010A/D181 — Tri-Service ARM countermeasures program; PE #0602303A — Missile Technology, PE 0603757A/D465 — NLOS PMO Full Scale Development Program; PE 0603761A-EW Vulnerability/Susceptibility Technical Support; PE #0603363F — Tactical Air-To-Surface Weapons.

(U) **Other Appropriation Funds:** ($ in Thousands) None

(U) **International Cooperative Agreements:** DART Memorandum of Understanding.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603314A**
PE Title: **Directed Energy** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
A422	Directed Energy	4320	34486	41014	Cont	Cont
A431	Classified Program	1353	10971	- 0 -	—	—
PE TOTAL		5673	45457	41014		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Soviet Union maintains a large constellation of satellites capable of monitoring, identifying, and targeting U.S. forces as well as an anti-satellite (ASAT) system capable of destroying similar U.S. satellites. The U.S. has no ASAT capability. The Joint Chiefs of Staff has validated U.S. Space Command's Multi-Command Required Operational Capability (MROC) for space control. Current studies indicate that the most cost effective means of space control is an ASAT system that includes a mix of both kinetic energy (KE) and directed energy (DE) weapons. This Program Element (PE) encompasses the research in laser beam control engineering required to develop an ASAT DE weapon, and leverages off the DE development in the Strategic Defense Initiative Organization.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project A422 — Directed Energy Components: This element funds the ASAT-specific research and development effort for the SDIO-funded Ground-Based Free Electron Laser (GBFEL) project, including the design and procurement of ASAT beam control, tracking and pointing equipment. An additional $20M has been added to this program in FY 1990 to fund an upgrade to the Sea Lite Beam Director (SLBD) for complementary beam control evaluations of the Mid-Infrared Advanced Chemical Laser (MIRACL).

(U) FY 1989 Accomplishments: This is a classified program for 1989. Milestone 0 (MS 0) was approved for the ASAT Program and Milestone 1 (MS 1) for directed energy (DE) ASAT systems is planned for FY 1991. No ASAT-related SLBD/MIRACL work was accomplished.

(U) FY 1990 Planned Program:

- **(U)** GBFEL — Definition of ASAT system engineering requirements, subsystem design and trade studies, acquisition tracking and pointing (ATP) hardware development, and satellite imaging research
- **(U)** SLBD/MIRACL — Provide an upgrade to conduct tracking and beam propagation research in support of laser beam control

(U) FY 1991 Planned Program:

- **(U)** Continue prior studies and complete the ATP subsystem development
- **(U)** Continue development of the target imaging hardware (computer, sensor) and software
- **(U)** No further funding for SLBD/MIRACL is programmed under this PE. Further requirements for the ASAT applications of GBFEL will be based on the outcome of the program outlined above

(U) Project A431 — This is a classified program. Program transferred to PE #0603322A, Project AB60, effective FY 1991.

Program Element: **#0603314A**

PE Title: **Directed Energy** Budget Activity: **#2**

(U) Work Performed By: U.S. Army Strategic Defense Command; Lawrence Livermore Laboratories, Livermore, CA; Los Alamos Laboratories, Albuquerque, NM; Boeing Aerospace Corp, Kent WA; TRW, Inc., Redondo Beach, CA; Lockheed Corp., Mountain View, CA; and UNISYS, Great Neck, NY.

(U) Related Activities:

- **(U)** PE #0602214C, SDIO Directed Energy Program
- **(U)** PE #0603605F, USAF Advanced Weapons
- **(U)** PE #0603392A, Anti-Satellite Weapons (ASAT)

(U) Other Appropriation Funds: ($ in Thousands) Not applicable.

(U) International Cooperative Agreements: None

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603392A**
PE Title: **Anti-Satellite Weapons (ASAT)**
Project Title: **Anti-Satellite Weapons**

Project Number: **# DE16**
Budget Activity: **#3**

NO PICTURE AVAILABLE

POPULAR NAME: **ASAT**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		MS 0 Jan 88	MS 1 Jan 90		
Engineering Milestones					
T&E Milestones					
Contract Milestones			DEM/VAL Jun 90		
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract			45750	176482	1530000 (1307768)
Support Contract			8100	10400	90000 (71500)
In-House Support			5000	4700	36000 (26300)
GFE/ Other			15000	16200	144000 (112800)
Total		0	73850	207782	1800000 (1518368)

Program Element: **#0603392A** Project Number: **# DE16**
PE Title: **Anti-Satellite Weapons (ASAT)** Budget Activity: **#3**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Soviet Union maintains a large constellation of satellites capable of monitoring, identifying and targeting U.S. forces as well as an anti-satellite (ASAT) systems capable of destroying similar U.S. satellites. The U.S. has no ASAT capability to respond in kind. The Joint Chiefs of Staff have validated U.S. Space Command's Multi-Command Required Operational Capability (MROC) for a space control ASAT system. Accomplishment of operational functions requires a combination of surveillance, command and control (C2) and engagement capabilities. This program is primarily focused on the development of kinetic energy (KE) capabilities. Battle management, command, control and communications (BM/C3) concepts will be explored and developed under this program by the Air Force to the extent necessary to ensure ASAT weapon system compatibility with the existing or planned USCINCSPACE C2 capability and existing or planned interfaces with the National Military Command System. The system will be initially a small land based set and the program will be managed by the Army through the use of a Joint Program Office.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** The Defense Acquisition Board approved Milestone 0 for a KE ASAT system on 9 January 1989. Residual funds and research programs from the canceled air-launched ASAT were used for initial ASAT studies. The following activities associated with concept definition have been completed using reimbursable Air Force funds:
  - Established a Joint Program Office
  - Developed program plans
  - Completed concept definition
  - Completed performance of engineering and timeline analysis
  - Developed an acquisition strategy

(U) FY 1990 Planned Program:

- Complete engineering analyses and performance of cost and operational effectiveness analysis to support MS 1
- After MS 1 approval, competitively select system prime contractor(s) for the conduct of demonstration/validation (DEM/VAL)
- Concurrently initiate experiments designed to reduce program risk and resolve critical issues which include the development of a BM/C3 test bed, development of the KE ASAT booster, full-scale hypervelocity impact tests and potentially the proof-of-principle test of a novel ASAT concept

(U) FY 1991 Planned Program:

- Conduct KE ASAT system design review (SDR)
- Continue the KE ASAT DEM/VAL program leading to FY 1992 tests
- Continue risk reduction program including BM/C3 test bed, satellite signature collection/analysis, KE ASAT booster development. Extensive test data will be leveraged from Strategic Defense Initiative (SDI) projects and programs which are applicable to the ASAT programs. This test data will be integrated with ASAT modeling, simulations, and ground tests (e.g., hypervelocity impact and novel/innovative concept tests) as components and subsystems progress through the DEM/VAL phase

(U) Program Plan to Completion:

- Conduct KE ASAT Milestone II NLT September 1992
- Select contractor for full-scale development (FSD)/low rate initial production
- FSD Initial Operational Test and Evaluation (IOT&E) test requirements identified

Program Element: **#0603392A** Project Number: **# DE16**
PE Title: **Anti-Satellite Weapons (ASAT)** Budget Activity: **#3**

- Complete FSD by June 94
- Conduct development test/operational test (DT/OT) Jun 94 until Mar 95
- Award production contract FY 95
- Deliver first systems in FY 96/97

D. (U) WORK PERFORMED BY: U.S. Army Strategic Defense Command: U.S. Navy Strategic Systems Program Office; Teledyne Brown Engineering, Huntsville, AL; Johns Hopkins University/Applied Physics Laboratory, Laurel, MD; Nichols Research Company, Huntsville, AL; Answer Corporation, Arlington, VA; Coleman Research Corporation, Huntsville, AL; Booz-Allen Hamilton, Huntsville, AL.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY: Not applicable; this is a new start for FY90

F. (U) PROGRAM DOCUMENTATION:

- Defense Acquisition Board Acquisition Decision Memorandum Program(s) dated 9 March 1989
- Defense Acquisition Decision Memorandum for Kinetic Energy Anti-Satellite (KE ASAT) Concept Definition Selection (u) dated 15 Dec 1989

G. (U) RELATED ACTIVITIES:

- Program Element #0603314A, (Directed Energy); Army and Navy directed energy research
- Program Element #0102424F, (SPACETRACK); Includes Air Force Surveillance and BM/C3 development for ASAT
- Program Element #0603222C, (Kinetic Energy Weapons); SDIO kinetic energy weapons research
- Program Element #0603221F, (Directed Energy Weapons); SDIO directed energy research

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) TEST AND EVALUATION DATA: The ASAT Test and Evaluation Master Plan has been completed and awaiting final Service and OSD approval for a MS I review in Jan 90.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603604A**

PE Title: **Nuclear Munitions Advanced Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D135 Nuclear Development Support	2429	1260	1367	Cont	Cont
D153 Nuclear Effects Support Team (NEST)	4844	2085	2219	Cont	Cont
PE TOTAL	7273	3345	3586		

B. (U) BRIEF DESCRIPTION OF ELEMENT: Modern, effective, and safe nuclear weapon systems are needed to fight successfully on the nuclear battlefield. The projects in this PE fund the Army's nuclear systems advanced development efforts in support of those needs and fund the management and engineering support activities required to interface with the Department of Energy (DOE) and Army hardware developers. Nuclear Effects Support Team (NEST) provides nuclear weapons effects expertise to developers of Army materiel with nuclear survivability requirements. The Nuclear Survivability Assessment Team (NSAT) assesses the nuclear survivability of mission essential deployed equipment and identifies corrective measures to improve nuclear survivability where needed. These teams of experts support the Army research and development community in developing nuclear hardened systems and identifying nuclear survivability improvements needed in mission essential deployed equipment. Additionally, this program element funds advanced development of components to meet modern nuclear operational, safety, security and reliability requirements in a cost effective manner for follow-on to current nuclear projectiles and conducts design, development, and test efforts for a container to increase safety, security, and survivability of artillery fired atomic projectiles.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D135 — Nuclear Development Support: This project provides funding for a core of personnel to carry out centralized management of RDT&E effort under the auspices of the Project Manager for Nuclear Munitions.

(U) FY 1989 Accomplishments:

- **(U)** Funded civilian salaries and travel in the Project Management for Nuclear Munitions Office (PM-NUC) to manage and support all Research, Development, Test and Evaluation efforts on assigned projects
- **(U)** Developed preliminary drawings, fabricated test hardware, and completed Advanced Development of the Survivability Overpack Container (SOC)

(U) FY 1990 Planned Program:

- **(U)** Funds civilian salaries and travel in the PM-NUC Office in Research, Development, Test, and Evaluation (RDT&E) and provides funds for the office operating budget of PM-NUC

(U) FY 1991 Planned Program:

- **(U)** Funds civilian salaries and travel in the PM-NUC Office in Research, Development, Test, and Evaluation (RDT&E) and provides funds for the office operating budget of PM-NUC

(U) Project D153 — Nuclear Effects Support: This project provides funding for the Nuclear Effects Support Team (NEST) and the Nuclear Survivability Assessment Team (NSAT). The NEST provides nuclear weapons effects expertise to developers of Army materiel with nuclear survivability

Program Element: **#0603604A**

PE Title: **Nuclear Munitions Advanced Development** Budget Activity: **#4**

requirements essential to deployed equipment and identifies corrective measures to improve requirements. The NSAT assesses as required the nuclear survivability of mission essential Army systems/equipment which are critical in nuclear conflict.

(U) FY 1989 Accomplishments:

- **(U)** Provided nuclear survivability design assistance to approximately fifty project managers
- **(U)** Continued the development of expert system design aids to assist project managers in designing for nuclear survivability
- **(U)** Conducted survivability assessments of developmental systems as requested by the Secretary of the Army for Research Development and Acquisition. Assess Test and Evaluation Master Plans for adequacy in nuclear survivability
- **(U)** Completed the nuclear survivability assessment of the LANCE battery
- **(U)** Initiated nuclear survivability assessments of the PATRIOT and the M60 Tank and M109 Howitzer battalions
- **(U)** Completed nuclear survivability assessments of the four infantry battalions and the Multiple Launch Rocket System battery

(U) FY 1990 Planned Program:

- **(U)** Provide nuclear survivability design assistance to approximately fifty project managers
- **(U)** Continue the development of expert system design aids to assist project managers in designing for nuclear survivability
- **(U)** Bring the fielded system assessments to an orderly conclusion
- **(U)** Conduct survivability assessments of developmental systems as requested by the Secretary of the Army for Research Development and Acquisition. Assess test and evaluation master plans for adequacy in nuclear survivability

(U) FY 1991 Planned Program:

- **(U)** Provide nuclear survivability design assistance to approximately sixty project managers
- **(U)** Continue the development of expert system design aids to assist project managers in designing for nuclear survivability
- **(U)** Conduct survivability assessments of developmental systems as requested by the Secretary of the Army for Research Development and Acquisition. Assess test and evaluation master plans for adequacy in nuclear survivability

(U) Work Performed By: In-house efforts are performed at U.S. Army Armament Research, Development, and Engineering Center, Picatinny Arsenal, NJ; Harry Diamond Laboratories, Adelphi, MD; U.S. Army Electronic Warfare/Reconnaissance, Surveillance, and Target Acquisition Center, Fort Monmouth, NJ; and Ballistic Research Laboratory, Aberdeen Proving Ground, MD. Major contractors are Booz, Allen & Hamilton, Bethesda, MD; Kaman Sciences Corporation, Colorado Springs, CO; Science Applications International Corporation, McLean, VA; and Mission Research Corporation, Santa Barbara, CA.

(U) Related Activities: PE #0602120A (Electronic Survivability and Fuzing Technology). This PE is used in the transfer of survivability and hardening technology. Nuclear survivability is a Tri-Service effort in coordination with the Defense Nuclear Agency. It has been coordinated with the Quadripartite and North Atlantic Treaty Organization (NATO) nations by standardization agreements. PE #0604603A (Nuclear Munitions) is the engineering development of the 155mm nuclear projectile, associated components, and the survivability overpack container (SOC). There is no unnecessary duplication of effort within the Department of the Army or the Department of Defense.

Program Element: **#0603604A**

PE Title: **Nuclear Munitions Advanced Development** Budget Activity: **#4**

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603606A**

PE Title: **Landmine Warfare and Barrier Advanced Technology** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D006 Landmine Warfare Dev	2208	2335	2414	Cont	Cont
D608 Countermine & Barrier Dev	6721	7786	9359	Cont	Cont
PE TOTAL	8929	10121	11773		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element (PE) provides for advanced development of landmine warfare and countermine capabilities. The introduction of the smart munitions concept to landmine warfare has the potential of producing an enormous force multiplier. Coordinated use of smart landmines, scatterable landmines and conventional mines equipped with increased lethality, advanced sensors and command and control enhances their effectiveness with selective targeting capabilities to ambush, divert and delay the enemy. The smart landmine operation has the potential of significant manpower reductions in the battle area and in the logistics tail. Funding increases in the FY 1990 and 1991 countermine program reflect recent Congressional guidance. The House Armed Services Committee (HASC) directed the DOD to "... add priority, focus, and resources to the countermine program. This added effort should have as ultimate goals stand-off mine detection and stand-off minefield breaching capabilities...." In a similar vein, the Senate Armed Services Committee (SASC) noted of the FY 1989 program "... that the Army has requested insufficient funds for countermine warfare. The Committee invited the Army to reassess its requirements for countermine warfare and submit a reprogramming to restore funding for critical new technologies...." The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D006 — Landmine Warfare Development: This program provides for the advanced development of landmine warfare by investigating and exploiting materials, warhead technologies and advanced target recognition evolving from exploratory development. The objective of the program is to develop a wide-area mine (WAM) for hand emplacement, Volcano delivery, and also as a submunition for delivery by missile (Army Tactical Missile System or Multiple Launch Rocket System) for the deep battle. The WAM concept also has the potential for incorporating a remote command and control capability to the minefield.

(U) FY 1989 Accomplishments:

- **(U)** Completed proof of principle field testing of two WAM competitive concepts
- **(U)** Completed demonstration of Controllable Safing and Arming (S&A) Devices
- **(U)** Provided technical support to the Defense Advanced Research Projects Agency (DARPA)/Armament Research Development and Engineering Center (ARDEC) Advanced Mine Technology Program for Minefield Secure Data Links, Anti-Helicopter mine and Robotic WAM

(U) FY 1990 Planned Program:

- **(U)** Develop software model of the Intelligent Minefield concept to support Intelligent Minefield demonstration starting in FY92.

Program Element: **#0603606A**

PE Title: **Landmine Warfare and Barrier Advanced Technology** Budget Activity: **#2**

- **(U)** Develop and demonstrate brassboard Secure Data Link networks for Command/Control of landmines from multiple concepts
- **(U)** Provide technical support to the Defense Advanced Research Projects Agency (DARPA)/US Army Armament Research, Development and Engineering Center (ARDEC) Advanced Mine Program

(U) FY 1991 Planned Program:

- **(U)** Integrate secure data links into WAM
- **(U)** Integrate resettable safe and arm (S&A) into Anti-Helicopter mine Brassboard and demonstrate three conceptual approaches
- **(U)** Integrate command and control features into WAM.

(U) Project D608 — Countermine and Barrier Development: Responding to the programmatic imperatives of the Congress and the Army user community, this program leads tc an Advanced Technology Transition Demonstration (ATTD) of two competing standoff minefield detection systems from two developing commands (FY 1991) as well as additional research prior to a down-select technical demonstration in FY 1991 of a stand-off mine neutralization technique to counter hardened (fuze independent) mines.

(U) FY 1989 Accomplishments:

- **(U)** Began development of two bimodal dispersed explosives breacher concepts (heavy forces) in coordination with the US Marine Corp (USMC), Naval Coastal Systems Center (NCSC), Naval Weapons Center (NWC), Waterways Experiment Station (WES) and Ballistics Research Lab (BRL) for technical demonstration in FY1991
- **(U)** Prepared and coordinated Technical Development Plan (TDP) for the standoff minefield detection system. This joint effort between Belvoir Research, Development and Engineering Center (BRDEC), Waterways Experiment Station (WES), and Project Manager-Mines, Countermine and Demolitions (PM-MCD) supports an ATTD in FY1991
- **(U)** Began development of Minefield Recognition and Cueing System (MIRACS) for remote minefield detection ATTD FY1991, in coordination with WES, to provide minefield discrimination software for aerial sensors
- **(U)** Tested for neutralization of mines, independent of fusing, using concepts for both reactive munitions and bimodal explosives
- **(U)** Initiated multiple tube sensor development for photon backscatter mine detector. Analyzed feasibility of fabricating and demonstrating a multiple tube x-ray sensor for vehicular use
- **(U)** Conducted joint brassboard of distributed explosive concepts with the USMC

(U) FY 1990 Planned Program:

- **(U)** Initiate a study of an integrated breacher system to meet requirements of the heavy forces. Competing technologies include: reactive munitions, wide area neutralization device, and high power microwave.
- **(U)** Complete standoff minefield detection system linescanner improvements and conduct technology evaluation field test; evaluate breadboard MIRACS

(U) FY 1991 Planned Program:

- **(U)** Downselect among three technological approaches to meet requirements for an improved dispersed explosive system for hardened mine neutralization for the heavy forces: Dispersed Explosives Charged Array/Shaped Charge Munition (DECA/SCAM), explosive net, and bimodal explosives.

Program Element: #0603606A

PE Title: **Landmine Warfare and Barrier Advanced Technology** Budget Activity: #2

- (U) Conduct an Advanced Technology Transition Demonstration (ATTD) of competing approaches to meet requirements for a standoff aerial detection system: Remote Minefield Detection System (REMIDS) and Airborne Mine Detection and Reconnaissance System (AMIDARS)

(U) Work Performed By: In-House efforts will be accomplished by Belvoir RD&E Center, Ft. Belvoir, VA, ARDEC, Picatinny Arsenal, NJ, and Waterways Experiment Station, Vicksburg, MS. Major contractors are IITRI, Chicago, IL; Chicago Aerial, Barrington, IL, and AVCO, Burlington, MA.

(U) Related Activities:

PE #0602624A (Weapons and Munitions Technology)
PE #0602784A (Military Engineering Technology)
PE #0604619A (Wide Area Mine Eng Dev)
PE #0603619A (Landmine & Barrier Systems)
PE #0604808A (Landmine Warfare/Barrier Engineering Development)
PE #0601102A (Defense Research Sciences)
PE #0602786A (Logistics Technology)
There is no unnecessary duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603607A**
PE Title: **Joint Service Small Arms Program** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D627 Joint Service Small Arms Program (JSSAP)	9404	6726	5406	Cont	Cont
PE TOTAL	9404	6726	5406		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Joint Service Small Arms Program (JSSAP) effort is directed at the development and demonstration of brassboard systems leading to the advanced development of small arms systems for all the Services. JSSAP supports the following mission Area Analyses: The Army Close Combat Light and Special Operations mission areas, specifically addressing deficiencies for light forces and special operations forces; the Marine Corps Infantry Aspects of Close Combat; the Air Force Air Base Ground Defense; and the Navy Special Warfare. Program scope and activities are governed by official Memorandum of Agreement on the Management of Multi-Service Systems/Programs/Projects and DOD Directive 5000.1, Major Systems Acquisition. Efforts are consistent with planning initiatives and goals as delineated in the Small Arms Master Plan (SAMP). The main effort includes the six following areas: (1) Advanced Combat Rifle — Funds four contractors providing hardware for a field experiment in FY 1990. Goal is an increase of 100 percent in hit probability under conditions of combat stress. (2) Close Assault Weapon — Primarily for military police and special operations forces — Reduce life cycle cost through standardization and increase range 50 percent to 100 meters. (3) High Velocity Boost — 40 percent increase in range with same penetration. (4) Common Module Fire Control — reduced life cycle cost, with increased weapon effectiveness. (5) Canister Cartridge — 0.9 probability of hit at 100 meters — new requirement; and (6) Training ammunition — 50-90 percent reduction in range with full functioning in standard weapons. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D627 — Joint Service Small Arms Program:

(U) FY 1989 Accomplishments:

- **(U)** Completed initial safety certification of Advanced Combat Rifle (ACR) field demonstration hardware
- **(U)** Completed Advanced Combat Rifle (ACR) field demonstration range instrumentation installation
- **(U)** Initiated checkout/acceptance of ACR field demonstration range
- **(U)** Obtained Service support for Close Assault Weapon (CAW) Joint Service Operational Requirement (JSOR)/procured CAW combat shotgun candidates for FY 1990 demonstration
- **(U)** Initiated fabrication of staged propulsion concepts for improved light armor penetration
- **(U)** Prepared specifications for modular fire control components in preparation for FY 1990 brassboard fabrication contract leading to FY 1991 demonstration
- **(U)** Demonstrated Feasibility of initial Canister Cartridge concepts
- **(U)** Designed, fabricated, and initiated testing of Cal .50 limited range training ammunition in preparation for transition decision in FY 1990

Program Element: #0603607A
PE Title: **Joint Service Small Arms Program** Budget Activity: #2

- (U) Initiated actions for FY 1990 development contract of 7.62 mm short range training ammunition

(U) FY 1990 Planned Program:

- (U) Complete acceptance of ACR field demonstration range
- (U) Complete ACR field test evaluation
- (U) Complete evaluation of CAW combat shotgun concepts and conduct transition In-Process Review (IPR)
- (U) Complete preliminary evaluation of advanced propulsion concept for light armor defeating ammunition and deliver verification hardware for Government testing.
- (U) Award brassboard development contract and finalize prototype designs for FY 1991 Common Module Fire Control demonstration in machinegun
- (U) Fabricate canister cartridge brassboard and initiate demonstration and conduct In-Process Review (IPR) in preparation for FY 1991 transition
- (U) Complete Cal. 50 limited range ammo demonstration and conduct transition IPR
- (U) Award Contract for 7.62mm short range training ammunition and finalize design in preparation for transition in FY91

(U) FY 1991 Planned Program:

- (U) Provide ACR data for Army Small Arms Master Plan (SAMP) decision
- (U) Complete 7.62mm short range training ammunition demonstration and conduct transition IPR
- (U) Conduct machinegun demonstration of common module fire control and provide the input to Army SAMP decision process/conduct transition IPR for full scale development
- (U) Provide applicable input to SAMP decision process for Advanced Individual Combat Weapon in support of Army SAMP
- (U) Initiate design of Advanced Beam Sighting System brassboard for helicopter doorgunners leading to demonstration and transition decision

(U) Work Performed By: The prime in-house organization is US Army Armament Research Development and Engineering Center, Picatinny Arsenal, NJ with other major efforts at Naval Weapon Support Center, Crane, IN, and Air Force Armament Technology Laboratory, Eglin Air Force Base, FL. Primary contractors are: Olin Corp, East Alton, IL; Heckler and Koch, Inc, Arlington, VA; Steyr-Daimler-Puch AG, Steyr, Austria; Colt Industries, Hartford, CT; AAI Corporation, Baltimore, MD; and ADEC, Swarthmore, PA.

(U) Related Activities:

PE #0601102D (Defense Research Sciences);
PE #0602624A (Weapons & Munitions Technology);
PE #0602623A (Joint Service Small Arms Program);
PE #0603802A (Weapons and Munitions Advanced Development).

The Joint Service Small Arms Program (JSSAP) was created to assure that there is no unnecessary duplication of small arms effort within the DOD, and to adequately address all Services small arms needs. Full coordination among all the Armed Services is maintained by the JSSAP Management Committee and joint-Service working groups representing the user, developer, and evaluator communities.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603612A**

PE Title: **Advanced Anti-Tank Weapon System (Line-of-Sight Anti-Tank Weapons System)** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D096 Line-of-Sight Anti-Tank	36428	55717	22009	- 0 -	117482
D308 Advanced Anti-Tank Weapon System-Medium	994	- 0 -	- 0 -	- 0 -	
PE TOTAL	37422	55717	22009	- 0 -	

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides for the development of advanced anti-tank weapon systems to equip designated maneuver forces. TOW provides a vehicular mounted long-range anti-tank kill capability, and the DRAGON provides a manportable medium-range close combat kill capability. Systems developed within the mission element will consider improvement of, and replacement of TOW and DRAGON. The Advanced Anti-Tank Weapon System-Medium (AAWS-M), as the DRAGON replacement, and the Line-of-Sight Anti-Tank (LOSAT), as the Improved TOW Vehicle (ITV) replacement are intended to have a high kill rate against threat armored vehicles of the 1990's at extended ranges under day/night and adverse weather and dirty battlefield conditions. These systems will be hardened against countermeasures and will not require extensive training for effective employment. The AAWS-M transitioned to full-scale engineering development (PE #0604611A) in Nov 1989. LOSAT combines the Kinetic Energy Missile (KEM) for improved lethality, and a modified Bradley chassis for better mobility and survivability. LOSAT will transition to full-scale engineering development (PE #0604819A) in FY 1991. Advanced Missile System-Heavy (AMS-H), the candidate to replace TOW systems other than ITV, was split into a separate PE (#0603810A/DE15) in FY 1989. A related effort is the full-scale development start of the TOW Sight Improvement Program along with other TOW activities to complement LOSAT on the battlefield. In FY 1990 and FY 1991 threat materiel acquisition/exploitation has been programmed in PE #0605709A/DC28 and will be executed upon authorization/appropriation.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603612A** Project Number: **#D096**
PE Title: **Advanced Anti-Tank Weapon System** Budget Activity: **#4**
Project Title: **Line-of-Sight Anti-Tank**

NO PICTURE AVAILABLE

POPULAR NAME: **LOSAT**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones					
Engineering Milestones					
T&E Milestones				EUTE 1/91	
Contract Milestones				Award FSD Contract 3/91	
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		30699	31837	18629	81028 (0)
Support Contract		800	1737	414	3549 (0)
In-House Support		2395	12808	2223	18723 (0)
GFE/ Other		2534	9335	743	14182 (0)
Total		36428	55717	22009	117482 (0)

Program Element: #0603612A | Project Number: #D096
PE Title: **Advanced Anti-Tank Weapon System** | Budget Activity: #4

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The current and projected armor threat and operational concept envisioned for fighting the anti-armor battle requires an effective, extended range, vehicular mounted, heavy anti-tank capability for the infantry. The Line-of-Sight Anti-Tank (LOSAT) will be capable of operating out to maximum range of direct fire combat engagements and will perform under day/night adverse weather and obsurants. The LOSAT program will develop a replacement system(s) for the Improved TOW Vehicle platforms, The Infantry dedicated Heavy Anti-Tank System LOSAT will be counter-measures hardened to perform effectively in a dirty battlefield environment. LOSAT will incorporate warhead capabilities to defeat the evolving Soviet armor threat.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Initiated Kinetic Energy Missile (KEM) prototype development program by joining existing program
- (U) Conducted KEM program sled tests
- (U) DARPA awarded contract with LTV 4/88

(U) FY 1990 Planned Program:

- (U) Continue KEM prototype development program and flight tests
- (U) Best technical approach (BTA)/source selection for candidate system

(U) FY 1991 Planned Program:

- (U) Integrate KEM on a Bradley chassis
- (U) Complete KEM prototype development program and flight tests from the prototype LOSAT system (KEM) integrated on a Bradley chassis
- (U) Award full-scale development (FSD) contracts
- (U) Conduct early user tests

D. (U) WORK PERFORMED BY: In-house efforts performed by Line-of-Sight Anti-Tank (LOSAT) Weapon Systems Project office, US Army Missile Command (MICOM), Redstone Arsenal, AL. LTV of Dallas, TX was the selected contractor for the KEM prototype development program and has since teamed with Texas Instruments of Dallas, TX.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** The previous Advanced Anti-tank Weapon System (AAWS) PE #0603612A, Project Number D096 was split into two parts. FY 1990 Impact: $13 million was put into a new PE: Advanced Missile System — Heavy (AMS-H) PE #0603810A, Project Number DE15. This leaves the remaining $56.598 million in the LOSAT PE. FY 1991 Impact: $3 million was put into new PE: Advanced Missile System-Heavy (AMS-H) PE #0603819A, Project Number DE15. This leaves $21.777 million in the LOSAT PE.

Program Element: #0603612A | Project Number: #D096
PE Title: **Advanced Anti-Tank Weapon System** | Budget Activity: #4

F. (U) PROGRAM DOCUMENTATION:

Letter of Agreement	11/85
Advanced Anti-tank Weapon System-Heavy Program Decision Memorandum	8/86
Special In-Process-Review (IPR)	12/87
AAWS-H HQDA Program Review	8/88
Organizational and Operational Plan	1/89

G. (U) RELATED ACTIVITIES:

- Program Element #0603810A, Project Number DE15 (Advanced Missile System-Heavy (AMS-H))
- Project Number #D308 (Advanced Antitank Weapon System-Medium)
- Program Element #0603757A (Forward Area Air Defense System)
- Program Element #0602303A (Rocket & Missile Technology)
- Program Element #0603313A (Hypervelocity Missile)
- Program Element #0604310A (Ground Launched HELLFIRE)
- Program Element #0603321A (Missile Counter-Countermeasure Technology)
- Program Element #0602120A (Electronic Survivability and Fuzing Technology)
- Program Element #0602624A (Weapons and Munitions Technology)
- Program Element #0602618A (Ballistics Technology)
- Program Element #0602709A (Night Vision and Electo-Optics Technology)
- Program Element #0603710A (Night Vision, Combat Vehicles)
- Program Element #0604819A (Advanced Antitank Weapon System-Heavy)
- Program Element #0203802A (TOW Product Improvement Program-TOW 2B Project: #D336)

There is no unnecessary duplication of effort within the Army or other services/agencies within the Department of Defense. This is assured by continuous coordination with other services and agencies and oversight of the program by the OSD-level Conventional Systems Committee.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

J. (U) TEST AND EVALUATION DATA: The LOSAT Advanced Technology Transition Demonstrator (ATTD) Phase Flight Test Program will consist of 23 firings at White Sands Missile Range. The first three flights will be unguided Forward Looking Infrared (FLIR) Calibration Flights. The next two flights will be full-up guided missiles being flown for the purpose of gathering technical data on certain critical parameters. The remaining 18 missiles will be fired for scoring against specified targets. Some of these will be fired from a test fixture, while the last phase will be fired from a prototype vehicle. Vehicle firings are scheduled for completion by 3QFY91.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603619A**

PE Title: **Landmine Warfare and Barrier — Advanced Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D005 Landmine Advanced Development	12124	734	2988	- 0 -	
D606 Countermine and Barrier Advanced Development	1492	- 0 -	- 0 -	- 0 -	
PE TOTAL	13616	734	2988	- 0 -	

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element (PE) provides for advanced development of new mine, countermine, and explosive demolition systems by prototyping modern technology demolitions, advanced development sensors, logic networks, fuzes, power sources, warheads, components and modules into complete systems. Modern conventional explosive technologies can provide a significant enhancement in capabilities to destroy large demolition targets. They provide an alternative to nuclear demolition systems.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D005 — Landmine Advanced Development:

(U) FY 1989 Accomplishments:

- **(U)** Completed Wide Area Mine (WAM) proof-of-principle testing

(U) FY 1990 Planned Program:

- **(U)** Initiate development for an improved fuzing for conventional mines
- **(U)** WAM transitions to full-scale engineering development in PE #0604619A (Landmine Warfare) Project D088

(U) FY 1991 Planned Program:

- **(U)** Continue development and operational testing of improved fuzing for conventional mines

(U) Project D606 — Countermine and Barrier Advanced Development:

(U) FY 1989 Accomplishments:

- **(U)** Initiated test integration and evaluation for MIRADOR prototype sensor

(U) FY 1990 Planned Program:

- **(U)** Program terminated

(U) Work Performed By: The Project Manager for Mines, Countermine and Demolitions, Picatinny Arsenal, NJ, is assigned the responsibility for landmine, countermine and explosive demolition development. The major supporting laboratories are the Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ, and the Belvoir Research, Development and Engineering Center, Fort Belvoir, VA. Principal countermine contractor employed at this time is EG&G, Albuquerque, NM. The major WAM contractors are Honeywell Inc at Hopkins, MN and Textron at Boston, MA.

Program Element: **#0603619A**

PE Title: **Landmine Warfare and Barrier — Advanced Development** Budget Activity: **#4**

(U) Related Activities:

Component work and exploratory development for this program are conducted in PE #0602786A (Logistics Technology), #0602784A (Military Engineering Technology) and #0603606A (Landmine Warfare and Barrier Advanced Technology). Engineering development efforts, which result from this program are accomplished in PE #0604808A (Landmine Warfare/Barrier Engineering Development) and #0604619A (Landmine Engineering Development). Mine and countermine efforts are closely coordinated to incorporate counter-countermeasures as applicable. The Project Manager for Mines, Countermine and Demolitions monitors related programs to ensure no unnecessary duplication of effort with the Army or DoD. Development information on mines is coordinated and exchanged among the Services by the Tri-Service Joint Technical Coordinating Group for Unpowered Weapons. The Department of Defense's Land Warfare monitors the scatterable mine program to avoid Service duplication.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0603627A

PE Title: **Smoke, Obscurant and Equipment Defeating Systems — Advanced Development** Budget Activity: #4

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DE78 Equipment Defeating Systems Advanced Development					
	4919	3723	3781	Cont	Cont
DE79 Smoke, Obscurant Systems Advanced Development					
	1630	4933	8570	Cont	Cont
PE TOTAL	6549	8656	12351		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program responds to the need to provide smoke, obscurant and equipment defeating materiel and equipment to increase survivability of U.S. forces by defeating or degrading threat surveillance and weapon system sights, guided munitions, directed energy weapons, and other weapon systems. This program supports the conduct of advanced development (AD) in smoke and obscurant agents, munitions, and devices. U.S. forces must be able to effectively neutralize and degrade directed energy weapon systems and threat electro-optical systems that operate in the full range of the electromagnetic spectrum. Improvements and new developments are required across the entire multispectral range from visual through IR and millimeter (radar) wavelengths. These improvements will be applied to projectile, rocket, missile, ground and air combat vehicular defense and large area obscuration/smoke systems. The Combat Vehicle Defensive Obscurating System (CVDOS) project expands previous vehicular smoke systems by providing a mixture of capabilities that will screen the vehicle and accompanying vehicles while in motion. CVDOS is being developed for the M1A1 Tank and the M2/3 Bradley Fighting Vehicles. The Large Area/Mobile Projected Smoke System (LA/MPSS) mounts the XM55 smoke generator system on a chassis variant of the Bradley Fighting Vehicle to provide a mechanized capability. Additionally, a variant of the Hydra 70 rocket system will also be mounted on the LA/MPSS to augment insufficient mortar and artillery projected smoke. The 40mm High Velocity Smoke Grenade provides light forces with quick forming visual smoke when fired from the MK19 Grenade Machine Gun.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project DE78 — Equipment Defeating Systems Advanced Development:

- (U) Classified Program

(U) Project DE79 — Smoke, Obscurant Systems Advanced Development:

(U) FY 1989 Accomplishments:

- (U) Completed Multiple-Salvo Smoke Grenade Launcher (MSGL) and continued Millimeter (MM) Wave Grenade technical testing
- (U) Conducted MSGL Milestone I/II decision in-process review

Program Element: **#0603627A**

PE Title: **Smoke, Obscurant and Equipment Defeating Systems — Advanced Development** Budget Activity: **#4**

(U) FY 1990 Planned Program:

- **(U)** Initiate advanced development of Large Area Mobile Projected Smoke System.

(U) FY 1991 Planned Program:

- **(U)** CVDOS transitions to engineering development, Program Element 64609D200

(U) Work Performed By: In-house work is conducted by the US Army Chemical Research, Development and Engineering Center and the US Army Test and Evaluation Command, Aberdeen Proving Ground, MD. The primary development contractor for the Combat Vehicle Defensive Obscurating System (CVDOS) project is AAI Corporation, Hunt Valley, MD. Prime contractors for remaining program tasks are unknown at this time.

(U) Related Activities:

Program Element #0602622A (Chemical, Smoke and Equipment Defeating Technology)
Program Element #0604609A (Smoke and Equipment Defeating Systems — Engineering Development)
In order to meet other Service needs and to prevent unnecessary duplication of effort, coordination is maintained with the other Services through joint participation in the Smoke and Aerosol Working Group of the Joint Technical Coordinating Group, joint participation and attendance at Smoke Weeks and Smoke/Obscurants symposia, personal contacts, and joint distribution of technical and other reports.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603642A** Project Number: **# D123**
PE Title: **Medium Surface-to-Air Missile** Budget Activity: **#4**
Project Title: **Medium Surface-to-Air Missile (MSAM)**

NO PICTURE AVAILABLE

POPULAR NAME: **MSAM**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			Initiate Concept Exploration	Continue Concept Exploration	TBD
Engineering Milestones					
T&E Milestones					
Contract Milestones					
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract				4500	TBD
Support Contract				1200	TBD
In-House Support				340	TBD
GFE/ Other				858	TBD
Total				6898	TBD

Program Element: #0603642A
PE Title: **Medium Surface-to-Air Missile**
Project Number: # D123
Budget Activity: #4

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Medium Surface-to-Air Missile (MSAM) system is a potential replacement for HAWK in the U.S. Army in the North Atlantic Treaty Organization (NATO) countries. MSAM is projected to be a highly mobile, high firepower, low manpower intensive system. An objective MSAM system could be acquired as a whole new system or HAWK could be replaced on a modular basis. The potential exists for MSAM to be a cooperative development effort to support both U.S. and European requirements.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- (U) Initiated discussions on cooperation agreements with allies
- (U) Continued Office, Secretary of Defense (OSD) study on MSAM concepts

(U) FY 1990 Planned Program:
- (U) Approve NATO Staff Target on MSAM
- (U) Complete OSD Study on MSAM concepts
- (U) Initiate bilateral study with West Germany

(U) FY 1991 Planned Program:
- (U) Initiate NATO Feasibility Study
- (U) Initiate concept exploration of US MSAM

D. (U) WORK PERFORMED BY: In-house effort to be done by U.S. Army Missile Command, Redstone Arsenal, AL; and U.S. Army Air Defense School, Fort Bliss, TX. Contractor to be determined. OSD study done by Atlantic Systems Research and Engineering, Springfield, VA. Bilateral study with West Germany done by Institute for Defense Analysis (US) and Industril Anlangen—Betrilbgesellschaft (GE)

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** Not applicable.

F. (U) PROGRAM DOCUMENTATION:

JMSNS — 7/86
O&O — Draft at present time
Draft NATO Staff Target under review

G. (U) RELATED ACTIVITIES: NATO Air Force Armaments Group Air Group VI meetings on MASM were attended by U.S. Army representatives. Independent European Program Group (IEPG) MSAM Feasibility Study is in progress. U.S. Marine Corps has a required operational capabilities for a Medium Surface-to-Air Weapon System (MSAWS).

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Annex B, "Parametric Analyses of Currently Planned and Future Ground Based Air Defenses" to existing Extended Air Defense Memorandum of Agreement with West Germany is under negotiation.

J. (U) TEST AND EVALUATION DATA: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603706A**

PE Title: **Identification-Friend-or-Foe — Advanced Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D243	Positive Hostile Identification — Advanced Development				
	14954	- 0 -	1013	Cont	Cont
D297	Cooperative Identification — Advanced Development				
	1687	- 0 -	- 0 -	Cont	Cont
PE TOTAL	16641	- 0 -	1013		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program, Target Acquisition for Army Weapons, is directed toward identifying and developing high reliability equipment designed to acquire and positively identify aircraft and ground combat vehicles in the air-to-air, air-to-ground, ground-to-air, and ground-to-ground modes. The ability to detect and engage targets has advanced further than the ability to positively identify them. The result is that weapons cannot be employed to maximum effectiveness without incurring high levels of fratricide. Accordingly, positive identification of foes has been cited as a major mission area deficiency for Air Defense, Close Combat, Aviation and Fire Support. Effort provides for advanced development of multiple sensor technologies, signal processors, and data fusion techniques capable of being integrated onto emerging or existing weapons platforms. This effort supports Joint-Service initiatives investigating new technologies for target acquisition and positive target identification. Funding will provide program wide management support services including government labor, technical and administrative support contracts, and equipment and maintenance contracts essential to overall technical effort.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D243 — Positive Hostile Identification — Advanced Development: This project conducts demonstrations to identify developing system specific devices for target acquisition and non-cooperative positive target identification. Primary focus is in the areas of electro-optical technology, acoustics technology, and electronic support measures. Through analysis, simulation and test bed reviews, this project will conduct base line technology studies of all Army Mission Area target acquisition and identification sensor suites to identify the most promising systems. This project will perform analytical assessments addressing the potential applicability of next generation Artificial Intelligence (AI)/Fusion firmware and its contribution to total force operational effectiveness through common processing. The project will develop engineering representations of underlying propagation phenomenology regarding passive sensor technologies and will conduct performance predictions regarding high profile application of candidate technology prior to demonstration. Overall effort will ensure smooth transition and integration of these devices onto weapons platforms that are either in full scale development or fielded systems undergoing improvements. Emphasis will be placed on developing/integrating devices into M-1, M2, ATACMS, SADARM, LHX, FAAD LOS-F, HIP/AFAS, FAAD LOS-R, FAAD NLOS, and MLRS TGW systems. This project is a skip year new start.

(U) FY 1989 Accomplishments:

- **(U)** Conducted individual follow on Non-Cooperative Identification Friend or Foe Technology Evaluation (NIFFTE) for ground and air targets
- **(U)** Supported European testing/demonstration of air and ground target recognition

Program Element: #0603706A

PE Title: **Identification-Friend-or-Foe — Advanced Development** Budget Activity: #4

- (U) Completed Target Acquisition for Army Weapons, Ground Target (TAAWS-GT) at Ft Hunter Liggett, CA. DEMO baselined current and emerging target acquisition and identification technologies/techniques against friendly/enemy ground vehicles. Army Materiel Systems Analysis Agency (AMSAA) conducted an independent evaluation of data and concurred with findings
- (U) Demonstrated passive acquisition systems such as Infrared (IR) search and track
- (U) Demonstrated Laser Vibration systems for target identification
- (U) Demonstrated feasibility of multi-sensor fusion integration
- (U) Completed Army Non-Cooperative Target Recognition (NCTR) Roadmap
- (U) Program was designated lead in Tri-Service NCTR Program

(U) FY 1990 Planned Program: (See PE #0604709A)

- (U) Continue to monitor technological developments
- (U) PE0603706A currently not funded
- (U) Multi-Mission Area Sensor Demonstration (MMAS) planned for summer FY90. (Funded under PE #0603758A—DK21).

(U) FY 1991 Planned Program: Effort will support technology demonstrations and the development of evaluation and analysis facilities

- (U) Follow-up data fusion analysis of FY90 MMAS technology demonstration
- (U) Conduct full scale planning effort necessary to conduct follow-on Multi-Mission Area Sensor DEMO II (MMAS) in FY92.
- (U) Tank Demo will continue to determine feasibility of integrating acoustic and infra-red identification and sensor technologies into an armor platform for employment against ground and air targets. Future goal is to fuse technologies into the fire control system. Planning and coordination for an FY92 demo activity will commence FY91.
- (U) OCONUS Demo will place target acquisition equipment in the hands of soldiers for application in a unit environment. Plan to introduce during exercise REFORGER 91.
- (U) Develop instrumented evaluation and analysis facility designed to support technology demonstrations. Three phased development period commences in FY91. Planned site would include an Identification Friend-or-Foe (IFF) tracking system, electromagnetic validation facility, ground vehicle tracking system, and a Global Positioning System (GPS) tracker

(U) Project D297 — Cooperative Identification — Advanced Development: This project is directed toward the development of techniques and equipment to provide high reliability equipment to identify friendly aircraft. The project includes improvement of current MARK XII IFF system for use as an interim until MARK XV, a new compatible US and North Atlantic Treaty Organization (NATO) Question & Answer IFF system is fielded.

(U) FY 1989 Accomplishments:

- (U) Participation in MARK XV Defense Acquisition Board (DAB)/II Nov 88)
- (U) Met Milestone II DAB December 1988
- (U) Tested product improvements to MARK XII IFF

Program Element: **#0603706A**

PE Title: **Identification-Friend-or-Foe — Advanced Development** Budget Activity: **#4**

(U) FY 1990 Planned Program: (See PE #0604709A)

- (U) Not funded

(U) FY 1991 Planned Program: Not Applicable

(U) Work Performed By: Teledyne Electronics, Newbury Park, CA; Scope Electronics, Reston, VA; Texas Instrument Corp, Dallas, TX; Georgia Institute of Technology, Atlanta, GA; Hazeltine Corp, Greenlawn, NY; RCA, Morristown, NJ; Martin Marietta, Orlando, FL; Northrup Corp, Anaheim, CA; ESL Inc, Sunnyvale, CA; Biodynamics Corp. Eugene, OR; Westinghouse, Baltimore, MD; Hughes Aircraft, Los Angeles, CA; Adaptive Sensors Inc, Los Angeles, CA; Bendix Corp, Baltimore, MD.

(U) Related Activities:

PE #0604709A (Identification-Friend-or-Foe Engineering Development)
PE #0603742F (Combat Identification Technology)
PE #0604215N (Support Equipment)
PE #0604725F (Combat Identification Systems)
PE #0603740A (Air Defense Command, Control and Intelligence — Advanced Development)
PE #0604741A (Air Defense Command, Control and Intelligence — Engineering Development)
PE #0603790N (NATO Research and Development)
All combat identification related development is overseen by a Tri-Service General officer steering committee to synchronize service identification efforts and avoid unnecessary duplication of effort

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable

(U) International Cooperative Agreements: Not Applicable

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603710A**

PE Title: **Night Vision Advanced Technology** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DK70	Night Vision Advanced Technology					
		11200	11961	13421	Cont	Cont
DK86	Night Vision Airborne Systems					
		3006	6083	3671	Cont	Cont
DK87	Night Vision Combat Vehicles					
		4334	3417	3204	Cont	Cont
PE TOTAL		18540	21461	20296		

B. (U) BRIEF DESCRIPTION OF ELEMENT: US forces face the threat of battlefield engagement with a numerically superior enemy force capable of effective operation on a 24 hour basis under degraded battlefield/weather conditions. To counter this threat, development of high performance, target acquisition/engagement and pilotage systems capable of 'Around the Clock' operation at extended stand-off ranges under all battlefield/weather conditions is essential to the survivability of U.S. troops. This program utilizes the Department of Defense (DOD), Night Vision & Electro-Optic technology base investment strategy as a baseline for the prototype and systems development of new and improved tactical stand alone, fire control and multisensor system suites for infantry, anti-armor, air defense, combat vehicle and airborne operational scenarios. In addition to performance capabilities of the systems under these development phases, strong emphasis is placed on weapon systems integration requirements, logistics burdens, production cost reductions and countermeasure threats. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project DK70 — Night Vision Advanced Technology: The Army has the need for a cost-effective ability to fight at night and during adverse weather conditions as effectively as during the day. This project utilizes advanced state-of-the-art technology developed under other program elements #0601102A and #0602709A as a baseline to develop low cost, high performance night vision and electro-optic equipment for use in manportable, combat vehicle, and airborne applications. Prototype and systems development are concentrated in the areas of manportable thermal sights, infrared search and track suites for air defense and automated multisensor processors, and target acquisition sensors for combat vehicles and airborne platforms.

(U) FY 1989 Accomplishments:

- **(U)** Initiated development of proof-of-principal demonstrator for an Advanced Air Defense Electro-Optical System (AADEOS). This effort is designated as one of the Army's critical Advanced Technology Transition Demonstrations (ATTDs)
- **(U)** Initiated development of sensor fusion processor demonstration towards the fusion of multiple sensors in target acquisition and engagement suites. This effort is designated as a key technology demonstration in support of the Army's Multisensor Target Acquisition ATTD
- **(U)** One Watt Linear Cooler Qualification test completed

Program Element: **#0603710A**
PE Title: **Night Vision Advanced Technology** Budget Activity: **#2**

(U) FY 1990 Planned Program:

- **(U)** Continue development of the ADDEOS prototype system
- **(U)** Initiate program to modularize critical components of 2nd generation Forward Looking Infrared (FLIR) technology to incorporate miniturized packaging of detector/Dewar assemblies
- **(U)** Continue development of target acquisition sensor fusion demonstration program for multi-sensor system suite applications, acquire targets

(U) FY 1991 Planned Program:

- **(U)** Complete fabrication of ADDEOS and conduct field test to support transition to the Forward Area Air Defense (FAAD) weapon system manager in FY 1992
- **(U)** Continue development on 2nd generation FLIR detector Dewar assembly,
- **(U)** Continue development of advanced sensor fusion processor in preparation for transition to Multi-Sensor Target Acquisition ATTD in FY92

(U) Project DK86 — Night Vision Airborne Vehicles: This project exploits new technological advances in 'State-of-the-Art' night vision and electro-optic equipment and applies it towards specific US Army airborne systems. Primary emphasis of this project is on the integration of high performance second generation thermal imaging technology into fire control and pilotage systems of advanced airborne vehicles. The new systems will provide the range and sensitivity to meet the requirements of fire control and pilotage for these advanced aircraft systems. The use of Forward Looking Infrared (FLIR), image intensification, millimeter wave, and Laser technology in support of improved night pilotage and obstacle avoidance/wire detection to allow for nap-of-the-earth pilotage at high speeds under adverse atmospheric conditions.

(U) FY 1989 Accomplishments:

- **(U)** Completed modification of the ASSET aircraft testbed
- **(U)** Implemented a design simulation study to determine optimum sensor/processor design characteristics to meet Army Aviation requirements relative to obstacle avoidance and wire detection
- **(U)** Initiated Advanced Helicopter Pilotage Program consisting of advanced dual spectrum sensors, novel display techniques, and obstacle avoidance systems to support US Army Aviation Systems Command's (AVSCOM) Rotocraft Pilot's Associate ATTD

(U) FY 1990 Planned Program:

- **(U)** Based upon prior study results, initiate a prototype development effort for an Obstacle and Avoidance System (OASYS)
- **(U)** Continue development of Advanced Helicopter Second Generation Pilotage Prototype

(U) FY 1991 Planned Program:

- **(U)** Continue fabrication of OASYS in preparation for aircraft integration in FY 1992
- **(U)** Conduct Dual Spectrum Imagery Demonstration Flight Test in preparation for transition to user in FY 1992

(U) Project Project DK87 — Night Vision, Combat Vehicles: This project addresses the unique US Army requirements for multisensor and electro-optic technologies for combat vehicles, mechanized infantry, and other ground maneuver elements Most combat vehicles require the integration of more than one electro-optical sensor. The combination of a gunner target acquisition system, a laser system, and potential use of a commander's viewer device demands a total system integration concept which will maximize the combined effect of multisensors. US Army Communications and Electronics Command (CECOM) Center for Night Vision and Electro-Optics (C2NVEO) will

Program Element: #0603710A
PE Title: **Night Vision Advanced Technology** Budget Activity: #2

utilize the advanced state-of-the-art second generation infrared detector technology as the baseline to develop the multisensor suites required by the Army's extremely sophisticated weapons delivery systems in combat vehicles. The Standardized Advanced Infrared Systems (SAIRS) is a second generation scanning infrared imaging system featuring a countermeasure protected sensor assembly, high performance two dimensional detector arrays, and a digital signal processor for applications requiring performance in excess of first generation common module FLIRS.

(U) FY 1989 Accomplishments:

- (U) Completed fabrication of the SAIRS prototype systems. Initiated integration of 480 x 4 focal plane array assemblies in preparation for major field trials in 1st QTR FY 1990

(U) FY 1990 Planned Program:

- (U) Conduct extensive field trials of the SAIRS prototype system and transition technology to LHX weapon system manager in third quarter FY 1990
- (U) Initiate 30 month development effort for a 2nd generation tank thermal sight for implementation into the Heavy Force Modernization (HFM) tank program

(U) FY 1991 Planned Program:

- (U) Continue development of the 2nd generation tank thermal sight

(U) Work Performed By: The work is performed by the US Army Communications and Electronics Command (CECOM) Center for Night Vision and Electro-Optics (C2NVEO) at Fort Belvoir, VA. Major contractors include: Martin Marietta Corporation, Orlando, FL. and Texas Instruments, Inc., Dallas, TX.

(U) Related Activities: This advanced development program bridges the developmental gap between PE #0602709A Project DH95 (Night Vision & E-O Devices); PE #0603774 Project D131 (Night Vision Systems Advanced Development); and PE #0604710A, Project DL70 (Night Vision Devices).

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: International interchange of information is accomplished primarily through active participation on various NATO working groups, the Technical Cooperation Program (United States, United Kingdom, Canada, Australia), and the International Standardization Program.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603713A** Project Number: **D370**
PE Title: **Army Data Distribution System (ADDS)** Budget Activity: **#4**
Project Title: **PJH-Position Location Reporting System (PLRS)/ Joint Tactical Information Distribution System (JTIDS) HYBRID**

NO PICTURE AVAILABLE

POPULAR NAME: **ADDS**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones					EPLRS FUE & Prod Dec Rev 93 JTIDS Prod Dec 92, FUE 93
Engineering Milestones		Cont EPLRS Phase 5	Comp EPLRS Ph 5: NCS-J/DJRU EDM EPLRS VHSIC	Init NCS Dwnszng/ADA Conv Comp Initiate VHSIC EPUU Conv	Complete NCS Downsizing & ADA Con-version FY94 & EPLRS VHSIC
T&E Milestones		Complete EPLRS Phase 2; Test	Comp EPLRS Ph 3 Test JTIDS TT	Complete JTIDS TT/IOT&E	Init & Cmp EPLRS OTE, 93
Contract Milestones		Award P^{3}I Phase C NCS-J/DJRU EDM	Exercise P^{3}I Opts NCS Dnszng & ADA Conv		Awrd LRIP JTIDS, FY92 Awd EPLRS Prod. FY93
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		8902	8502	16249	198,223 (16,207)
Support Contract		1243	2898	825	29,382 (1,875)
In-House Support		9448	7715	4627	62,768 (6,743)
GFE/ Other		0	0	0	0
Total		19593	19115	21701	290373 (24,825)

Program Element: **#0603713A** Project Number: **D370**
PE Title: **Army Data Distribution System (ADDS)** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Emerging tactical automated battlefield systems need real time and jam resistant data communications on both an intra and inter system basis. Current deployed communication systems are limited by restricted data handling capacity, electronic warfare (EW) vulnerability, voice/data contention, lack of adequate automatic relay capabilities and poor mobility. To correct these "shortfalls," the Army Data Distribution System (ADDS) combines and enhances proven components/modules of two existing systems: the Joint Army and Marine Corps Position Location Reporting System (PLRS) and the Tri-Service Joint Tactical Information Distribution System (JTIDS). By taking advantage of the advanced state of acquisition of these two projects, it is possible to produce a synergistic system to satisfy the stated data distribution requirements of the Army and overcome existing deficiencies earlier than would otherwise be possible with a totally new development. The ADDS supports near real time and high priority data communication requirements associated with the five functional mission areas of air defense, fire support, intelligence/electronic warfare, maneuver control and combat service support.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Completed 1553B EPLRS User Unit (EPUU) development
- **(U)** Initiated and completed EPLRS Ph 2 Testing
- **(U)** Continued EPLRS very high speed integrated circuit (VHSIC) insertion development
- **(U)** Continued EPLRS Phase 5 development
- **(U)** EPLRS Production System Verification Contract
- **(U)** Awarded Net Control Station (NCS-J) Dedicated Joint Tactical Information Distribution System (JTIDS) Relay Unit (DJRU) Engineering Development Model (EDM) contract
- **(U)** Continued development of EPLRS test program sets for integrated Forward Test Equipment (IFTE)

(U) FY 1990 Planned Program:

- **(U)** Initiated and completed NCS-J/DJRU Advanced Development Model (ADM) Demo at Ft. Huachuca
- **(U)** Initiate effort to support EPLRS competitive award
- **(U)** Complete EPLRS phase 5 development
- **(U)** Award EPLRS Phase 3 Pre Planned Product Improvement (P^3I) production contract
- **(U)** Initiate JTIDS Technical Test
- **(U)** Initiate and complete EPLRS Ph3 Testing
- **(U)** Exercise P3I option
- **(U)** Complete development of EPLRS test program sets for IFTE
- **(U)** Complete EPLRS VHSIC insertion development
- **(U)** Delivery of DJRU EDM Models

(U) FY 1991 Planned Program:

- **(U)** Initiate Net Control Station (NCS) Downsizing/Air Defense Artillery (ADA) conversion for EPLRS
- **(U)** Complete JTIDS Technical Test
- **(U)** Initiate and complete JTIDS initial operational test & evaluation (IOT&E)
- **(U)** Exercise P3I option
- **(U)** Initiate VHSIC EPUU Conversion
- **(U)** Complete Delivery of NCS-J EDM Models
- **(U)** Continue effort to support EPLRS competitive award

Program Element: **#0603713A** Project Number: **D370**
PE Title: **Army Data Distribution System (ADDS)** Budget Activity: **#4**

(U) Program Plan to Completion:

- **(U)** Participate in FAADC2I IOT&E
- **(U)** EPLRS First Unit Equipped (FUE) (P3I)
- **(U)** Initiate and complete EPLRS validation testing/operational test and evaluation (OT&E)
- **(U)** Complete EPLRS VHSIC insertion in production
- **(U)** Complete Net Control Station (NCS) downsizing/ADA conversion
- **(U)** Award Joint Tactical Information Distribution System (JTIDS) production contract
- **(U)** JTIDS First Unit Equipped (FUE)
- **(U)** Award EPLRS Production contract

D. (U) WORK PERFORMED BY: In-house efforts will be supported by Tobyhanna Army Depot, Electronic Proving Ground (EPG) Ft. Huachuca and accomplished by the US Army Communications-Electronics Command (USACECOM), Ft Monmouth, NJ. The Army program is managed by PEO, Communications Systems and Project Manager, Position Location Reporting System/Tactical Information Distribution System (PLRS/TIDS), Ft Monmouth, NJ, in conjunction with the JTIDS Joint Program Office, Hanscom AFB, MA. Contractual efforts are provided by MITRE Corporation, Bedford, MA: Plessey (formerly the Singer Company), Little Falls, NJ; Hughes Aircraft Company, Fullerton, CA.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None
2. **(U) SCHEDULE CHANGES:** Due to several software/hardware anomalies revealed during technical test, the Phase C hardware acquisition award was delayed until a plan to minimize Government risk was developed. This plan included a major program restructure to include return to a more normal nonconcurrent program schedule. Full scale production has been delayed from FY 1993 to FY 1995.
3. **(U) COST CHANGES:** Schedule changes resulted in program funding adjustments.

F. (U) PROGRAM DOCUMENTATION:

	EPLRS
Cost and Operational Effectiveness Analysis (Draft)	02/89
Required Operational Capability (ROC)	09/86
Organization and Operation Plan (O&O)	10/86
Baseline Cost Estimate (BCE)	12/88
Computer Resource Management (CRMP) (Draft)	08/89
Test and Evaluation Master Plan (TEMP) update	06/89
Systems Segment Specification update	08/89
Basis of Issue Plan (BOIP) Feeder Data	07/89
Quantitative and Qualitative Personnel Requirment Information (QQPRI)	01/90
Class 2M (SCN-1) (Final)	
Net Control Station (NCS-J)/Dedicated JTIDS Relay Unit (DJRU) (Draft)	
Cost and Operational Effectiveness Analysis (Draft)	02/89
Systems Segment Specification update	
Class 2M (SCN-1) (Final)	02/87
Net Control Station (NCS-J)/Dedicated JTIDS Relay Unit (DJRU) (Draft)	03/89

Program Element: **#0603713A** Project Number: **D370**
PE Title: **Army Data Distribution System (ADDS)** Budget Activity: **#4**

G. (U) RELATED ACTIVITIES:

- PE #0604805A (Command, Control, Communications Systems — Engineering Development)
- PE #0203726A (Advanced Field Artillery Tactical Data System)
- PE #0604741A (Air Defense Command, Control and Intelligence — Engineering Development)
- PE #0604321A (All Source Analysis System — ASAS)
- The above related activities rely on EPLRS and/or JTIDS to provide data communication service in order to meet their data communication requirements.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
1. PROCUREMENT			
Other Procurement, Army BU1400	70837	0	22184
2. MILITARY CONSTRUCTION			
Not Applicable			

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) TEST AND EVALUATION DATA:

(U) FY 1989 Accomplishments:

- **(U)** Completed EPLRS Ph 2 Testing
- **(U)** Initiated and completed Net Control Station (NCS-J) Dedicated Joint Tactical Information Distribution System (JTIDS) Relay Unit (DJRU) Advanced Development Model (ADM) Demo

(U) FY 1990 Planned Program:

- **(U)** Initiate and complete EPLRS Ph 3 Testing
- **(U)** Initiate JTIDS TT

(U) FY 1991 Planned Program:

- **(U)** Complete JTIDS TT in FY91
- **(U)** Initiate and complete JTIDS IOT&E
- **(U)** Participate in FAADC2I IOT&E

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603730A (TIARA)**
PE Title: **Tactical Surveillance System — Advanced Development** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF ELEMENT: This PE supports advanced development work directed at meeting the deep intelligence and targeting needs of tactical commanders as stated in Field Manual (FM) 100-5 and under airland battle tactics to fight outnumbered and win. Specific tactical imagery exploitation studies and developments are under the Army's Tactical Exploitation of National Capabilities (TENCAP) program and includes development of the tactical Imagery Processing and Dissemination System (IPDS) as part of the Joint Services Imagery Processing System (JSIPS) program with USAF/USMC. The IPDS will provide direct operational access to National and Tactical Imagery in near-real-time to provide critical, deep target intelligence support to field commanders. Additional work under this element includes advanced and engineering development of the Tactical Radar Correlator (TRAC) which enhances survivability and ensures receipt of selected theater imagery sources directly to the IPDS for exploitation. These efforts are all directed at meeting the Army's need for timely information on enemy forces under day, night, and all weather conditions anywhere in the world. Further details may be found at the TOP SECRET Special Access Level in the Tactical intelligence and Related Activities (TIARA) Congressional Justification Book (CJB), Volume VI, and the TENCAP Master Plan.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D560—Tactical Surveillance System—Advanced Development

(U) FY 1989 Accomplishments:

- **(U)** Completed critical design of IPDS with the USAF/USMC in the JSIPS program
- **(U)** Initiated assembly and integration of the initial capability of the TRAC system

(U) FY 1990 Planned Program:

- **(U)** Complete the development of the initial TRAC capability

(U) FY 1991 Planned Program:

- **(U)** Complete the hard-copy exploitation segment (HES) and field into intitial IPDS
- **(U)** Perform user evaluation of the initial IPDS
- **(U)** Initiate testing using the modularized antenna for aircraft dual datalink capability with TRAC
- **(U)** Continue development funding of IPDS within the joint (JSIPS) program, and testing of the initial prototype

(U) Work Performed By: In-house efforts accomplished by US Army Engineering Topographic Laboratory (ETL), Ft Belvoir, Virginia Contractors: E-Systems, Garland, Texas; Aerospace Corp, El Segundo, California; MRJ, Inc., Fairfax, Virginia; and Science Applications Inc., Tucson, Arizona.

(U) Related Activities: PE #0604740A (Tactical Surveillance System Engineering Development) Technological developments designed to shorten the time required to collect, exploit and disseminate information are related to this development. These areas include automated reconnaissance procedures, communications and high data rate compression technologies, tactical identification and targeting, and studies of various communication means for tactical imagery transfer (i.e., secondary dissemination) to include satellite communications. To ensure no duplication of effort, this work is coordinated with offices of the Secretary of Defense, Navy and Air Force TENCAP offices, the National Security Agency, Defense Intelligence Agency, Army Materiel Command, and other classified agencies. Coordination is also accomplished as part of the program reviews conducted by the Office of the Secretary of Defense (Director for Research and Engineering).

Program Element: **#0603730A (TIARA)**

PE Title: **Tactical Surveillance System — Advanced Development** Budget Activity **#4**

(U) Other Appropriation Funds: ($ in Thousands) Not applicable

(U) International Cooperative Agreements: Not applicable

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element #0603734A
PE Title **Military Engineering Advanced Technology** Budget Activity: #2

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DT08 Combat Engineering Systems	2300	3565	2380	Cont	Cont
PE TOTAL	2300	3565	2380		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element (PE) funds the AirLand Battlefield Environment (ALBE) technology demonstration program. The focus of the demonstrations is on Tactical Decision Aid (TDA) software. This software fills a technology gap in the current battlefield command and control system by giving the commander the ability to exploit the impacts of the environment to optimize use of weapons systems and other materiel assets. The TDAs also enable a more accurate and timely assessment of the impact of environmental factors on threat forces enabling the commander to react within the decision cycle of the enemy. The TDAs integrate the impacts of terrain, weather and atmospheric obscurants and produce information tailored for direct use in both planning and conducting combat operations. Initial versions of the software have been installed on the Digital Topographic Support System (DTSS) Prototype workstation and on the Proof-of-Concept Integrated Meteorological System (IMETS). Work is proceeding toward a major FY 1990 demonstration of a more comprehensive TDA package for integration into the DTSS, the Manueuver Control System (MCS), and the All Source Analysis System (ASAS). The upgraded software will provide field commanders with new capability to exploit multi-spectral imagery and data from space based platforms. These will include assessment of the impact of the environment on mobility, countermobility, Nuclear/Biological/Chemical (NBC), air defense and aviation operations and, the ability to better predict and react to enemy operations influenced by the environment. Impacts on doctrine and training are also being identified during the demonstrations and critical feedback provided to the combat developers relative to potential non-materiel solutions to Army problems. The ALBE TDAs will provide a significant force multiplier and will not increase logistics requirements. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project DT08 — Combat Engineering Systems

(U) FY 1989 Accomplishments:

- (U) Transitioned and implemented TDA software on the prototype DTSS workstation
- (U) Second generation Geographic Information System (GIS) installed on ALBE testbed.
- (U) Transitioned and implemented TDA software on the IMETS.

(U) FY 1990 Planned Program:

- (U) Conduct a major user test of fused weather/terrain TDA software employing 3-D graphics techniques during a Division level exercise.
- (U) Transition improved TDA software to the prototype DTSS Workstation and proof-of-concept IMETS

(U) FY 1991 Planned Program:

- (U) Conduct a major user test of fused weather/terrain TDA software employing 3-D graphics techniques during a Corps level exercise

Program Element: #0603734A
PE Title: **Military Engineering Advanced Technology** Budget Activity #2

- **(U)** Modify TDA software to provide an initial integrated terrain and weather analysis capability to lower echelon Army units with limited computations and display capabilities

(U) Work Performed By: The Engineer Topographic Laboratories, Fort Belvoir VA; the Atmospheric Sciences Laboratory, White Sands Missile Range, NM; the Waterways Experiment Station Vicksburg, MS; the Cold Regions Research and Engineering Laboratory, Hanover NH and the primary contractor, Battelle Pacific Northwest Laboratory, Richland, WA

(U) Related Activities:
PE #0602784A, Military Engineering Technology
PE #0601102A, Defense Research Sciences

In order to preclude unnecessary duplication, this research is coordinated with the following agencies annually, or more frequently as required:

U.S. Army Materiel Command;
U.S. Army Training and Doctrine Command;
U.S. Army Forces Command;
Department of Defense, Office of the Deputy Undersecretary of Defense for Research and Advanced Technology;
Defense Mapping Agency;
Department of Energy;
U.S. Air Force;
U.S. Navy; and the
U.S. Geological Survey, Department of Interior.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603742A**

PE Title: **Advanced Electronic Devices Development** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number / Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DF32 Advanced Electronic Devices	6197	7734	5640	Cont	Cont
PE TOTAL	6197	7734	5640		

B. (U) BRIEF DESCRIPTION OF ELEMENT: Provides essential funding to complete development of selected critical electronic components, assemblies and subsystems, so they can be inserted directly into systems under development. This will permit incorporation of the latest performance and cost improvements, thus avoiding fielding of technologically obsolete systems. Technology demonstrations assist in the nuclear hardening design of tactical and strategic command, control, communications and intelligence (C^3I) and other electronic systems, including initial radiation and electromagnetic pulse hardening, to ensure that Army weapons systems operate in hostile battlefield environments. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project DF32 — Advanced Electronic Devices:

(U) FY 1989 Accomplishments:

- **(U)** Developed and demonstrated monochrome and color thin film electroluminescent flat panel display modules for Smart Weapons, M1A1 Tank, Mobile Subscriber Equipment (MSE), and Joint Surveillance and Target Attack Radar System (JSTARS)
- **(U)** Flight tested high power jammer modules for aircraft survivability and insertion into ALQ-136
- **(U)** Delivered and evaluated first generation modular radar in test bed. Transferred module to industry
- **(U)** Optimized cell/battery design of the magnesium-manganese dioxide version of lithium-sulfur dioxide battery BA-55901U.

(U) FY 1990 Planned Program:

- **(U)** Begin development of militarized full color electroluminescent display subsystems for All Source Analysis System (ASAS), Advanced Field Artillery Tactical Data System (AFATDS) and Forward Area Air Defense Command Control and Intelligence (FAADC2I)
- **(U)** Develop FAADC2I next generation smaller, cheaper, more reliable monolithic transceiver modules into smart munitions
- **(U)** Continue development of test bed for time sensitive C^3I systems to validate Advanced technology (6.2) electromagnetic pulse hardening guidelines/practices
- **(U)** Deliver upgraded high performance TTC-38 telephone switch replacement parts to communications-electronics command
- **(U)** Initiate multiband 1.0 KW, continuous wave traveling wave tube amplifier, for Apache Escort Jammer for increased range and survivability

Program Element: **#0603742A**

PE Title: **Advanced Electronic Devices Development** Budget Activity: **#2**

- **(U)** Deliver advanced integrated circuit generated with Very High Speed Integrated Circuit (VHSIC) Hardware Description Language (VHDL) design technology with contractor and manufacturer independent documentation to Program Manager, Single Channel Ground and Airborne Radio System (PM SINCGARS)

(U) FY 1991 Planned Program:

- **(U)** Transition color flat panel display technology to battle management system, Fiber Optic Guided-Missile (FOG-M) and FAADC2
- **(U)** Apply SINCGARS proven VHDL design methodology to more advanced complex Army systems (i.e.) Light Helicopter Experimental (LHX), Heavy Force Modernization (HFM)
- **(U)** Institutionalize Army's computer aided design methodology for the rapid replacement of obsolete or non-available electronic parts
- **(U)** Demonstrate 1.0 KW traveling wave tube module for Apache Escort Jammer Module
- **(U)** Demonstrate next generation, smaller, cheaper, more reliable monolithic transmitter/ receiver modules into smart munitions
- **(U)** Update the Army parts obsolescence avoidance methodologies and transfer to Army centers, other government agencies, and industry

(U) Work Performed By: In-house effort: Electronics Technology & Devices Lab (ETDL), Fort Monmouth, NJ, & Harry Diamond Lab, (HDL), Adelphi, MD. Contractors: MACOM, Burlington, MA; GT&E, Westborough, MA; Litton, San Carlos, CA

(U) Related Activities:
PE #0602705A (Electronics & Electronic Devices); PE #0602120A Electronic Survivability & Fuzing Tech. Coordination with other Government agencies and through DOD Advisory Group ensures no duplication of effort

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603745A (TIARA)**
PE Title: **Tactical Electronic Support Systems — Advanced Development** Budget Activity: **#4**

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D406 — Single Source Processor-SIGINT (SSP-S):

(U) FY 1989 Accomplishments:

- (U) Completed system software development
- (U) Completed shelter equipment integration
- (U) Developed training software
- (U) Conducted test and evaluation
- (U) Completed hardware development

(U) FY 1990 Planned Program: Not applicable.

(U) FY 1991 Planned Program: Not applicable.

(U) Project D535 — Intelligence Fusion Analysis Demonstration:

(U) FY 1989 Accomplishments:

- (U) Identified and validated specific applications for map knowledge base and advanced data correlation techniques (to include terrain and spatial analysis functions) to existing/emerging All Source Analysis System/Enemy Situation Correlation Element (ASAS/ENSCE) hardware, to include the porting of experimental cartographic system for interactive intelligence preparation of the battlefield (IPB) support in an ASAS/ENSCE hardware and software environment
- (U) Continued to develop/fabricate basic neural net building blocks; continued to investigate applications of neural net technology to the automation of key intelligence fusion functions in the areas of data correlation, IPB, templating/nodal analysis and situation assessment; began design of specific prototype neural net hardware architectures for high-payoff ASAS/ENSCE applications
- (U) Continued to develop software tools and techniques in support of parallel/concurrent processing and investigated mass storage technologies and large-scale data base management techniques, with particular emphasis on improving performance of ASAS/ENSCE manipulation of large-scale data bases
- (U) Began design and development of an expandable, modular test bed software architecture to facilitate integration and evaluation of candidate fusion technology software and hardware applications in ASAS/ENSCE intelligence fusion system operations

(U) FY 1990 Planned Program:

- (U) Continue to prototype and evaluate feasible applications of artificial intelligence-based techniques and algorithms for data fusion and display to current/emerging ASAS/ENSCE hardware; continue to apply map display/knowledge base processing techniques for terrain and spatial analysis to IPB/situation assessment and target analysis
- (U) Investigate and validate applications of available parallel processing hardware and software technology to specific large-scale data fusion implementation problems
- (U) Develop, demonstrate and evaluate specific prototype neural net hardware architecture for high pay-off
- (U) Continue to explore emerging hardware and software processing, storage and display technologies.

Program Element #0603745A (TIARA)

PE Title **Tactical Electronic Support Systems — Advanced Development**

Budget Activity #4

- (U) Develop baseline software architecture and prototype as a tactical intelligence fusion test bed for integration and evaluation of fusion technology applications

(U) FY 1991 Planned Program:

- (U) Continue to explore emerging hardware and software processing, storage and display technologies
- (U) Continue to investigate and validate applications of available parallel processing hardware and software to large-scale ASAS ENSCE fusion operations, to include prototyping high-payoff ASAS/ENSCE applications of neural net technology
- (U) Continue to prototype feasible applications of artificial intelligence-based techniques and algorithms for data fusion and display to current emerging ASAS/ENSCE hardware, using the tactical intelligence fusion test bed
- (U) Continue to refine and upgrade the fusion technology test bed architecture

(U) Work Performed By: Major contractor for SSP-S is Ford Aerospace Corporation, San Jose, CA. The SSP-S Materiel Developer is Joint Tactical Fusion Program, McLean, VA, the Combat Developer is TRADOC and the Army Proponent is HQ, INSCOM Vint Hill Farm Station, Warrenton, VA. Major Contractor for Intelligence Fusion Analysis Demonstration is Jet Propulsion Laboratory, Pasadena, CA. In-house developing organizations are US Army Communications-Electronics Command (CECOM), Ft Monmouth, NJ, Center for Signals Warfare, Vint Hill Farms Station, Warrenton, Va, US Army Materiel Command, Alexandria, Va, and the Program Manager, Joint Tactical Fusion, McLean, Va

(U) Related Activities: PE #0604327A (Joint Tactical Fusion Program) is a related program. As in the Joint Tactical Fusion Program, extended coordination is conducted with other Services to avoid duplication of effort to include the US Marine Corps in the Technical Control and Analysis Center (TCAC) project.

(U) Other Appropriation Funds: (\$ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Other Procurement, Army V15900 Single Source Processor- SIGINT	4610	- 0 -	- 0 -

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603747A**

PE Title: **Soldier Support and Survivability** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D610	Food Advanced Development	1194	2396	2498	Cont	Cont
D669	Clothing and Equipment	4032	3842	3609	Cont	Cont
DC09	Unit/Organizational Equipment	- 0 -	481	1425	Cont	Cont
PE TOTAL		5226	6719	7532	Cont	Cont

B. (U) BRIEF DESCRIPTION OF ELEMENT: Development of improved clothing, individual equipment, fabric shelters, field service equipment, food and food service equipment enhances soldier battlefield efficiency, survivability and sustainment. New food items and food service equipment developed meet high nutrition requirements and reduce numbers of food service personnel, food procurement costs, and total food logistics support requirements. Individual clothing and equipment items being developed lighten the soldier's load and provide improved protection for all services against environmental extremes; nuclear, chemical and biological agents; and ballistic/laser hazards, and reduces detection from state of the art night vision devices.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D610 — Food Advanced Development: Conduct advanced development on improved subsistence and improved subsistence items to enhance soldier effectiveness

(U) FY 1989 Accomplishments:

- **(U)** Transitioned joint service, shelf stable bread program to procurement, providing the capability to supply fresh bread to units in the field
- **(U)** Conducted advanced development of Air Force Portable Collapsible Airlift Refrigeration Unit, providing capability for air shipment of fresh fruits and vegetables for all services
- **(U)** Transitioned Chemical Sanitation System for Field Operations to the Marine Corps

(U) FY 1990 Planned Program:

- **(U)** Conduct advanced development of joint service Dental Liquid Ration, providing capability to feed patients with jaw injuries
- **(U)** Transition Multi-Serving Retort Pouch technology to procurement
- **(U)** Conduct advanced development of Army High Mobility Universal Capability Field Kitchen

(U) FY 1991 Planned Program:

- **(U)** Conduct technical and user testing of Army High Mobility Universal Capability Field Kitchen
- **(U)** Conduct technical testing of advanced Family of Joint Operational Rations
- **(U)** Conduct field testing of Navy Shipboard Frost-Free Walk-In Refrigerators and Freezers
- **(U)** Conduct food advanced development of joint service New Generation Survival Ration

(U) Project D669 — Clothing and Equipment: Improve clothing and individual equipment to enhance soldier effectiveness and survivability.

Program Element: #0603747A
PE Title: **Soldier Support and Survivability** Budget Activity #4

(U) FY 1989 Accomplishments:

- (U) Completed technical test of interim Self-contained Toxic Environment Protective Outfit (STEPO)
- (U) Completed initial engineer design phase of STEPO
- (U) Developed design concepts of Multiple Threat Body Armor (MTBA)
- (U) Designed improved hermetic compressor for microclimate cooling
- (U) Conducted user evaluation of prototype backpack for Microclimate Cooling System
- (U) Added third wave-length directed energy protection eye protection device
- (U) Continued development and conducted developmental test I (DT I) test on Laundry and Decontamination Drycleaning System (LADDS)

(U) FY 1990 Planned Program:

- (U) Type classify interim STEPO
- (U) Initiate advanced development of Combat Vehicle Crewmen (CVC) Petroleum Oil Lubricants (POL) Resistant Tactile Glove, Aircrew Chemical Protective Clothing and Chem Bio Undergarment
- (U) Initiate technical test/user test (TT/UT) on STEPO
- (U) Human Factor/Manprint — evaluation of Multiple Threat Body Armor (MTBA)
- (U) Develop improved ambient air backpack/air vest for microclimate cooling
- (U) Test improved Ballistic/Laser Eye Protection Device with prescription capability
- (U) Complete design concept on CB Sortive Undergarments/Aircrew Chemical Protective Clothing (P3I)
- (U) Transition laser coating technology application to eye protection device

(U) FY 1991 Planned Program:

- (U) Develop prototype and test improved air vest
- (U) Type classify STEPO and Ballistic/Laser Eye protection Device
- (U) Develop and test prototype CB sortive undergarment/aircrew chemical protective clothing (Aircrew Uniform Integrated Battlefield P3I)
- (U) Transition MTBA to engineering development

(U) Project DC09 — Unit/Organizational Equipment Advanced Development: Develop and deploy new generation of lightweight tents, shelters and decontamination devices for unit level sustainability improvements. Work on unit/organizational equipment was previously accomplished in Project D669.

(U) FY 1989 Accomplishments:

- (U) See project D669 above

(U) FY 1990 Planned Program:

- (U) Continue development and conduct operational testing (OT) on LADDS

(U) FY 1991 Planned Program:

- (U) Initiate development of Night Maintenance Shelter, Water Conserving Field Shower System; Lightweight CB Hardened Family of Tents; the Light Infantry Division Heater
- (U) Complete demonstration phase and transition LADDS to full-scale development

(U) **Work Performed By:** In-house efforts will be accomplished by US Army Natick Research, Development and Engineering Center, Natick, MA; Project Manager for Clothing and Individual Equipment, Woodbridge, VA; Project Officer, Army Field Feeding, Ft Belvoir, VA; US Army Test and Evaluation Command, Aberdeen Proving Ground (APG), MD, Yuma Proving Ground, AZ, US

Program Element: #0603747A

PE Title: **Soldier Support and Survivability** Budget Activity: #4

Army Chemical Research Development and Engineering Center APG MD and U.S. Army Research Institute of Environmental Medicine Natick MA U.S. Army Aviation Research Laboratory Ft. Rucker, AL Contractors include Foster-Miller Inc Waltham MA Aerotek Inc New Haven CT, Analytics Inc, Willow Grove, PA, Metics Inc Everson PA East West Industries Inc Hauppauge, NY, Uvex Winter Optics Southfield RI and Quadrex HPS Inc Gainesville FL KPM-Tex Inc, Inwood, PA, American Optical Corp South Bridge MA Safetech Inc Newton PA and Research Inc, Waynesville, NC

(U) Related Activities:

PE #0601102A (Defense Research Sciences)

PE #0602786A (Logistics Technology)

PE #0603760A (Special Operations Forces (SOF) Equipment Advanced Development)

PE #0604713A (Combat Feeding, Clothing and Equipment)

The DOD Food and Nutrition Research Development Test Evaluation and Engineering Program is established by DOD 3235.2-R The Army is the Executive Agent for management of this fully coordinated Joint Services effort To prevent duplication of clothing and individual equipment item development, close coordination is maintained through joint working groups, joint Service agreements and circulation of requirements documents DOD Explosive Ordnance Disposal Board provides joint Service interest in STEPO Joint Logistics Commanders Panel on Chemical Protection supports Multipurpose Overboot development Ballistic/Laser Eye Armor is coordinated with the DOD Laser Hardened Materiels and Structures Group, Multi-Service Program for Advanced Concepts in Laser Eye Protection, and Annual Conference on Lasers on the Modern Battlefield There is no unnecessary duplication of effort within the Army or the DOD

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable

(U) International Cooperative Agreements: Not Applicable

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FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603759A**

PE Title: **Chemical Biological Defense and Smoke Advanced Technology** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DE83 Chemical Biological Defense Systems Advanced Technology	2745	3930	4071	Cont	Cont
PE TOTAL	2745	3930	4071		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element (PE) helps counter the chemical-biological (CB) threat through non-system specific technology demonstrations of Chemical Biological (CB) defense materiel. It provides all Services with more effective CB defense materiel. This program funds the Advanced Chemical and Biological Defense Advanced Technology Transition Demonstration (ATTD) for improved Detection, Decontamination and Protection which will speed maturing of advanced technologies and reduce risk in 6.3B of next generation and future systems. The program demonstrates through fabrication of subsystems and technology demonstrations, the capability to integrate diverse tecnologies to improve CB defense capabilities. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project DE83 — Chemical Biological Defense Systems Advanced Technology. This project establishes an Advanced Technology Transition Demonstration (ATTD) Program in the areas of agent Detection and identification, Decontamination and Individual and Collective Protection which will speed maturing of advanced Technologies to reduce risk in 6.3B.

(U) FY 1989 Accomplishments:

- (U) Conducted Computer Aided Design Network (CADNET) Demonstration and completed documentation to transition to 6.3B completed draft technical manual for Nuclear/Biological/Chemical (NBC) Defense Model CADNET which rapidly alerts battlefield units of a chemical environment. CADNET is lighweight, man portable, provides auto/manual modes for alarm retransmissions and interfaces chemical detector alarms with fielded army systems
- (U) Conducted Fixed Site detection and warning demonstration. The fixed site detection and warning system will provide an early warning and detection capability for critical fixed installations by integrating an array of current and develoment chemical detectors and alarms

(U) FY 1990 Planned Program:

- (U) Initiate Advanced Chemical and Biological Defense ATTD
- (U) Initiate penetrant assessment testing on current filters. Evaluate protective capabilities of current stock of collective protection filters against non-std agents. Assess capability of emerging protective tech and materials to provide adequate protection against potential penetrants
- (U) Initiate Detection ATTD subsystem for Biological/Chemical (BC) Detector. Identify/fabricate system components. Demonstrate feasibility of sampler and bio/chem module.

Program Element: **#0603759A**

PE Title: **Chemical Biological Defense and Smoke Advanced Technology** Budget Activity: **#2**

- **(U)** Initiate Detection ATTD subsystems for CB Mass Spectrometer. Identify/fabricate system components. Demonstrate feasibility of sampler and pyrolyzer

(U) FY 1991 Planned Program:

- **(U)** Complete penetrant assessment testing on filters
- **(U)** Complete Detection ATTD subsystem for BC Detector for transition to 6.3B in FY 1992; demonstrate integration of components, address technical and operational requirements, and conduct field trials with troops
- **(U)** Initiate Self Stripping Coating Decontamination subsystem of the Advanced Chemical and Biological Defense ATTD. This program will exploit candidate technologies for hasty decon of vehicles to increase decon effectiveness and decrease Mission Oriented Protective Posture (MOPP). Down select to most promising sacrificial coating
- **(U)** Continue CB Mass Spectrometer ATTD subsystem, demonstrate small mass analyzer, demonstrate Algorithm, and initiate integration of system components

(U) Work Performed By: In-house work is performed by Chemical Research, Development, and Engineering Center, Aberdeen Proving Ground, MD; Tank and Automotive Command, Warren, MI; Dugway Proving Ground, Dugway, UT; and Project Manager, REMBASS, Ft Monmouth, NJ. Contractors include Garret Corp, Los Angeles, CA; Litton Industries, Los Angeles, CA; and Radio Corporation of America, Burlington, MA.

(U) Related Activities:

PE #0601102A — Defense Research Sciences
PE #0602622A — Chemical, Smoke and Equipment Defeating Technology
PE #0603806A — Chemical Bilogical Defense Equipment — Advanced Development
PE #0603627A — Smoke and Equipment Defeating System — Advanced Development
PE #0603803A — Chemical Systems — Advanced Development

Activities are coordinated with other Government services and agencies. There is no unnecessary duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0603766A (TIARA) Project Number #D907
PE Title: **Tactical Electronic Surveillance Systems — Advanced Development** Budget Activity #4

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Continued the development and integration of Tactical Data Information Exchange System-B/Tactical Receive Equipment (TADIXS-B/TRE) capabilities into the existing family of electronic process and dissemination systems (EPDS)
- (U) Completed the user evaluation of prototype Tactical High Mobility Terminal (THMT)
- (U) Continued to refine the concepts and developed detailed system definitions for maximum utilization of emerging national capabilities

(U) FY 1990 Planned Program:

- (U) Continue studies and analyses to define optimum tactical interfaces to emerging national capabilities
- (U) Continue refinement of advanced capabilities for integration of TADIXS-B/TRE capabilities into existing EPDS
- (U) Continue on-going interface/coordination with other service Tactical Exploitation of National Capabilities (TENCAP) activities
- (U) Initiate feasibility study and lab demonstration for exploitation of signals parametric's (ESP) for timely target development, applicable to deep battle

(U) FY 1991 Planned Program:

- (U) Continue to refine the concepts and develop detailed system specifications to ensure compatibility/integration of TENCAP systems with emerging tactical systems (e.g. All Source Analysis System) (ASAS)
- (U) Continue software development to reduce man-intensive intelligence analysis to identify critical enemy elements/nodes for targeting, and demonstrate in a field environment
- (U) Continue on-going interfaces with other service TENCAP activities/agencies
- (U) Initiate miniturization of TENCAP capabilities for special combat requirements within non-Intelligence/Electronic Warfare (IEW) mission areas (i.e., air defense, fire support, aviation)
- (U) Complete integration of TADIXS-B/TRE capabilities into fielded systems
- (U) Continue evolutionary development of tactical exploitation of multi-spectral sensor products

D. (U) WORK PERFORMED BY: In-house development agencies: US Army Information Systems Command, Fort Huachuca, AZ. Contractor: Aerospace Corporation, El Segundo, CA.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** Not applicable.

F. (U) PROGRAM DOCUMENTATION: Not applicable

Program Element: **#0603766A (TIARA)** Project Number: **#D907**

PE Title: **Tactical Electronic Surveillance Systems — Advanced Development** Budget Activity: **#4**

G. (U) RELATED ACTIVITIES:

- Program Element #0604766A (Tactical Electronic Surveillance Systems — Engineering Development).
- Related developments are conducted by the Air Force, Navy, and national agencies. To ensure no duplication of effort, coordination is effected by the exchange of technical reports, attendance at scientific meetings and conferences, joint participation in subgroups and working panels, and joint funding/sponsorship of mutual high-priority development needs. In addition, formal requirements documents of each Service are exchanged, reviewed, and commented upon by other Services. Coordination is also accomplished as part of the program reviews conducted by the Office of the Secretary of Defense Director for Research and Engineering).

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

J. (U) MILESTONE SCHEDULE: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603772A**

PE Title: **Advanced Tactical Computer Science and Technology** Budget Activity: **#2**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D101 Tactical Automation	2717	4406	4834	Cont	Cont
D185 Military Software Integration	1783	- 0 -	- 0 -		
PE TOTAL	4500	4406	4834		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element (PE) develops and demonstrates advanced computer science and related technology for Army unique Command, Control, Communication, and Intelligence applications in all five functional areas of the battlefield: Air Defense, Combat Service Support, Fire Support, Intelligence Electronic Warfare, and Maneuver Control. It addresses critical Command and Control (C2) automation technologies, including computer security, distributed data base management, and Artificial Intelligence (AI) based commander's decision aids. Technology produced from this PE is transferred to project managers and system developers through demonstrations, Army and Defense Advanced Research Projects Agency (DARPA) testbeds, and field exercises. The intent is to effectively and efficiently speed up development and acquisition of computer based systems for secure, near real time automated information transfer and analysis. The work in this program element is consistent with the Army's resource constrained Technology Base Master Plan and force modernization plans. Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies and advanced technology transition demonstrations (ATTDs) are funded on a priority basis.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D101 — Tactical Automation:

This project will apply emerging Artificial Intelligence (AI) technology to critical Army Force Level C2 information management problems and develop the decision aids and planning tools for Air-Land Battle Management (ALBM). The project will define and develop the automated Command, Control Communications (C3) concept for low echelon elements at battalion and below so as to extend the Army Tactical Command and Control System (ATCCS) down to the individual squad/vehicle level. Other tasks relate to computer security, introducing secure computing into a tactical environment, and include risk assessment, certification, accreditation, and modeling of secure tactical systems. Adaptations of force level and lower echelon decision aids will be adapted for Heavy Force Modernization (HFM) vehicle C2 applications

(U) FY 1989 Accomplishments:

- **(U)** Demonstrated expanded Airland Battle Management STAR (A system development planning tool) Artificial Intelligence (AI) support tools
- **(U)** Demonstrated upgraded Heuristic course of action combat evaluator
- **(U)** Initiated Execution Monitoring Decision Support Software development areas
- **(U)** Completed initial coordination and development of an ALBM transition plan with US Army Communications-Electronics Command (CECOM) and ATCCS Program Executive Offices/Program Managers (PEO/PMs)
- **(U)** Developed multilevel secure version of Army Secure Operating System (ASOS) and submitted to National Security Center for certification at A1 level

Program Element: **#0603772A**

PE Title: **Advanced Tactical Computer Science and Technology** Budget Activity: **#2**

(U) FY 1990 Planned Program:

- **(U)** Develop coordinated Advanced Technology Transition Demo (ATTD) functional specification with PEO Command and Control (PEOC2), PM Operations Tactical Data Systems (PM OPTADS), and PM Field Artillery Tactical Data Systems (PM FATDS)
- **(U)** Initiate Port of ALBM Star AI Tools for Army Tactical Command and Control System (ATCCS) Common Hardware Software (CHS)
- **(U)** Initiate ATTD prototype development of Maneuver Planner for ATCCS Manpower Control System/CHS
- **(U)** Initiate ATTD prototype development of Fires Planner for ATCCS AFATDS/CHS
- **(U)** Initiate prototype development of brigade/battalion Tactician Decision Support AID
- **(U)** Initiate development of Heavy Force Modernization (HFM) C2 Demo Prototype Decision Support Capabilities
- **(U)** Coordinate Combined Army Center (CAC) and CECOM evaluation of ALBM technology completeness and operational validity

(U) FY 1991 Planned Program:

- **(U)** Continue porting, development, and testing of ALBM STAR AI tool parts to ATCCS CHS
- **(U)** Preliminary ATTD Maneuver planning software test and evaluation in Maneuver Control System MCS/CHS environment and continued development
- **(U)** Preliminary ATTD Fires planning software Test and Evaluation in AFATDS/CHS environment and continued development
- **(U)** Preliminary Brigade/Battalion Tactician Decision Support Software Test and Evaluation
- **(U)** Preliminary HFM C2 Decision Support prototype Test and Evaluation

(U) Project D185 — Military Software Integration: This project applies emerging Artificial Intelligence (AI) technology to critical Army C2 problems.

(U) FY 1989 Accomplishments:

- **(U)** Completed ALBM MOVES and Fire Support integration and demonstrations (FORCES)
- **(U)** Demonstrated ALBM/Maneuver Control System (MCS) Communications

(U) FY 1990 Planned Program: None planned.

(U) FY 1991 Planned Program: None planned.

(U) Work Performed By: In-House: Center for C3 Systems, Center for Software Engineering, US Army Communications-Electronics Command, Fort Monmouth, NJ; Software Systems Engineering, San Diego, CA; Odyssey Research Assoc., Ithaca, NY; DARPA, Rosslyn, VA; TRW, Redondo Beach, CA; SRI International, Menlo Park, CA; Computer Sciences Corp., Shrewsbury, NJ; Monmouth College, West Long Branch, NJ; TAMSCO, Eatontown, NJ; Lockheed, Austin, TX.

(U) Related Activities: Computer Security Certification/Accreditation and Secure Applications Modeling are closely related to, and support computing, Army Secure Operating System program. Projects D101 and D185 are related to strategic computing initiative and are coordinated with/supported by DARPA. There is no unnecessary duplication of efforts within DOD.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603774A**
PE Title: **Night Vision Systems Advanced Development**
Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D131 Night Vision Systems Advanced Development	3827	3040	3272	Cont	Cont

B. (U) BRIEF DESCRIPTION OF ELEMENT: Night vision equipment provides the Army with the capability to locate, identify and engage targets under all battlefield conditions, around the clock and at extended stand-off ranges. The threat of numerical superiority is countered through exploitation of darkness and reduced visibility as an advantage on the battlefield. This program element provides for the advanced development of multisensor system suites and eyesafe laser rangefinder devices applicable to target acquisition and engagement for use with combat vehicles and individual weapon systems.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D131 — Night Vision Systems Advanced Development (AD) — Project objectives are to develop night vision technology for transition to engineering development and for insertion into other technology and products related to night vision.

(U) FY 1989 Accomplishments:

- (U) Continued AD effort for Milti-Sensor Target Acquisition System (MTAS)

(U) FY 1990 Planned Program:

- (U) Continuation of MTAS AD to include testing and integration into the Advanced Tank Cannon System (ATACS) Turret

(U) FY 1991 Planned Program:

- (U) Completion of MTAS integration into the Lightweight ATACS Armament System and initiation of field demonstrations and testing for the tank improvement program

(U) Work Performed By: In-house efforts accomplished by the U.S. Army Communications and Electronics Command (CECOM), Ft. Monmouth, NJ and the Center for Night Vision and Electro Optics (C/NVEO), Ft. Belvoir, VA. MTAS contractor is Rockwell International. Other contractors to be determined.

(U) Related Activities: Sensors and end item equipment serve multi-service and multi-national (NATO) roles coordinated with Army Night Vision program elements #0604710A and #0603710A. There is no unnecessary duplication of effort within the Army or Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603801A (TIARA)**

PE Title: **Aviation-Advanced Development** Budget Activity: **#4**

A. (U) RESOURCES: (S in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DB32 Advance Maintenance Concepts and Equipment	2759	1723	1625	Cont	Cont
DB33 Cargo Handling Equipment	- 0 -	715	929	Cont	Cont
DB45 Aviation Life Support Equipment Advanced Development	2121	2086	2580	Cont	Cont
DC29 ASEMA Advanced Development	- 0 -	11203	- 0 -	Cont	Cont
PE TOTAL	4880	15727	5134	Cont	Cont

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides RDTE advanced development funds for aviation support of tactical programs associated with air mobility support and advance maintenance concepts/ equipment. Project DB32, Advance Maintenance Concepts and Equipment, enhances utilization of current and future aircraft by improving the efficiency of maintenance (primarily in the area of diagnostics/prognostics) and servicing operations, through: replacing obsolete, unsupportable ground support equipment with new, standardized, multi-output equipment compatible with all Army aircraft models; developing rapid battle damage repair procedures and tools to speed the return of aircraft to combat ready status; and developing new equipment for aerial recovery of damaged aircraft. Included in this project is the Intelligent Fault Locator Battalion-Level Demonstration, a program to test artificial intelligence-based troubleshooting software on a battalion of AH-64 Apache aircraft. Project DB33, Cargo Handling Equipment (CHE), focuses on the development of equipment and operational improvements in loading and offloading helicopter cargo in all-weather, around-the-clock combat scenarios. Project DB45, Aviation Life Suport Equipment (ALSE) Advanced Development, increases survivability on the integrated battlefield and in worldwide environments. ALSE also enhances the ability of the air crew to return to flight through new protective clothing ensembles, aviator protective masks, laser protective visors, survival kits, restraint systems and microclimatic cooling devices.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project DB32 — Advance Maintenance Concepts and Equipment:

(U) FY 1989 Accomplishments:

- (U) Completed Mechanical Component Diagnostics Program
- (U) Initiated Intelligent Fault Locator Diagnostics Program
- (U) Initiated generation of New Aircraft Tool System technical data package

(U) FY 1990 Planned Program:

- (U) Continue Intelligent Fault Locator Diagnostics Program and battalion-level demonstration
- (U) Initiate Advanced Boresight System development

(U) FY 1991 Planned Program:

- (U) Complete Intelligent Fault Locator Diagnostics Program and demonstration
- (U) Continue Advanced Boresight System development
- (U) Initiate Composite Structure Battle Damage Repair Kit development

Program Element: **#0603801A (TIARA)**
PE Title: **Aviation-Advanced Development** Budget Activity: **#4**

(U) Project DB33 — Cargo Handling Equipment:

(U) FY 1989 Accomplishments: Not Applicable.

(U) FY 1990 Planned Program:

- (U) Initiate advanced development of helicopter internal/external pallet system
- (U) Initiate aerial cargo handling heavy-lift system development
- (U) Initiate advanced materials aerial cargo sling development

(U) FY 1991 Planned Program:

- (U) Complete helicopter internal/external pallet development and tests
- (U) Complete advanced material aerial cargo sling development
- (U) Continue aerial cargo handling heavy-lift system development

(U) Project DB45 — Aviation Life Support Equipment (ALSE) Advanced Development

(U) FY 1989 Accomplishments:

- (U) Completed proof-of-principle (POP) flight test on Aircrew Integrated Helmet
- (U) Completed low cost nuclear flash protection demonstration
- (U) Completed four-man microclimatic cooling prototype fabrication and test
- (U) Completed test and evaluation of NBC (simulant) contamination ingress on UH-60 with microclimatic cooling system prototype
- (U) Fabricated M-43 Protective Mask interface hardware for microclimatic cooling system
- (U) Developed and fabricated laser eye protection for SPH-4 and HGU-56P Aviator Helmet, and provided prototypes to meet special user requirements

(U) FY 1990 Planned Program:

- (U) Test laser eye protection for SPH-4 and HGU-56P Aviator Helmet
- (U) Award contract for advanced laser eye protection to protect against additional wavelengths
- (U) Complete Aircrew Integrated Helmet advance development. Hold Milestone II in-process review (IPR), and prepare for engineering development contract
- (U) Initiate advanced development program for a non-carbon based regenerative NBC filtration system for Army aircraft
- (U) Fabricate and test inflatable body and head restraint system prototypes

(U) FY 1991 Planned Program:

- (U) Prepare statement of work and initiate advanced development contract for NBC Contamination Avoidance Program
- (U) Initiate NBC Airborne Remote Detection Program
- (U) Test, evaluation and Milestone III IPR for Inflatable Body and Head Restraint System
- (U) Fabricate, install, and test Non-Carbon Based Regenerative NBC Cockpit Filtration System for proof-of-concept

(U) **Work Performed By:** Sikorsky Aircraft Division, United Technologies Corp, Stratford, CT; GENTEX Inc, Carbondale, PA; Midwest Research Institute Corp, Kansas City, MO; Honeywell Inc, Minneapolis, MN; Optical Radiation Corp, Los Angeles, CA; Technology Inc, Dayton, OH; American Optical, Southbridge, MA; Garrett Air Research, Torrance, CA; Flight Dynamics, Portland, OR; and LME Inc, Alexandria, VA. In house work is performed by Aviation Applied Technology Directorate, Ft Eustis, VA; Chemical Systems Laboratories, APG, MD; Natick Research and Development Center, Natick, MA; US Air Force, Aeronautical Systems Division, Wright-Patterson AFB, OH; US Army Aviation Systems Command, St Louis, MO.

Program Element: **#0603801A (TIARA)**

PE Title: **Aviation-Advanced Development** Budget Activity **#4**

(U) Related Activities:

Program Element #0602211A (Aviation Technology)
Program Element #0602786A (Logistics Technology)
Program Element #0604270A/D653 D665 (Electronic Warfare Development)
Program Element #0603244F (Aircraft Non-Nuclear Survivability)
Program Element #0603262N (Aircraft Survivability and Vulnerability)
Program Element #0604801A/DC45 (Aviation Life Spt Systems ED)
There is no unnecessary duplication of effort within the Army or the Department of Defense

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable

(U) International Cooperative Agreements: Not Applicable

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603802A**

PE Title: **Weapons and Munitions — Advanced Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D007 Field Artillery Ammunition and Fuzes Advanced Development	1869	- 0 -	- 0 -		
DC39 Smart Submunition Warhead	19219	14929	15056	- 0 -	49204
DK83 Fire and Forget Common Infrared Seeker	823	953	1991	Cont	Cont
XXXB MK19 Improvements	- 0 -	1693	1519	Cont	Cont
PE TOTAL	21911	17575	18566		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program supports the design and advanced development of both direct and indirect-fire weapons and munitions. Indirect-fire munitions and submunitions with more effective seekers, propelling charges, projectiles and fuzing, providing increased lethality and range, are required to offset the superior numbers of systems employed by Warsaw Pact countries. Indirect-fire efforts include an anti-armor warhead proof-of-principle program for the Army Tactical Missile System (Army TACMS) Block II; and a common infrared seeker proof-of-principle program to provide a seeker with potential application to Army TACMS, Multiple Launch Rocket System (MLRS), and 155mm howitzer systems. Direct-fire tasks under this element provide for development and improvements to existing individual and crew-served weapons including hand guns, rifles, grenade launchers, shotguns, machineguns and light anti-armor weapons. Among developments and improvements required are sighting systems, ammunition, fire control for day and night engagements, an improved lightweight rifle-launched, or individual shoulder-launched, anti-armor munition, and small arms designs. The project efforts involve coordinated joint programs which support all services.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D007 — Field Artillery Ammunition and Fuzes: Development of modular, case propellant charges for 155mm artillery systems, providing simplified logistics and facilitating development of a future autoloading capability.

(U) FY 1989 Accomplishments:

- **(U)** Completed testing and type classification of the modular charge propellants. There is no current intent to procure modular propellants due to new requirements for insensitive munitions and a shift in emphasis to more capable propellant systems to support the next generation self-propelled howitzer.

(U) Project DK83 — Fire and Forget Common Infrared Seeker: Develop a common infrared seeker (IR) with potential application to Army TACMS, MLRS, and 155mm Howitzer Systems

(U) FY 1989 Accomplishments:

- **(U)** Supported IR seeker contract being awarded in project DC39 of this program element (PE)
- **(U)** Initiated seeker gun-hardening analysis

Program Element: **#0603802A**

PE Title: **Weapons and Munitions — Advanced Development** Budget Activity: **#4**

(U) FY 1990 Planned Program:

- **(U)** Continue gun-hardening analysis of IR seekers

(U) FY 1991 Planned Program:

- **(U)** Support integration of gun hardening efforts in the seeker associated with project DC39 of this PE

(U) Project XXXB — MK19 Improvements: Product enhancement program for the MK19 Grenade Machine Gun, providing improved munitions, associated fire control, training devices, and mounts.

(U) FY 1989 Accomplishments: Not Applicable

(U) FY 1990 Planned Program:

- **(U)** Award contract; initiate effort for a cannister round for close-in defense
- **(U)** Award contract; initiate effort for a tactical engagement simulator (TES) to be used in training in force-on-force exercises
- **(U)** Initiate testing of a nondevelopmental item (NDI) optical sight for the MK19

(U) FY 1991 Planned Program:

- **(U)** Build hardware; conduct technical test/user test (TT/UT); refine designs of cannister round
- **(U)** Complete TT/UT, conduct in-process review (IPR) for optical sight for MK19
- **(U)** Conduct TT/UT of Tactical Engagement Simulator (TES) and conduct IPR
- **(U)** Award contract; initiate effort for lightweight ground mount for MK19

(U) Work Performed By: In-house work is performed by Project Manager, Cannon Artillery Weapons System, and Product Manager, Grenade Machine Gun, Picatinny Arsenal, NJ; Missile Command, Huntsville, AL; Naval Surface Weapons Center, White Oak, MD. Major contractors include Talley Defense Industries, Mesa, AZ, Armtec Defense Products, Cochella, CA; Chamberlain Corp., Scranton, PA; Motorola, Scottsdale, AZ; New Mexico Institute of Mining and Technology, NM; Army Materiel Systems Analysis, Aberdeen, MD; Harry Diamond Laboratories, Adelphi, MD; Air Force Armament Systems Laboratory, Eglin AFB, FL., McDonnel-Douglas Astronautics Corp., Titusville, FL., Brunswick Defense Corp., Costa Mesa, CA., Marquardt Company, Van Nuys, CA.

(U) Related Activities:

PE #0603004A (Weapons and Munitions — Advanced Development)

There is no unneccessary duplication of effort within the Army or Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
PROCUREMENT:			
WTCV G13400 MK19-3	12000	19736	- 0 -

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603802A** Project Number: **#DC39**

PE Title: **Weapons and Munitions — Advanced Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Smart Submunition Warhead

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
ATACMS Block II	19219	14929	15056	- 0 -	49204

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Program conducts the proof-of-principle demonstration of a two-color infrared seeker in a terminally-guided submunition. The effort supports the ATACMS Block II Smart Submunition requirement to kill armored combat vehicles in the deep battle area, and will provide submunition and seeker data to support other missile, rocket and cannon applications.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project DC39 — Smart Submunition Warhead

(U) FY 1989 Accomplishments:

- **(U)** Request for proposal released
- **(U)** Contract awarded August 1989

(U) FY 1990 Planned Program:

- **(U)** Seeker and submunition design
- **(U)** Hardware demonstration (Captive Flight Testing)

(U) FY 1991 Planned Program:

- **(U)** Continue hardware demonstration (Drop Testing)
- **(U)** Prepare final reports — July 1991

D. (U) WORK PERFORMED BY: This program is managed by the Army TACMS Block II Smart Submunition Warhead Product Manager. Submunition contracts were awarded through a competitive source selection process to two contractors; Raytheon Company, Laurel, MA and General Dynamics, Ontaria, CA. An integration contract was awarded to LTV Aerospace and Defense Company, Dallas, TX.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None
2. **(U) SCHEDULE CHANGES:** None
3. **(U) COST CHANGES:** None

F. (U) PROGRAM DOCUMENTATION:

Mission Element Need Statement	4/81
Required Operational Capability	5/85

Program Element: **#0603802A** Project Number: **#DC39**
PE Title: **Weapons and Munitions — Advanced Development** Budget Activity: **#4**

G. (U) RELATED ACTIVITIES:

- **(U)** PE #0602303A (Missile Technology), Army Missile Command's Terminally Guided Submunition (TGSM) and SKEET target-sensing submunition work
- **(U)** PE #0604724F (Tactical C^3 Counter-measures); Air Force's Precision Location Strike System (PLSS)
- **(U)** PE #0603303A D216 Multiple Launch Rocket System (MLRS), Terminal Guidance Warhead (TGW)
- **(U)** PE #0603802 Fire & Forget Common IR SEEKER (Project DK83)
- **(U)** Capabilities of the above systems will be complimentary in nature. There is no unnecessary duplication of effort within the Army or Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

1. **(U) PROCUREMENT:** Not Applicable.
2. **(U) MILITARY CONSTRUCTION:** Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Letters of intent from France, Turkey and Italy to investigate possible future cooperative opportunities.

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
Request for proposal release	02/89
Contract award	07/89
Final report	08/91

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603803A**

PE Title: **Chemical Systems — Advanced Development**

Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DE76 Lethal Chemical Material Advanced Development	- 0 -	7101	4522	Cont	Cont

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides for the advanced development of chemical systems including lethal, non-lethal incapacitating device/munition, and anti-protective munition. This effort responds to national security policy direction to accelerate efforts to replace the chemical warfare deterrent munitions stockpile with safer, modern binary chemical munitions. Anti-protective and incapacitating materiels will offer U.S. forces a capability to respond to an enemy chemical attack with a variety of chemical munitions.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project DE76 — Lethal Chemical Materiel: The Capstone Organization and Operational (O&O) Plan for Chemical Weapons, approved 5 Jan 87, established the requirement for an anti-protective chemical munition. The munition will contain a new retaliatory, lethal (or militarily significant sub-lethal) chemical payload capable of defeating chemically protected combatants. Anti-protective materiel will offer U.S. forces a capability to respond to an enemy chemical attack with a variety of chemical munitions, thus significantly burdening the enemy with additional protective measures and logistical problems.

(U) FY 1989 Accomplishments: No funded program.

(U) FY 1990 Planned Program:

- **(U)** Prepare and approve acquisition strategy & acquisition plan for Anti-Protective Chemical Munition
- **(U)** Approve organizational & operational plan
- **(U)** Prepare and approve integrated logistic support plan (ILSP)

(U) FY 1991 Planned Program:

- **(U)** Initiate advance development design program

(U) Work Performed By: The advanced development contractor has not been determined at this time. Primary government organizations performing project activities are:

- **(U)** Office of the Project Manager for Binary Munitions
- **(U)** Chemical Research, Development and Engineering Center
- **(U)** U.S. Army Chemical School (Training & Doctrine Command)
- **(U)** Dugway Proving Ground (Test and Evaluation Command)
- **(U)** U.S. Army Material Systems Analysis Activity
- **(U)** Armaments Research, Development and Engineering Center

Program Element: **#0603803A**

PE Title: **Chemical Systems — Advanced Development** Budget Activity: **#4**

(U) Related Activities: PE #0604803A (Chemical Systems Engineering Development)

(U) Other Appropriation Funds: ($ in Thousands) No Procurement or Military Construction appropriation-funded activities will be performed during FY 1990/FY 1991.

(U) International Cooperative Agreements: Not applicable to this project.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603804A**

PE Title: **Logistics and Engineer Equipment — Advanced Development**

Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D266 Airdrop Equipment Adv. Dev.	2465	2253	1518	Cont	Cont
D428 Tactical Rigid Wall Shelters Adv. Dev.	3168	8047	6536	- 0 -	
DG01 Combat Engineer Equipment Adv. Dev.	3200	1512	1160	Cont	Cont
DG10 Advanced Tactical Power Sources Adv. Dev.	2608	922	911	Cont	Cont
DG11 Advanced Electrical Energy Concepts Adv. Development	2431	1072	798	Cont	Cont
DG14 Logistics Support Equipment Adv. Dev.	1125	1476	1727	Cont	Cont
DK39 General Support Equipment Adv. Dev.	340	639	309	- 0 -	
DK41 POL Distribution Equipment Adv. Dev.	534	536	490	Cont	Cont
PE TOTAL	15871	16457	13449	Cont	Cont

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program supports advanced development of technology necessary to field new and improved combat support and combat service support equipment essential to sustaining combat operations. New and improved equipment developed increases the tactical mobility and survivability of combat forces while reducing the logistics support burden. Advance battery technology will substantially reduce operational and support costs.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

- **(U)** Project D266 — airdrop equipment Advanced Development: Develop and test airdrop equipment to improve soldier mobility, sustainment and survivability.

(U) FY 1989 Accomplishments:

- **(U)** Completed development of Heavy Drop Derigging System
- **(U)** Completed development of Enhanced Container Delivery System
- **(U)** Awarded contract for 20K lb and 42K and 60K Low Altitude Retro-Rocket System (LARRS)

(U) FY 1990 Planned Program:

- **(U)** Reprogram funds from D279 tasks to D266 in order to fully fund 20K lbs portion of LARRS and initiate 42K portion of LARRS contract
- **(U)** Complete development of quick release tiedown
- **(U)** Award contract for 60K lbs Tandem Low Altitude Parachute Extraction System (LAPES)

(U) FY 1991 Planned Program:

- **(U)** Begin low altitude (300 ft) linked platform development
- **(U)** Initiate 42K & 60K portion of LARRS contract

Program Element: #0603804A

PE Title: **Logistics and Engineer Equipment — Advanced Development** Budget Activity: #4

- (U) Conduct technical feasibility test (TFT) of 20K lb LARRS
- (U) Complete 60K Tandem LAPES contract
- (U) LARRS is a continuing program

(U) Project D428 — tactical rigid wall shelters Advanced Development: Develop family of tactical rigid wall shelters to enhance soldier command, control, communications; survivability; and sustainability

(U) FY 1989 Accomplishments:

- (U) Completed advanced development of Standard Integrated Command Post System (SICPS) tent programs and transitioned to full-scale development (FSD).
- (U) Resumed development of chemically-biologically (CB) hardened shelters for medical use in battalion and division areas (program unfunded in FY 88)
- (U) Initiated development of M577 Tracked SICPS

(U) FY 1990 Planned Program:

- (U) Continue development of M577 Tracked SICPS to include fabrication and test of prototype
- (U) Continue development of CB hardened shelters for medical use
- (U) Complete advanced development of SICPS shelter program and transition to FSD

(U) FY 1991 Planned Program:

- (U) Continue development of nuclear hardened shelter for High Mobility Multi-Purpose Wheeled Vehicle (HMMWV)
- (U) Transition development of CB hardened shelters for medical use to FSD
- (U) Complete testing of M577 Tracked SICPS. Transition M577 Tracked SICPS to FSD
- (U) This is a continuing program

(U) Project DG01 — Combat Engineer Equipment Advanced Development: Conduct advanced development of tactical bridging.

(U) FY 1989 Accomplishments:

- (U) Redesigned Heavy Assault Bridge (HAB) to 26M due to revised user requirement
- (U) Initiated fabrication rework of first prototype HAB scissors bridge to 26M
- (U) Initiated contract for German Horizontal Launched Assault Bridge on Abrams chassis for side-by-side testing

(U) FY 1990 Planned Program:

- (U) Modify two HAB launchers to accommodate 26M bridges
- (U) Initiate fabrication of two 26M bridges
- (U) Initiate Abrams chassis technical data package (TDP) for HAB production
- (U) Complete manuals and training for technical & user tests (TT/UT)

(U) FY 1991 Planned Program:

- (U) Initiate HAB technical tests (TT)
- (U) Conduct engineering design testing (EDT) of 26M Scissors HAB
- (U) Continue TDP for Abrams HAB launcher chassis
- (U) Continue HAB bridge & launcher TDP for competitive procurement
- (U) Transition HAB to engineering development
- (U) Prepare manuals for horizontal launch bridge testing

Program Element: **#0603804A**

PE Title: **Logistics and Engineer Equipment — Advanced Development** Budget Activity: **#4**

(U) Project DG10 — Advanced Tactical Power Sources Advanced Development: Develop advanced tactical power sources to improve soldier mobility, sustainability and survivability.

(U) FY 1989 Accomplishments:

- (U) Completed power processor effort for Microwave/Millimeter Wave Monolithic Integrated Circuit (MIMIC)
- (U) Completed safety study and field testing of throwaway Lithium Thionyl Chloride (LTC) batteries
- (U) Started development of an advanced lithium rechargeable battery
- (U) Finalize LTC throwaway battery designs and transition to production

(U) FY 1990 Planned Program:

- (U) Initiate development of lithium throwaway battery state-of-charge indicator
- (U) Initiate rechargeable lithium battery laboratory and field evaluation for multi-system standard matrix battery
- (U) Complete resolution of safety and disposal problems of high-rate rechargeable batteries
- (U) Evaluate prototype power processor for MIMIC

(U) FY 1991 Planned Program:

- (U) Conduct Laboratory evaluation of state-of-change indicator
- (U) Reduce size/weight of power processor for MIMIC utilizing micro-circuit technology
- (U) Complete field evaluation of rechargeable lithium batteries
- (U) Fabricate prototype low cost, advance charger/analyzer
- (U) Develop switch technology for high temperature super-conducting magnetic energy storage power source

(U) Project DG11 — Advanced Electrical Energy Concepts: Develop advanced electrical energy concepts and devices to improve soldier mobility, sustainability and survivability.

(U) FY 1989 Accomplishments:

- (U) Completed development testing and operational testing (DT/OT) of power conditioners

(U) FY 1990 Planned Program:

- (U) Conduct Milestone II/III in-process review (IPR) for power conditioners
- (U) Start program to provide in-line generators for vehicle electric power
- (U) Fabricate high-power density auxiliary power using high-speed engine technology

(U) FY 1991 Planned Program:

- (U) Complete prototype fabrication of Enhanced Distribution Illumination Set Electrical (EDISE)
- (U) Initiate development of man-portable generators
- (U) This is a continuing program

(U) Project DG14 — Logistics Support Equipment Advanced Development:

(U) FY 1989 Accomplishments:

- (U) Completed design/fabrication of upgraded Universal Self-Deployable Cargo Handler (USDCH)
- (U) Started DT/OT of USDCH
- (U) Requisitioned cranes from Navy to satisfy requirement for Air Transportable Lifting Device (ATLD)

Program Element: #0603804A

PE Title: **Logistics and Engineer Equipment — Advanced Development** Budget Activity: #4

- (U) ATLD TC Limited Procurement Urgent (LPU) Milestone completed for limited quantity
- (U) Complete testing of self-deployable components

(U) FY 1990 Planned Program:

- (U) Continue technical feasibility for USDCH
- (U) Conduct acquisition strategy (AS) materiel acquisition review (MARC) for USDCH
- (U) Conduct USDCH Milestone I/II IPR

(U) FY 1991 Planned Program:

- (U) Initiate productivity enhancements P3I program for USDCH
- (U) Conduct technical feasibility testing of self-deployable prototype
- (U) Award proof-of-principal prototype contract for automated warehouse distribution system
- (U) This is a continuing program

(U) Project DK39 — General Support Equipment Advanced Development: Develop new environmental support equipment to improve soldier mobility, sustainability and survivability.

(U) FY 1989 Accomplishments:

- (U) Initiated evaluation of pre-treatment system as part of improved Reverse Osmosis Water Purification Unit (ROWPU) components
- (U) Initiated evaluation of hollow fiber reverse osmosis elements
- (U) Awarded contract for design and fabrication of lightweight multi-media filter

(U) FY 1990 Planned Program:

- (U) Continue ROWPU component effort to evaluate pre-treatment systems, lightweight materials and hollow fiber reverse osmosis elements
- (U) Conduct evaluation of improved water storage devices
- (U) Award proof-of-principle contract for Auxiliary Power and Environmental Control System (APECS)

(U) FY 1991 Planned Program:

- (U) Continue evaluation of lightweight materials, and alternate configurations of reverse osmosis elements as part of ROWPU components
- (U) Complete pre-treatment evaluation
- (U) This is a continuing program

(U) Project DK41 — POL Distribution Equipment Advanced Development: Design new POL transfer surveillance and distribution items to improve soldier mobility and survivability.

(U) FY 1989 Accomplishments:

- (U) Completed technical data package for Arctic Fuel Dispensing Equipment (AFDE)
- (U) Completed pipeline construction techniques and conduct materiel study to determine best technical approach
- (U) Procured candidate Standard Army Refueling System (SARS) nozzles/receptacles for testing and evaluation

(U) FY 1990 Planned Program:

- (U) Transition AFDE program into production
- (U) Test candidate SARS refueling nozzels and receptacles
- (U) Initiate portable oil spectrographic analysis (POSA) development

Program Element: **#0603804A**

PE Title: **Logistics and Engineer Equipment — Advanced Development**

Budget Activity: **#4**

- **(U)** Procure prototype and test spectrometrics for POL analysis
- **(U)** Finalize Modular Base Petroleum Laboratory (MBPL) technical data package

(U) FY 1991 Planned Program:

- **(U)** Finalize tech data package (TDP) for standard refueling nozzles and receptacles
- **(U)** Complete development of POL quality analysis spectrophotometer
- **(U)** Initiate PLS flat rack refueling module program
- **(U)** Initiate POL surveillance and survivability program for pipeline
- **(U)** This is a continuing program

(U) Work Performed By: In-house efforts will be accomplished by the Troop Support Command, Natick Research, Development and Engineering Center, Natick, MA and Belvoir Research, Development and Engineering Center, Fort Belvoir, VA, the US Army Laboratory Command, Electronic Technology Devices Laboratory, Fort Monmouth, NJ, and the US Navy Sea Systems Command, Alexandria, VA. Contractors include Garrett Corp, Phoenix, AZ; BMY, York, PA; Foster-Miller Inc, Waltham, MA; MTI, Latham, NY; Altus Corp, San Jose, CA; Textron Marine Systems, New Orleans, LA; Data Inc, St Louis, MO; Albany International, Albany, NY; GTE, Waltham, MA; Saft America, Cockeysville, MD; Service Application International Corp, Alexandria, VA; Radian Corp, Alexandria, VA; Advanced Engineering Research Corp, McLean, VA; Sundstrand Fluid Handling Co, Arvarda, CA; FMC, Jonesboro, AR; and Wheatly Pump and Valve Co, Tulsa, OK, Avionics Instruments, Inc, Avenel, NJ; BDM, Mclean, VA; SAIC, Tysons Corner, VA; VSE, Alexandria, VA.

(U) Related Activities:

PE #0601102A (Defense Research Sciences)
PE #0602705A (Electronics and Electronics Devices)
PE #0602786A (Logistics Technology)
PE #0603001A (Logistics Advanced Technology)
PE #0604804A (Logistics and Engineer Equipment Engineering Development)
Coordination to avoid duplication is accomplished with other Services and Agencies through the Department of Defense Joint Intermodular Steering Group Joint Committee on Tactical Shelters, Program Advisory Group for Bulk Petroleum Fuels Distribution, DOD Executive Agent for Land Based Water Resources, the Water Resources Management Action Group, Interagency Advance Power Group, and the DOD Project Manager for Mobile Electric Power.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603805A** Project Number: **#D091**

PE Title: **Combat Service Support Control System (CSSCS) Evaluation and Analysis** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Combat Service Support Control System

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
CSSCS	4796	832	11193	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Combat service support (CSS) functional data required by Commanders during combat operations must be automated to accommodate the growing complexity, speed, and lethality of modern warfare. CSS control centers must provide a rapid decision support capability and supportive information to the Commanders more quickly than is possible with the present manual systems. This program develops for the CSS battlefield functional area an automated capability to provide key command selected information to support the force Commander's decision process and enhance the capability to process and analyze data for internal CSS functional command and control. The CSSCS will share selected information with the remaining four battlefield functional areas of the Army Tactical Command and Control System (ATCCS) (maneuver control, air defense, fire support and intelligence/electronic warfare). The CSSCS must be available in the 1993 timeframe to coincide with the introduction of automation in all battlefield functional areas.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project D091 — Combat Service Support Control System:

(U) FY 1989 Accomplishments:

- **(U)** Completed PM staffing
- **(U)** Initial CSSCS capability demonstrated on surrogate hardware (HP-330)
- **(U)** Started refinement of CSSCS capabilities to provide the initial corps/division-level system

(U) FY 1990 Planned Program:

- **(U)** Milestone I/II Review
- **(U)** Develop Version 2 software package

(U) FY 1991 Planned Program:

- **(U)** Award full-scale development Contract
- **(U)** Design CSSCS Segment 3 software to provide ATCCS initial capabilities for operational readiness assessments, and sustainment planning to support combat operations
- **(U)** Enhance the operational division level prototypes at 1st Cavalry Division and the 9th Infantry Division to corps level prototypes (III Corps)
- **(U)** Complete integration of Maneuver Control System Segment 11 common Command and Control software into CSSCS processing architecture

D. (U) WORK PERFORMED BY: Contractors are TRW Inc., Carson, CA (Developer); and Teledyne Brown Engineering, Shrewsbury, NJ (Independent Verification and Validation); Engineering Professional Services, Shrewsbury, NJ/Springfield, VA (Acquisition Support Contractor). In-house developing organizations are: the US Army Information Systems Engineering Commands, Ft Huachuca, AZ; the US Army Logistics Center, Ft. Lee, VA; US Army Communications-Electronics Command, Ft Monmouth, NJ.

Program Element: **#0603805A** Project Number: **#D091**

PE Title: **Combat Service Support Control System (CSSCS) Evaluation and Analysis** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable
2. **(U) SCHEDULE CHANGES:** Not applicable
3. **(U) COST CHANGES:** As a result of direction received from the Chief of Staff of the Army, program has been restructured and funding has been substantially increased to address the increased program scope.

F. (U) PROGRAM DOCUMENTATION:

Mission Element Need Statement (MENS)	5/82
Required Operational Capability (ROC)	7/88
Operational and Organizational (O&O) Concept	7/88

G. (U) RELATED ACTIVITIES:

PE #0602783A (Computer and Software Technology)
PE #0604818A (Army Tactical C^3I Systems Engineering)
PE #0604779A (Joint Interoperability of Tactical Command and Control Systems (JINTACCS))
The Combat Service Support Computer System (CSSCS) is part of the overall Army Tactical Command and Control System (ATCCS) and is managed by the Program Executive Office Command and Control Systems (PEO-CCS) who ensures total system integrity and interoperability and that no unnecessary duplication exists.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Other Procurement, Army (W34600)	- 0 -	1025	- 0 -

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
Award Contract for Objective System	1QFY91
Initial Operational Test & Evaluation (IOTE)	3QFY93
Initial Operational Capability (IOC)	4QFY93
Milestone III	4QFY93

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603806A**

PE Title: **Chemical/Biological Defense Equipment Advanced Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D483 Radiac Equipment Advanced Development	2394	3247	4100	Cont	Cont
D601 Chemical Detection and Warning Concepts	3596	6903	10280	Cont	Cont
DE80 Chemical Biological Individual Protection Concepts	- 0 -	- 0 -	3021	Cont	Cont
DE81 Chemical Biological Decontamination Materiel Concepts	3169	8053	5443	Cont	Cont
DJ30 Nuclear, Biological, and Chemical Survivability	646	1494	1667	Cont	Cont
PE TOTAL	9805	19697	24511		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides for advanced development of radiological and chemical/biological/toxin agent detection and warning systems, individual and collective protection systems, decontamination systems, and provides a technical cell of expertise for nuclear, biological and chemical survivability criteria and assistance to major equipment development commands. Department of Defense (DOD) Directive 5160.5 designates the Army as Executive Agent for development of NBC defensive equipment. In FY 88, radiacs equipment efforts were accomplished in PE #0603604A.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D483 — Radiac Equipment Advanced Development: Provides for advanced development of personnel and equipment-mounted detection, monitoring and warning materiel for nuclear battlefield hazards.

(U) FY 1989 Accomplishments:

- **(U)** Pocket Radiac test and evaluation master plan (TEMP) approved
- **(U)** Pocket Radiac operational and organizational (O&O) plan approved
- **(U)** Initiated advanced development (AD) on Radiac Trainer

(U) FY 1990 Planned Program:

- **(U)** Complete design, and build Pocket Radiac test units
- **(U)** Complete Radiac Trainer AD
- **(U)** Conduct engineering design test and Milestone (MS) II in-process review (IPR) for Advanced Airborne Radiac

(U) FY 1991 Planned Program:

- **(U)** Initiate full-scale development (FSD) for Advanced Airborne Radiac
- **(U)** Pocket Radiac
  - Required operational capabilities (ROC) approved
  - Conduct MS II IPR
- **(U)** Initiate FSD for PDR-75 Trainer

Program Element: **#0603806A**

PE Title: **Chemical/Biological Defense Equipment Advanced Development** Budget Activity: **#4**

(U) Project DE80 — Chemical/Biological Individual Protection Concepts: This project provides for advanced development of new respiratory protection technology for soldiers. This is a new start.

(U) FY 1989 Accomplishments:

- **(U)** No planned program

(U) FY 1990 Planned Program:

- **(U)** No planned program

(U) FY 1991 Planned Program:

- **(U)** Initiate advanced development (AD) for new aircrew protective mask

(U) Project DE81 — Chemical/Biological Decontamination Materiel Concepts: Provides for advanced development of new, non-corrosive, and simplier to use, decontaminating solutions and systems for use on the contaminated battlefield.

(U) FY 1989 Accomplishments:

- **(U)** Built first prototype of the Nonaqueous Equipment Decontamination System (NAEDS) Fixed Site, XM19

(U) FY 1990 Planned Program:

- **(U)** Initiate technical test of two modules of Modular Decontamination System DS2 (Decontamination Solution Number 2) pumper-scrubber module and high-pressure washer module
- **(U)** XM19 Fixed Site NAEDS ROC/JSOR approved

(U) FY 1991 Planned Program:

- **(U)** Modular Decontamination System
  - Conduct concept evaluation program (CEP) of continuous mixer module
  - Complete technical test of DS2 pumper-scrubber and high-pressure washer module
  - Conduct user test (UT) of DS2 pumper scrubber module and high-pressure washer module
- **(U)** Nonaqueous Equipment Decontamination System (NAEDS) Fixed Site XM19
  - Initiate technical test

(U) Project DJ30 — Nuclear, Biological, and Chemical (NBC) Survivability: This project provides for design integration support in advanced development to numerous weapons systems to ensure NBC survivability concepts are adequately addressed in the development phase.

(U) FY 1989 Accomplishments:

- **(U)** NBC survivability support continued for the F-16 Hardening Steering Committee, Chemical Defense Advisory Group, Nuclear and Chemical Survivability Committee, the Howitzer Improvement Program, Nuclear/Chemical Survivability Committee Secretariat, and Light Helicopter Family Working Group

(U) FY 1990 Planned Program:

- **(U)** NBC survivability support will be provided to over fifty separate programs

(U) FY 1991 Planned Program:

- **(U)** NBC survivability support will be provided to over fifty separate programs

Program Element: #0603806A

PE Title: **Chemical/Biological Defense Equipment Advanced Development** Budget Activity: #4

(U) Work Performed By: The Project Manager for NBC Defense Systems, Aberdeen Proving Ground (APG), MD; Chemical Research, Development and Engineering Center, APG MD; Army Tank-Automotive Command, Warren, MI; Human Engineering Laboratory, APG, MD; and Electronic Warfare at CECOM, Ft Monmouth, NJ. Contractors include Brunswick, Delmarua, FL; TRW Defense Systems Group, Redondo, CA; Texas Instruments, Dallas, TX, Environmental Analytical Systems Inc., (EASI) Towson, MD; and General Atomics, San Diego, CA; SAIC LaJolla, CA; and Booz-Allen, NJ.

(U) Related Activities:

PE #0604806A (Chemical/Biological Defense Equipment Engineering Development); PE #0603604A (Nuclear Munitions AD)

To meet other Services' needs and to prevent unnecessary duplication of effort, execution of this program is coordinated through the Joint Chemical Warfare/Chemical/Biological Defense Research, Development and Acquisition Plan; Joint Services Radiac Working Group, Joint working and review groups; and periodic joint reviews of the Joint Chemical-Biological Research, Development, Test, and Evaluation Program.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0603806A
PE Title: **Chemical/Biological Defense Equipment Advanced Development**
Project Number: # D601
Budget Activity: #4

A. (U) RESOURCES: ($ in Thousands)

Project Title: Chemical Detection and Warning Concepts

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
NBC Reconnaisance, Detection, and Identification (RDI)	3596	6903	10280	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project is vital to the advanced development of new manned and unmanned Nuclear, Biological and Chemical (NBC) detectors and alarms that will greatly enhance the U.S. capability to detect, provide alarm, and identify threat agents on the battlefield. The project will provide for smaller, more dependable systems that will detect, locate, mark and identify contamination. The new systems will also evaluate the effectiveness of the decontamination of personnel and equipment. The development of long-range laser detectors for ground employment will greatly improve the U.S. capability to avoid contaminated areas and provide timely early warning of NBC attack.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Conducted engineering design test and completed advanced development for XM22 Automatic Chemical Agent Alarm (ACADA)
- **(U)** Updated acquisition strategy for Chemical Agent Detector Network (CADNET)

(U) FY 1990 Planned Program:

- **(U)** Initiate advanced development for Multi-Purpose Integrated Chemical Agent Detector (MICAD) Digital System
- **(U)** Conduct Milestone II for XM22 ACADA
- **(U)** Initiate engineering design tests on CADNET Alarm

(U) FY 1991 Planned Program:

- **(U)** System design review for MICAD Digital System
- **(U)** Complete engineering design test on CADNET Alarm

D. (U) WORK PERFORMED BY: The Project Manager for NBC Defense Systems, Aberdeen Proving Ground (APG), MD, US Army Chemical, Research, Development, and Engineering Center (CRDEC), APG, MD, Test and Evaluation Command (TECOM), APG, MD, and Night Vision Electro-Optics Lab (NVEOL), Fort Belvoir, VA. Contractor for Project D601 is currently Environmental Technology Group Inc. (ETGI); other contractors will be competitively selected.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None.
2. **(U) SCHEDULE CHANGES:** None.
3. **(U) COST CHANGES:** Funds were increased to incorporate production cost savings on XM22 Automatic Chemical Agent Alarm (ACADA).

Program Element: **#0603806A** Project Number: **# D601**

PE Title: **Chemical/Biological Defense Equipment Advanced Development** Budget Activity: **#4**

F. (U) PROGRAM DOCUMENTATION: Not Applicable.

G. (U) RELATED ACTIVITIES: Activities are coordinated through PE #0604806A/DO20, Chemical Detection and Warning Material, and PE #0602622A/A553, CB Defense Exploratory Development. No duplication of effort exists within the Army or DOD.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

1. **(U) PROCUREMENT:** Not Applicable.
2. **(U) MILITARY CONSTRUCTION:** Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
ACADA	
MS II	11/89
CADNET	
MS III/TC	TBD
MICAD	
MS I/II	3/92

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603807A**
PE Title: **Medical Systems-Advanced Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D3KL	Administration and Management — U.S. Army Medical Material Development Activity (USAMMDA)				
	544	- 0 -	- 0 -	—	—
D808	DOD Drug and Vaccine Advanced Development				
	3972	4484	5157	Cont	Cont
D809	Medical Biological Defense Drug and Vaccine — Advanced Development				
	4997	4857	5527	Cont	Cont
D836	Combat Medical Materiel Advanced Development				
	7828	4599	5184	Cont	Cont
D993	Medical Defense Against Chemical Threats — Advanced Development				
	13295	12939	12887	Cont	Cont
PE TOTAL	30636	26879	28755		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element (PE) addresses joint Service and Army-unique requirements for development of medical materiel necessary to field an effective capability for medical defense against chemical warfare agents. Products developed in this program will provide for maximum soldier survivability and enhanced sustainability of performance in an environment contaminated with chemical threats. This program also funds research on advanced development of systems for medical protection against naturally occurring diseases and potential biological threats. This includes development and initial human testing of vaccines, arthropod vector repellents, prophylactic and therapeutic drugs, rapid identification and diagnostic systems for disease/biological agents. Additionally, the program supports advanced development of field medical equipment essential for combat casualty care on a high intensity battlefield while reducing logistical support requirements. Systems include resuscitation, blood substitutes, field x-ray, and field production of medical grade water and oxygen.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project Project D3KL — Administration and Management: This project provided funds for overall administration and management of USAMMDA. Costs include pay, travel and general support of civilian management personnel and administrative support staff and contractors. These resources were transfered to Project D993, this PE, effective FY 1990 as a zero sum transfer. Project D3KL was formerly managed under PE #0603751A (Medical Defense Against Chemical Warfare).

(U) Project D808 — DOD Drug and Vaccine Advanced Development: Supports the formulation, advanced toxicology and initial clinical testing of drugs and bacterial, viral and parasitic vaccines that will protect U.S. forces against infectious diseases of military significance.

(U) FY 1989 Accomplishments:

- **(U)** Continued phase II clinical tests of Shigella vaccine
- **(U)** Completed phase I clinical testing of Dengue Type 4 vaccine
- **(U)** Initiated clinical tests of Adenovirus vectored hepatitis B and Vivax malaria vaccines and immune globulin and monoclonal antibody for septic shock
- **(U)** Completed preclinical toxicology on antimalarial drug WR238605

Program Element: **#0603807A**

PE Title: **Medical Systems-Advanced Development** Budget Activity: **#4**

(U) FY 1990 Planned Program:

- (U) Initiate phase II tests of Adenovirus vectored hepatitis B vaccine and immune globulin and monoclonal antibody for septic shock
- (U) Initiate clinical tests of antimalarial drug WR238605 and antileishmanial drug WR6026
- (U) Continue clinical tests of Shigella vaccine
- (U) Initiate user test of Schistosome topical antipenetrant

(U) FY 1991 Planned Program:

- (U) Complete phase II clinical safety tests of compound WR 6026 and Adenovirus vectored hepatitis B vaccine
- (U) Complete preclinical tests of Qinghaosu (an anti-malarial drug)
- (U) This is a continuing program

(U) Project D809 — Medical Biological Defense Drug and Vaccine — Advanced Development: Supports development of a battlefield system for rapid identification and diagnostic systems and advanced development of vaccines, drugs, and immune enhancers effective in preventing or treating effects of biological agents.

(U) FY 1989 Accomplishments:

- (U) Continued Phase I clinical testing of Chickungunya vaccine
- (U) Continued phase I clinical testing of Tularemia vaccine
- (U) Evaluated non-developmental item (NDI) approach to biological warfare (BW) agent Rapid Identification System

(U) FY 1990 Planned Program:

- (U) Complete phase II testing of Chickungunya vaccine
- (U) Initiate preclinical testing of F & G botulinal toxoids
- (U) Initiate phase I testing of irradiated Q fever chloroform-methanol residue (CMR) vaccine
- (U) Transition general toxin antidote (highly activated charcoal-HAVC) to procurement

(U) FY 1991 Planned Program:

- (U) Complete preclinical testing of Type F & G botulinal toxoids
- (U) Complete phase I testing of Tularemia and irradiated Q fever CMR vaccines
- (U) Initiate user test of Rapid Identification System
- (U) This is a continuing program

(U) Project D836 — Combat Medical Materiel Advanced Development: Supports advanced development of new and improved systems essential for battlefield casualty care and return to duty.

(U) FY 1989 Accomplishments:

- (U) Initiated packaging studies for morphine injector
- (U) Continued development of Resuscitative Fluids Production System (REFLUPS)
- (U) Completed testing of UH-60 medical evacuation hoist
- (U) Completed efficacy studies on hypertonic saline Dextran blood expander

(U) FY 1990 Planned Program:

- (U) Initiate clinical testing of Field Computed Tomography (CT) Scanner
- (U) Continue user testing of antimicrobial dermal dressing
- (U) File new drug application (NDA) for a blood expander (Hypertonic Saline Dextran)
- (U) Initiate phase I testing of stroma-free hemoglobin blood substitute

Program Element: **#0603807A**
PE Title: **Medical Systems-Advanced Development** Budget Activity: **#4**

(U) FY 1991 Planned Program:

- **(U)** *Continue phase I testing of stroma-free hemoglobin blood substitute*
- **(U)** Initiate phase I testing of microencapsulated antibiotics
- **(U)** Initiate user testing of Field Computed Tomography (CT) Scanner

(U) Work Performed By: D3KL — Supports program administration and management activities for multiple development projects within this and other program elements at USAMMDA, FT Detrick, MD. These resources were transferred to Project D993, this PE, effective FY 1990 as a zero sum transfer.

D808 — Work is performed in-house by Walter Reed Army Institute of Research, Washington, DC, and its field units in Thailand, Malaysia, Kenya, and Brazil; Letterman Army Institute of Research, San Francisco, CA; U.S. Army Medical Materiel Development Activity, Fort Detrick, MD; and Naval Medical Research and Development Command, Bethesda, MD. Primary civilian contractors: Hazelton Laboratories, Rockville MD; Engineering and Economics Research Inc., Germantown, MD; Johns Hopkins University Hospital, Baltimore, MD; University of Illinois, Chicago, IL; and University of Kansas Medical Center, Kansas City, KA.

D809 — Work is performed in-house by U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, MD; Walter Reed Army Institute of Research, Washington, DC; and U.S. Army Medical Materiel Development Activity, Fort Detrick, MD. Primary civilian contractors: Porton Products, International, Washington, D.C.; Columbia University, New York, NY; and Salk Institute, San Diego, CA.

D836 — Work is performed in-house by U.S. Army Medical Materiel Development Activity, Fort Detrick, MD; U.S. Army Bioengineering Research and Development Laboratory, Fort Detrick, MD; U.S. Army Institute of Dental Research, Washington, DC; Letterman Army Institute of Research, San Francisco, CA; and National Institute of Standards and Technology, Gaithersburg, MD. Primary civilian contractors: American Optical Corporation, Southbridge, MA; Travenol Laboratories, Deerfield IL; and Imatron Inc., San Francisco CA.

(U) Related Activities: D3KL supports administration and management of all development efforts at USAMMDA, including medical materiel required for defense against infectious disease and biological warfare agents, health hazards of Army systems, and care of combat casualties. These resources were transferred to Project D993, this PE, effective FY 1990 as a zero sum transfer.
Program Element #0601102A, Defense Research Sciences
Program Element #0602787A, Medical Technology, Projects
Program Element #0603002A, Medical Advanced Technology
Program Element #0604807A, Medical Materiel/Medical Defense Equipment-ED

There is no unnecessary duplication of efforts in Army or DoD programs. This effort is coordinated with the following agencies annually, or more frequently as required: Department of Defense, Office of the Deputy Under Secretary of Defense for Research and Advanced Technology-All Joint Technology Coordinating Groups of the Armed Services Biomedical Research Evaluation and Management Committee- Joint Services Container Steering Group-DOD Executive Agent for Land-Based Water Resources- Program Advisory Group for Bulk Petroleum Fuels Distribution-World Health Organization-Pan American Health Organization

(U) Other Appropriation Funds: ($ in Thousands) Procurement of transitioned products is provided for in Other Procurement Army 5310 or Operation and Maintenance Army 202x17, or passed to other procuring agencies as appropriate.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603807A** Project Number: **#D993**
PE Title: **Medical Systems-Advanced Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Medical Defense Against Chemical Threats—Advanced Development

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
	13295	12939	12887	Cont	Cont

Project D993 was formerly managed under PE #0603751A (Medical Defense Against Chemical Warfare).

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Use of chemical agents by adversaries would have an immense adverse impact on individual survivability and operational capabilities of U.S. troops on the integrated battlefield. A system of medical defense against chemical agents is required to provide individual soldiers protection, sustain individual performance in a chemical environment and provide for self-aid/buddy-aid and medical treatment of chemical casualties. This project, which addresses joint Service and Army-unique requirements, provides advanced development of countermeasures for chemical agents, including life support equipment, pretreatment and therapeutic drugs, and individual/casualty decontamination compounds.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Initiated testing of Powered Ventilator
- (U) Continued testing of Individual Chemical Resuscitator
- (U) Transitioned nerve agent consultant antidote to full-scale development (FSD)
- (U) Continued testing of Vital Signs Monitor

(U) FY 1990 Planned Program:

- (U) Initiate user testing of Life Detector
- (U) Complete user testing of Vital Signs Monitor
- (U) Continue testing of the Nerve Agent Convulsant Antidote
- (U) File new drug application for Medical Aerosolized Nerve Agent Antidote
- (U) Initiate work on 2nd generation nerve agent antidote

(U) FY 1991 Planned Program:

- (U) Initiate development of second generation nerve agent antidote and pretreatment
- (U) Initiate development of pretreatment for cyanide intoxication.
- (U) Complete advanced development of Life Detector

D. (U) WORK PERFORMED BY: Work is performed in-house by the following organizations: U.S. Army Medical Materiel Development Activity, Fort Detrick, MD; U.S. Army Bioengineering Research and Development Laboratory, Fort Detrick, MD; Walter Reed Army Institute of Research, Washington, DC; Letterman Army Institute of Research, San Francisco, CA; U.S. Army Research Institute of Environmental Medicine, Natick, MA; Uniformed Services University of Health Sciences, Bethesda, MD; Wright-Patterson AFB, Dayton, OH. Major contractors include: Battelle Columbus Laboratories, Columbus, OH; Riker Labs, St. Paul, MN; SRI International, Menlo Park, CA.

Program Element: **#0603807A** Project Number: **#D993**
PE Title: **Medical Systems-Advanced Development** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Transdermal Nerve Agent Pretreatment was terminated due to adverse reactions identified in safety testing. Alternative efforts are underway to increase duration of action of oral sustained release formulation.
2. **(U) SCHEDULE CHANGES:** Anticyanide pretreatment was not transitioned to development as planned, but was retained in the technology base for additional feasibility testing and comparison with alternative drug candidates.
3. **(U) COST CHANGES:** Funding reductions are a result of decreased Army TOA and funding of other higher priority programs. These funding reductions will result in program delays and system curtailment. The impact will be constrained by termination of transdermal nerve agent pretreatment, technical delays in the anticyanide program and decisions to slow or curtail other development efforts. Development of topical skin protectants has been postponed until the mid-1990's. Overall capabilities in medical chemical defense will be diminished, especially those contributing to enhanced force sustainability, rather than reduction of individual lethality.

F. (U) PROGRAM DOCUMENTATION:

O&O Plan for a Family of Chemical Agent Pretreatment Compounds	11/86
O&O Plan for a Family of Chemical Agent Antidotes	11/86
LOA Advanced Life Detector	01/83
JSOR, Nerve Agent Pretreatment, Pyridostigmine	05/87
LOA, NBC Casualty Vital Signs Monitor	01/83
JSOR, Multichambered Autoinjector	11/88
JSOR, Powered Ventilator	03/87
ROC, CWA Resuscitator	05/87
DJSOR, Aerosolized Nerve Agent Antidote	5/89
JSOR, Nerve Agent Anticonvulsant	11/88
JSOR, Vesicant Antidotes	11/88
DJSOR, CWA Resistant Battle Dressing Cover	01/87
JSOR, Life Detector	08/88
DJSOR, NBC Casualty Vital Signs Monitor	08/88
DROC, Resuscitation Device	08/89

G. (U) RELATED ACTIVITIES:

- PE #0601102A, Defense Research Sciences, Project BS11
- PE #0602787A, Medical Technology, Project A875
- PE #0603002A, Medical Advanced Technology, Project D995
- PE #0604807A, Medical Materiel/Medical Biological Defense Equipment -Engineering Development, Project D848
- There is no unnecessary duplication of efforts in Army or DOD programs. Duplication of effort within the Army is avoided through centralized management of the Medical Chemical Defense Program at U.S. Army Medical Research and Development Command. Inter-service duplication is avoided by continuing joint service coordination, collaboration and liaison. Army, as executive agent for DOD Medical Chemical Defense, executes formal coordination by Joint Service Agreement, a Memorandum of Agreement with Air Force, and Joint Technology Coordinating Group of the Armed Services Biomedical Research Evaluation and Management Committee. Research efforts are also coordinated with Quadripartite and NATO nations through meetings and data exchanges.

Program Element: **#0603807A** Project Number: **#D993**
PE Title: **Medical Systems-Advanced Development** Budget Activity: **#4**

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Procurement of transitioned products is funded through Other Procurement Army 5310 or Operation and Maintenance Army 202x17, or passed to other procuring agencies, as appropriate.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
Milestone IB IPR for Multi-chambered Autoinjector	4Q FY 1990
Milestone II/III IPR for Aerosolized Nerve Agent Antidote	2Q FY 1990*
Milestone II/III IPR for Sustained Release Oral Nerve Agent Pretreatment	4Q FY 1990*
Milestone III IPR for Skin Decontamination Kit	1Q FY 1990
Milestone II IPR for Individual Chemical Resuscitator	2Q FY 1990
Milestone II IPR for Life Detector	4Q FY 1990
Milestone III for Convulsant Antidote Nerve Agent	4Q FY 1990**
Milestone II IPR for Powered Ventilator	2Q FY 1990

* Respond to FDA requirement for additional study.
** Delay in JSOR approval.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0603810A** Project Number: **#DE15**
PE Title: **Advanced Missile System-Heavy** Budget Activity: **#4**
Project Title: **Advanced Missile System-Heavy (AMS-H)**

NO PICTURE AVAILABLE

POPULAR NAME: **AMS-H**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			MDR I/II 8/90		
Engineering Milestones			SCDR 3/90		
T&E Milestones					
Contract Milestones		Tech Demo Award 3/89	Complete Demo 9/90		
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		8000	5100	- 0 -	13100 (0)
Support Contract		1848	193	- 0 -	2041 (0)
In-House Support		814	5609	513	6936 (0)
GFE/ Other		20	1900	500	2420 (0)
Total		10682	12802	1013	24497 (0)

Program Element: **#0603810A** Project Number: **#DE15**
PE Title: **Advanced Missile System-Heavy** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The current and projected armor threat and operational concept envisioned for fighting the antiarmor battle requires an effective, extended range, vehicular mounted, heavy antitank capability for the infantry. The AMS-H will be capable of operating out to maximum range of direct fire and will perform under day/night adverse weather conditions, and obscurants. The AMS-H program will develop a replacement missile for the TOW on the Bradley Fighting Vehicle, High Mobility Multi-purpose Wheeled Vehicle and Cobra platforms. AMS-H will be countermeasured hardened to perform effectively in a dirty battlefield environment. AMS-H will incorporate growth potential to defeat the evolving Soviet armor threat. This program element will conduct a technical demonstration of an imaging infrared seeker. This fire & forget technology is a candidate technology for employment in the engineering development phase of AMS-H.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- **(U)** Cost plus incentive fee contracts awarded to Hughes Aircraft Company and Texas Instruments, Inc for the AMS-H Demo

(U) FY 1990 Planned Program:
- **(U)** Conduct ground and captive flight tests
- **(U)** Conduct dirty battlefield tests

(U) FY 1991 Planned Program:
- **(U)** Complete dirty battlefield test
- **(U)** Complete government analysis of test data

D. (U) WORK PERFORMED BY: In-house efforts performed by Advanced Anti-Tank Weapons Systems (AAWS) Project Office, Program Executive Office-Fire Support, Redstone Arsenal, AL. Contractors are Hughes Aircraft Company and Texas Instruments, Inc.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None
2. **(U) SCHEDULE CHANGES:** None
3. **(U) COST CHANGES:** None

F. (U) PROGRAM DOCUMENTATION:

Letter of Agreement	11/85
AAWS-H Program Decision Memorandum	8/86
Special IPR	12/87
AAWS-H-HQDA Program Review	8/88
Organizational and Operational Plan	1/89

G. (U) RELATED ACTIVITIES:
- Program Element #0604610A (Advanced Antitank Weapon System-Medium)
- Program Element #0603757A (Forward Area Air Defense System)
- Program Element #0602303A (Rocket & Missile Technology)
- Program Element #0603313A (Hypervelocity Missile)
- Program Element #0604310A (Ground Launched HELLFIRE)
- Program Element #0603321A (Missile Counter-Countermeasure Technology)
- Program Element #0602120A (Electronic Survivability and Fuzing Technology)

Program Element: **#0603810A** Project Number: **#DE15**
PE Title: **Advanced Missile System-Heavy** Budget Activity: **#4**

- Program Element #0602624A (Weapons and Munitions Technology)
- Program Element #0602709A (Night Vision and Electro-Optics Technology)
- Program Element #0603710A (Night Vision, Combat Vehicles)
- Program Element #0604819A (Advanced Antitank Weapon System-Heavy)
- Program Element #0203802A (TOW Product Improvement Program-TOW 2B Project: #D336)

There is no unnecessary duplication of effort within the Army or other Services/Agencies within the Department of Defense. This is assured by continuous coordination with other Services and Agencies and oversight of the program by the OSD-level Conventional Systems Committee.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) TEST AND EVALUATION DATA: The AMS-H test program will begin in the 4Q FY90 for technology demonstration phase.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604202A**
PE Title: **Aircraft Weapons** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D132 Air Self Defense	7077	9446	7607	2074	69000

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element funds the integration and qualification of a generic air-to-air missile system (using the STINGER missile) onto the AH-64 and AH-1 helicopters. The system provides aircrews with an urgently needed air-to-air, self-defense capability to defeat current fielded threats and projected near term threat improvements.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D132 — Air Self Defense:

(U) FY 1989 Accomplishments:

- **(U)** Awarded integration and qualification testing contract for Air-to-Air STINGER (ATAS) on the AH-1F helicopter to accomodate added requirement for seeker slaving multi-missile growth capability
- **(U)** Continued integration and qualification testing of ATAS on the AH-64 helicopter to accommodate added requirement for seeker slaving multi-missile growth capability

(U) FY 1990 Planned Program:

- **(U)** Award Multiple Integrated Laser Engagement System (MILES) ATAS development contract
- **(U)** Continue the integration and qualification testing of ATAS on the AH-64 and AH-1F helicopters

(U) FY 1991 Planned Program:

- **(U)** Continue the integration and qualification testing of ATAS on the AH-64 and AH-1F helicopters
- **(U)** Continue MILES/ATAS development

(U) Work Performed By: The prime contractors for the ATAS system are General Dynamics, Pomona, CA and Bell Helicopter Textron, Ft. Worth, TX. McDonnell Douglas Helicopter Company, St Louis, MO is prime for integration of ATAS on the AH-64. The contract for integration of ATAS on the AH-1F is American Electronics Laboratories (AEL), Lansdale, PA. The leads for Army in-house efforts are the Aviation, Program Executive Office (PEO) at the US Army Aviation Systems Command (AVSCOM), St Louis, MO; the US Army Test and Evaluation Command (TECOM), Aberdeen, MD; and the US Army Missile Command, Huntsville, AL.

(U) Related Activities: Close liaison is maintained with other Services and industry to avoid duplication of effort. The Army participated in the Tri-Service Joint Technical Coordinating Group for Air-Launched Non-Nuclear Ordnance, through which technical information is exchanged. Related program elements are #0602211A (Aviation Technology), #0603003A (Aviation Advanced Technology), and #0604315F (Advanced Short Range Air-to-Air Missile (ASRAAM)).

Program Element: **#0604202A**

PE Title: **Aircraft Weapons** Budget Activity: **#4**

(U) Other Appropriation Funds: (S in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Aircraft Procurement, Army*			
OH-58 Kits (AA0400)	17332	22959	24695
AH-64 Kits (AA6605)	2211	20745	85687

*Funding shown includes only the amount actually associated with this program element.

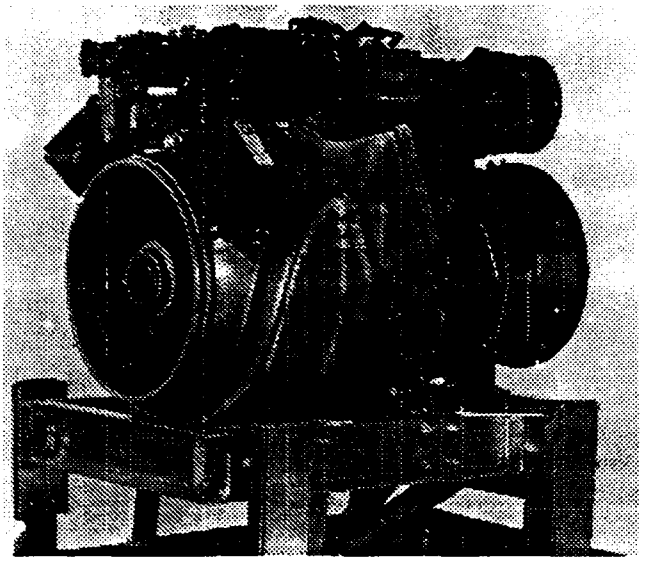
(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604216A** Project Number: **DC72**

PE Title: **Aircraft Propulsion Systems** Budget Activity: **#4**

Project Title: **T-800 Engine Engineering Development (LHX)**



POPULAR NAME: **T800 Engine**

A. (U) SCHEDULE/BUDGET INFORMATION: (S In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones				MS II Dec 90	MS IIIA 1 Qtr 95
Engineering Milestones		Start Qual Test (QT) Effort	Qual Tests	Qual Test Complete	Air Vehicle Support
T&E Milestones					EUTE 1Qtr 95 IOTE 4Qtr 96
Contract Milestones		Downselect One Team	Continue FSD with Winning Team		Complete FSD 4Qtr 96
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		47023	43733	34363	523700 (136781)
Support Contract		1200	1814	5873	17520 (2233)
In-House Support		2600	5369	13466	70080 (23045)
GFE/ Other					
Total		50823	50916	53702	611300 (162059)

Program Element: **#0604216A** Project Number: **DC72**
PE Title: **Aircraft Propulsion Systems** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project includes tasks to design, develop and qualify an advanced technology engine. The engine development project is designed to provide a reliable, maintainable, and fuel efficient engine in the 900 Kilowatt (1200 horsepower) class required for the Army's new Light Helicopter (LHX) and other applications. The Government's requirement allows industry the maximum latitude in design. This competitive development precedes the LHX program to provide a qualified engine for initial LHX prototype test and evaluation. The T800 engine will employ the latest state-of-the-art technology to reduce fuel consumption, reduce weight and improve reliability and maintainability relative to existing engines. These improvements are required to achieve the LHX performance and weight goals with an allowance for system growth. Following preliminary flight rating tests, LHTEC was selected to continue development and mature the engine to full qualification. Threat, operational requirements and performance parameters are identified with the LHX aircraft system (see PE #0604223A, D327 LHX Air Vehicle).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project DC72 — T-800 Engine Engineering Development (LHX)

(U) FY 1989 Accomplishments:

- (U) Conducted source selection evaluation activities to select winning team to continue engine development: Light Helicopter Turbine Engine Co., St. Louis, MO selected
- (U) Continued development and testing of winning design toward full qualification (QT)
- (U) Production planning continued
- (U) Continued development of training courseware
- (U) Engine control software development continued
- (U) Started database for reliability growth curves

(U) FY 1990 Planned Program:

- (U) Continue full qualification testing
- (U) Conduct demonstration for QT configuration engine
- (U) Initiate reliability, availability, and maintainability (RAM) durability tests
- (U) Continue monitoring of engine
- (U) Progress against contractual requirements

(U) FY 1991 Planned Program:

- (U) Initiate air vehicle support program
- (U) Complete qualification of T800 engine
- (U) Conduct reviews of engine progress against contract requirements
- (U) Implement engine pre-production effort
- (U) Delivery of flight test engines to LHX contractors
- (U) Initiate maintainability demonstration IIA effort

(U) Program Plan to Completion:

- (U) Delivery of flight test engines to LHX contractors
- (U) Award long-lead material contract for production
- (U) Install LHX T800 engine in prototype LHX air vehicle
- (U) Award of first T800 production contract
- (U) Initiate life verification test program

Program Element: **#0604216A** Project Number: **DC72**
PE Title: **Aircraft Propulsion Systems** Budget Activity: **#4**

D. (U) WORK PERFORMED BY: The major contractor is Light Helicopter Turbine Engine Co., St Louis, MO.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None
2. **(U) SCHEDULE CHANGES:** None
3. **(U) COST CHANGES:** None

F. (U) PROGRAM DOCUMENTATION: See PE #0604223A, Project D327 (LHX Air Vehicle)

G. (U) RELATED ACTIVITIES: Program Element #0604223A (LHX Air Vehicle)
There is no unnecessary duplication of effort within the Army or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: (S in Thousands) Production contract scheduled for award in FY93

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) TEST AND EVALUATION DATA: RAM validation will be a part of the production phase.

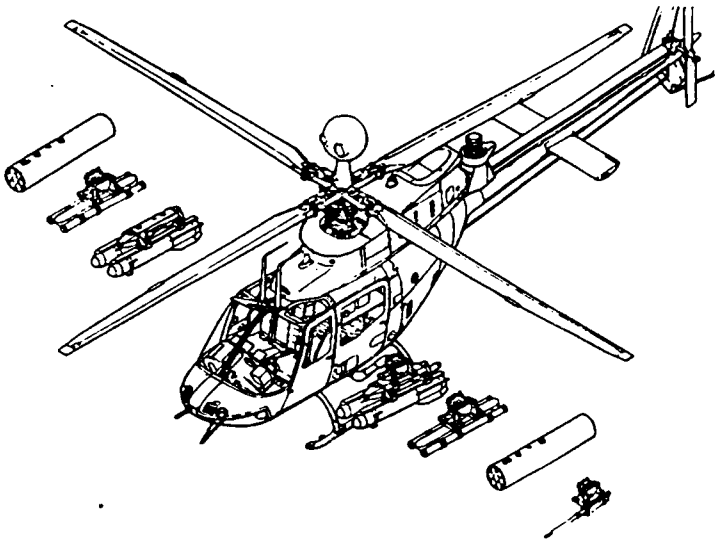
FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604220A** Project Number: **# D518**

PE Title: **Armed Army Helicopter Improvement Program (AHIP)** Budget Activity: **#4**

Project Title: **Weapon Systems Integration and Development**

POPULAR NAME: **Armed AHIP**



A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		Milestone V ASARC-Aug 89	N/A	N/A	N/A
Engineering Milestones	AHIP PMO tasked to modify and field 15 armed OH-58Ds in Aug 87. First Special Mission AHIP delivered to Ft. Bragg in Dec 87.				
T&E Milestones		N/A	N/A	N/A	Force Development Test & EvaluationNov 91
Contract Milestones		N/A	N/A	Development Award-Nov 90	N/A
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		N/A	N/A	24870	31155 (6285)
Support Contract		N/A	N/A	N/A	N/A
In-House Support		N/A	N/A	534	971 (437)
GFE/ Other		N/A	N/A	413	556 (143)
Total		N/A	N/A	25817	32682 (6865)

Program Element: #0604220A
PE Title: **Armed Army Helicopter Improvement Program (AHIP)**
Project Number: # D518
Budget Activity: #4

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project provides for the integration and testing required for the addition of weapons systems to the OH-58D (AHIP). Air-to-Air STINGER (ATAS) has been a program requirement from the initiation of AHIP, to provide a self-defense capability against airborne threats. An air-to-ground (ATG) weapons capability, to include HELLFIRE, Hydra 70 rockets and a .50-caliber machine gun, will allow the OH-58D to provide self-defense against ground threats and to service urgent targets in its projected armed reconnaissance role. A fully armed OH-58D will provide forward deployed air cavalry reconnaissance units and certain rapid deployment units with the ability to see, fight and survive at night. This addresses a current battlefield deficiency in the near term until the fielding of LHX in sufficient quantities. This project is a new start for FY91.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- (U) Milestone V ASARC conducted

(U) FY 1990 Planned Program: N/A

(U) FY 1991 Planned Program:
- (U) Development award, Nov 90

(U) Program Plan to Completion:
- (U) Development test, Nov 91
- (U) First unit equipped, Jun 92

D. (U) WORK PERFORMED BY: Bell Helicopter Textron, Incorporated, Fort Worth, Texas

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** N/A
2. **(U) SCHEDULE CHANGES:** N/A
3. **(U) COST CHANGES:** N/A

F. (U) PROGRAM DOCUMENTATION:

Decision Coordinating Paper	8/89
Test and Evaluation Master Plan	8/89

G. (U) RELATED ACTIVITIES: N/A

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
1. **Aircraft Procurement, Army:** AZ2200			47993
2. **MILITARY CONSTRUCTION:**			727

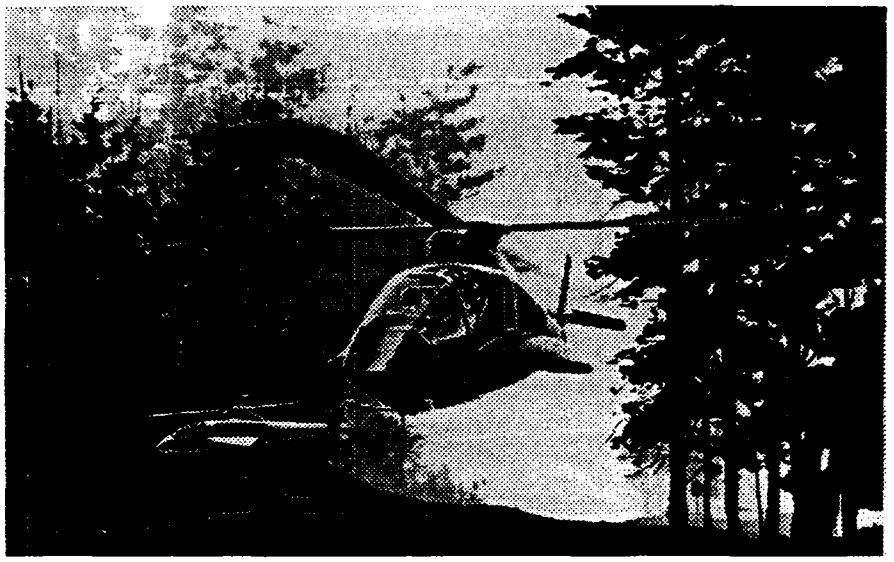
I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: N/A

J. (U) TEST AND EVALUATION DATA: Special mission flight and weapon testing for prime chance aircraft was done in Sept 87. Developmental testing will begin in Nov 91 and continue into FY 92.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604223A**
PE Title: **Light Armed Scout Helicopter**
Project Title: **LHX Air Vehicle and Mission**

Project Number: **D327**
Budget Activity: **#4**



POPULAR NAME: **LHX**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones				MS II 12/90	MS IIIA 1Q95
Engineering Milestones					First Flight 4Q93
T&E Milestones					EUTE 1Q95 IOTE 4Q96
Contract Milestones		DEM/VAL 10/88		FSD 12/90	Complete FSD 4Q96
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		115836	204226	391002	2917600 (2206536)
Support Contract		3858	7325	11222	68950 (46545)
In-House Support		6714	11721	9133	128050 (100482)
GFE/ Other					
Total		126408	223272	411357	3114600 (2353563)

Program Element: **#0604223A** Project Number: **D327**
PE Title: **Light Armed Scout Helicopter** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project provides for the development of the LHX helicopter. The LHX will replace the current light fleet of tactically obsolescent helicopters (AH-1, OH-6, and OH-58). The project will provide leap ahead combat lethality and battlefield survivability to defeat the threat of the mid-1990's and to modernize 100 percent of the Army's light attack/scout fleet. LHX will be integrated within the force structure to complement the AH-64 attack helicopter. LHX design requires a 7,500 pound empty weight aircraft and unit flyaway cost of $7.5 million (FY 1988 dollars). The LHX will correct major light fleet deficiencies — marginal night and adverse weather capability; capability to fly in high altitude and hot temperature environments; position location/navigation accuracy; inability to self -deploy to overseas theaters of operations; and inadequate reliability, performance, and survivability. LHX improvements include: lightweight composite airframe structures for enhanced power to weight ratios that provide increased agility, maneuverability, increased speed and excellent high altitude/hot day performance; advanced technology target acquisition and night vision sensors which allow greater standoff range and shorter exposure time to the threat as well as effective night/adverse weather operations; the Tri-Service common avionics architecture, compatible with the Navy Advanced Tactical Aircraft and Air Force Advanced Tactical Fighter; and built-in diagnostics/prognostics. The planned LHX characteristics have been addressed through design and demonstration during the Advanced Rotorcraft Technology Integration (ARTI) (PE #0603220A) program, associated government technical base programs, and industry-funded efforts. The competitive LHX demonstration/validation (DEM/VAL) phase will provide for essential system level application, and demonstration of these technologies to the Army's LHX. Specific objectives are to finalize system requirements and reduce technical, supportability, producibility, cost, and schedule risk for the follow-on full scale development (FSD) phase.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- (U) Awarded two competitive DEM/VAL contracts
- (U) Conducted systems requirements reviews
- (U) Completed preliminary design of mission equipment package (MEP) and tri-service architecture
- (U) Brassboard/breadboard laboratory demonstrations of MEP conducted
- (U) Preliminary design of air vehicle completed
- (U) Initiated wind tunnel testing

(U) FY 1990 Planned Program:
- (U) Continue design of aircraft subsystems and MEP
- (U) Issue Request for Proposal (RFP) for FSD
- (U) Complete DEM/VAL program

(U) FY 1991 Planned Program:
- (U) Award FSD contract to one contractor team
- (U) Initiate fabrication of LHX prototype aircraft
- (U) Initiate component and subsystem qualification test program
- (U) Conduct system design reviews
- (U) Aircraft MEP and integrated training system (ITS) development continues

(U) Program Plan to Completion:
- (U) Conduct first flight of LHX prototype aircraft (4QFY93)
- (U) Delivery of six LHX prototype aircraft (2QFY94)
- (U) Conduct flight qualification testing (1QFY96)
- (U) Long-lead award for LHX and ITS (1QFY94)

Program Element: **#0604223A** Project Number: **D327**
PE Title: **Light Armed Scout Helicopter** Budget Activity: **#4**

- **(U)** Production contract award (1QFY95)
- **(U)** Developmental testing/early user test and evaluation (1QFY95)
- **(U)** Initial operational test and evaluation (4QFY96)
- **(U)** First delivery (2QFY96)
- **(U)** First unit equipped (1QFY97)

D. (U) WORK PERFORMED BY: The major contractors are: McDonnell Douglas Aircraft Co./McDonnell Douglas Helicopter Co./Bell Helicopter Textron Inc., Mesa, AZ; Boeing Helicopter/Sikorsky Aircraft Co., Philadelphia, PA

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY: No change

1. **(U) TECHNICAL CHANGES:** None.
2. **(U) SCHEDULE CHANGES:** None.
3. **(U) COST CHANGES:** None.

F. (U) PROGRAM DOCUMENTATION: System Concept Paper, Test and Evaluation Master Plan, Integrated Logistics Support Plan, Cost and Operational Effectiveness Analysis, Independent Cost Estimate, Common Use Alternative Statement.

G. (U) RELATED ACTIVITIES:

- Program Element #0604216A (Aircraft Propulsion Systems (T-800 engine))
- Program Element #0603776A (LONGBOW Weapons System)
- Program Element #0203744A (Aircraft Modifications/Product Improvement Programs)
- Joint Integrated Avionics Working Group (JIAWG) for coordinating activities with the Navy and Air Force
- There is no unnecessary duplication of effort within the Army or Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Production contract scheduled for award in FY95

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) TEST AND EVALUATION DATA: RAM validation will be a part of the production phase.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0604270A
PE Title: **Electronic Warfare Development** Budget Activity: #4

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program encompasses advanced and engineering development (AD/ED) for tactical Electronic Warfare (EW), Aircraft Survivability Equipment (ASE), and Battlefield Deception. EW Vulnerability Projects, D234, D267, and D626 were previously covered under this PE in the FY 1988-1989 Descriptive Summary but are included under PE #0605604A since the FY 1990-1991 Summaries. Electronic Warfare (EW) encompasses the development of tactical EW equipment and systems mounted in both ground vehicles and aircraft. The capability to employ effective electronic countermeasures (ECM) is critical for success in a future land battle since the enemy can be expected to have weapons generally as effective as our own. The systems under this program provide the Army with the capability to degrade or deny hostile forces the effective use of their communications, countermortar/counterbattery radars, surveillance radars and infrared/optical battlefield surveillance systems. Existing Army EW systems must be replaced or upgraded to maintain their capability in the face of threat technical advancements. The EW systems and equipment developed under this program element are for use by brigade, division, corps and higher commanders. Aircraft Survivability Equipment (ASE) efforts provide for the development and system integration of survivability equipment to meet tactical and Special Electronic Mission Aircraft (SEMA) requirements. Equipment developed will increase combat effectiveness and potential for mission accomplishment by reducing or eliminating the ability of threat air defense systems to detect, hit, damage, or destroy Army aircraft. These threat systems include infrared, radar, laser, and optical/electro-optical capabilities. Projects in development include new or upgrading systems to counter mono-pulse, millimeterwave, frequency agile, pulse doppler, and continuous wave radars; passive infrared missile seekers; and laser directed weapon systems. This program responds to user requirements based on documented threats for both current and development Army aircraft. Battlefield deception encompasses efforts to provide the friendly force commander the ability to hide his forces and to portray false targets to threat weapons, targeting and intelligence systems. A multispectral approach using physical decoys, electromagnetic signals, etc., will be used to portray the deception. These false targets will disrupt the threats, timing and synchronization of command and control on the battlefield and will help create windows of opportunity for friendly forces to continue or regain momentum. Non-Communications Electronic Countermeasures Advanced Development, DK13 will be terminated in FY 1989. Within this PE in FY 1989, threat materiel may be acquired and exploited to support development. In FY 1990 and FY 1991 threat materiel acquisition/exploition has been programed in PE #0605709A/DC28 and will be executed upon authorization/appropriation.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) FY 1989 Accomplishments:

- **(U)** Continued risk reduction efforts for sensor and laser
- **(U)** Developed interface control documentation for host vehicles

(U) FY 1990 Planned Program: No Funded Program

(U) FY 1991 Planned Program: No Funded Program

(U) Project D611 — Tactical Deception Army-Wide: The Battlefield Deception program includes development of multispectral physical communications and electronics deception devices. Physical devices are decoys that replicate the visual, thermal, and passive radar signatures of military operations and equipment. Communications deception devices replicate radio communications of U.S. and opposing forces. Electronics deception devices replicate active radar signatures of U.S. equipment. This equipment is used to disrupt the enemy's concentration of fires and mislead his intelligence system, forcing the enemy commander to make bad battlefield decisions and lose or fail to regain momentum.

Program Element: #0604270A
PE Title: **Electronic Warfare Development** Budget Activity: #4

(U) FY 1989 Accomplishments:
- (U) Continued full-scale development of Multispectral Close Combat Decoys (MCCD); conducted technical tests
- (U) Continued full-scale development of Communications Deception System (CDS); completed preliminary design of hardware and software

(U) FY 1990 Planned Program:
- (U) Complete MCCD production prove-out tests, conduct initial operational test, and type classify standard

(U) FY 1991 Planned Program:
- (U) Complete proto type fabrication of CDS for engineering tests
- (U) Conduct critical design review of hardware and software for CDS
- (U) Begin fielding MCCD objective systems

(U) FY 1989 Accomplishments:
- (U) Initiated design and prototype fabrication of the host interface unit (HIU) to integrate the EPLRS and Intelligence and Electronic Warfare (IEW) systems
- (U) Initial logistics, automatic test equipment, and MANPRINT requirements developed

(U) FY 1990 Planned Program:
- (U) Complete advanced development of the EPLRS interface unit and initiate integration into IEW systems

(U) FY 1991 Planned Program:
- (U) Continue integration of HIU into IEW systems

(U) FY 1989 Accomplishments:
- (U) Phase II TACJAM-A effort awarded
- (U) Completed development and testing of the TACJAM Maintenance Trainer
- (U) Initiated and awarded electronic support measures (ESM) enhancements for common hardware and software modules for TACJAM-A, a joint program with the Tactical Cryptologic Program, PE 0305885G
- (U) Initiated electronic counter measures (ECM) enhancements for common hardware and software modules for TACJAM-A
- (U) Initiated design and fabrication of TACJAM-A ESM subsystem prototype
- (U) Logistics, and MANPRINT requirements for TACJAM-A ESM subsystem initiated

(U) FY 1990 Planned Program:
- (U) Complete and provision TACJAM maintenance trainer
- (U) Procure long lead items for TACJAM-A ESM Engineering Development models (EDM)
- (U) Modify TACJAM-A contract to incorporate ECM enhancements and formally incorporate modularity requirements
- (U) Initiate design and fabrication of TACJAM-A ECM subsystem prototype
- (U) Initiate design/fabrication of ESM EDM and antennas

(U) FY 1991 Planned Program:
- (U) Field TACJAM maintenance trainer
- (U) Complete fabrication of ESM prototype quantities and conduct acceptance testing
- (U) Continue fabrication of ESM EDM quantities and update design, as required, to reflect test results in area of performance, RAM and MANPRINT

Program Element: #0604270A
PE Title: **Electronic Warfare Development** Budget Activity: #4

- (U) Continue design and fabrication of ECM subsystem prototype
- (U) Initiate contract for ECM EDM subsystem fabrication

(U) Project DL14 — Expendable Jammers Engineering Development: The objective of this project is to develop expendable systems that will disrupt enemy communications and data transmissions during critical periods of a battle to confuse and disrupt enemy troop command and control.

(U) FY 1989 Accomplishments:
- (U) Conducted tests leading to critical design review

(U) FY 1990 Planned Program:
- (U) Conduct critical design review

(U) FY 1991 Planned Program:
- (U) Continue development of ADEXJAM in conjunction with various cargo rounds. Select candidates that provide increased range, accuracy and payload capabilities
- (U) OT II

(U) Work Performed By: The Project Manager Electronic Warfare/Reconnaissance is conducting in-house development, also Surveillance and Target Acquisition (PM EW/RSTA) Ft. Monmouth, NJ; the Program Executive Office-Intelligence and Electronic Warfare (PEO-IEW) Warrenton, VA; and Ft. Monmouth, NJ; and the Electronic Warfare/Reconnaissance, Surveillance and Target Acquisition Center (C EW/RSTA) Ft. Monmouth, NJ; Motorola Inc. at Scottsdale, Arizona, is the principle contractor for the CDS. TVI, Beltsville, Maryland is the contractor for the MCCD. The Project Office for Battlefield Deception Belvoir Research Development and Engineering Center (BRDEC), Ft. Belvoir, Virginia, manages this Project Element. Program management responsibility for DK12, DL12, DL14 is with the Project Manager Signal Warfare; Program management responsibility for D251, D540 is with the Project Manager Electronic Warfare, Reconnaissance and Surveillance and Target Acquisition, both PMs are under the Program Executive Officer for Intelligence and Electronic Warfare, Vint Hill Farm Station (VHFS), Warrenton, VA; the Program Executive Office-Intelligence/Electronic Warfare (PEO-IEW), Warrenton, VA, Hughes Aircraft Corp., Fullerton, CA; Sanders, Inc., Nashua, NH; and American Electronics Laboratory, Landsdale, PA; Fairchild Weston Systems Incorporated, Syosset, NY.

(U) Related Activities: Army Tri-Service Common Module Laser Program — Related EW developments are conducted by the Navy and Air Force. Navy developments are conducted in PE #0204575N (Electronic Warfare Readiness Support) and #0604573N (Shipboard Electronic Warfare Improvements). Air Force developments are conducted in PE #0604738F (Protective Systems), PE #0604739F (Tactical Protective Systems) and PE #0604710F (Reconnaissance Equipment). Coordination is effected between the services to minimize duplication of effort and ensure the interchange of technical data. This is accomplished by reviews conducted by Joint Requirements Oversight Group, through exchange of technical reports, attendance at scientific meetings and conferences and joint participation on subgroups and working panels including participation in A/O level quarterly reviews.

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604270A** Project Number: **#D653**
PE Title: **Electronic Warfare Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)
Project Title: Aircraft Survivability Equipment (ASE) Advanced Development

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
Aircraft Survivability Equipment	6277	8404	22108	Cont	Cont

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Terminated Proof of Principle (POP) for Cameo Bluejay for convenience of Government 11 May 1989
- (U) Initiated risk reduction/conduct effectiveness analysis for an Optical Countermeasure (OCM) system
- (U) Initiated analysis/system requirements for development of a frequency agile, highly directive infrared (IR) Jammer to counter the electro-optical guidance techniques of advanced heat seeking missiles
- (U) Completed testing of Radio Frequency Expendable Decoy
- (U) Initiated analysis/system requirements for development of an advance threat missile detector
- (U) Expanded scope of Nunn Amendment collaboration

(U) FY 1990 Planned Program:

- (U) Initiate development of infrared expendables to incorporate advanced technologies to expand the range of threats and increase effectiveness
- (U) Continue risk reduction/effectiveness analysis prior to starting development for OCM
- (U) Renegotiate Nunn Memorandum of Understanding (MOU) for OCM
- (U) Continue systems requirement analysis and preparation of specifications for Proof of Principles (POP) effort for development of Advanced Threat Infrared Jammer and Advanced Threat Missile Detector
- (U) Conduct ASE Effectiveness Analysis and Evaluations against actual threats
- (U) Enter Advanced Development of a common modular radar jammer for both SEMA and scout/attack aircraft
- (U) Initiate development of next generation integrated Survivability Suite utilizing a central ASE processor
- (U) Provide for in-house support

(U) FY 1991 Planned Program:

- (U) Optical Countermeasure (OCM) Program
  - Evaluate studies, formulate acquisition plan and strategy
  - Solicit demonstration/validation effort on completion of analysis
- (U) Continue ASE effectiveness evaluations
- (U) Continue development of Advanced Threat Radar Jammer and Infrared Expendables
- (U) Continue Advanced Infrared Jammer development

Program Element: **#0604270A** Project Number: **#D653**
PE Title: **Electronic Warfare Development** Budget Activity: **#4**

- **(U)** Continue Advanced Integrated Aircraft Survivability Equipment development
- **(U)** Continue development of a passive missile detector system compatible with helicopter and other aircraft signature suppression programs, applicable to scout attack and SEMA
- **(U)** Provide in-house support

D. (U) WORK PERFORMED BY: In-house developers are: US Army Aviation Systems Command (AVSCOM), St. Louis, MO; US Army Laboratory Command (LABCOM), Adelphi, MD; Electronic Warfare Reconnaissance Surveillance Target Acquisition (EW/RSTA) Center, Fort Monmouth, NJ; US Army Armament Munitions and Chemical Command (AMCCOM), Dover, NJ; Aviation Applied Technology Laboratory, Ft. Eustis, VA; Vulnerability Analysis Laboratory, White Sands Missile Range, NM; US Army Missile Command, Huntsville, AL; Redstone Arsenal, Huntsville, AL. Contractors are: ITT Corporation, Nutley, NJ; Loral Electronic Systems, Yonkers, NY; Dalmo-Victor, Belmont, CA; STG Electrosystems, Inc., St. Louis, MO; Sanders Associates, Nashua, NH; IBM, Oswego, NY; Sperry, Albuquerque, NM; Perkin-Elmer, Ambury, CT; BHTI, Ft. Worth, TX; Teledyne Brown, Huntsville, AL.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable
2. **(U) SCHEDULE CHANGES:** Terminated Cameo Bluejay program. Began new Optical CM program
3. **(U) COST CHANGES:** Reduced funding in FY90 reflects Congressional reduction as a result of termination of Cameo Bluejay program.

F. (U) PROGRAM DOCUMENTATION: Required Operational Capability ROC Dec 1984

G. (U) RELATED ACTIVITIES: Both Advanced Development (D653) and Engineering Development (D665) projects for ASE are in Program Element #0604270A (EW Development).

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Nunn Amendment — International Agreement on Optical Countermeasures

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604270A** Project Number: **#D665**
PE Title: **Electronic Warfare Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)
Project Title: Aircraft Survivability Equipment (ASE)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
Aircraft Survivability Equipment	16409	17448	10056	Cont	Cont

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Awarded AN/ALQ-136(V)2 production contract
- **(U)** Continued radar frequency interferometer development
- **(U)** Continued AN/ARP-39A(XE-2) development
- **(U)** Continued development of training devices. Awarded contract for development of composite air defense threat simulator array
- **(U)** Initiated project to develop an integrated ASE controller for use with Special Electronic Mission Aircraft (SEMA)
- **(U)** Completed development of spiral antenna assembly (SANTA)

(U) FY 1990 Planned Program:

- **(U)** Complete development of AN/APR-39A(XE-2). Conduct Milestone III in-process review (IPR)
- **(U)** Continue training device development
- **(U)** Complete integrated ASE development
- **(U)** Continue in-house/software support
- **(U)** Complete radar interferometer development

Program Element: **#0604270A** Project Number: **#D665**
PE Title: **Electronic Warfare Development** Budget Activity: **#4**

(U) FY 1991 Planned Program:

- **(U)** Initiate engineering development of Radio Frequency Expendable Decoy
- **(U)** Continue training device development
- **(U)** Continue in-house/software support

D. (U) WORK PERFORMED BY: In-house developers are: US Army Aviation Command (AVSCOM), St. Louis, MO; US ARMY Laboratory Command (LABCOM), Adelphi, MD; Electronic Warfare Reconnaissance Surveillance Target Acquisition (EW/RSTA) Center, Fort Monmouth, NJ; US Army Armament Munitions and Chemical Command (AMCCOM), Dover, N.J., Aviation Applied Technology Laboratory, Ft. Eustis, VA; Vulnerability Analysis Laboratory, White Sands Missile Range, NM; US Army Missile Command, Huntsville, AL; Redstone Arsenal, Huntsville, Al. Contractors are: ITT Corporation, Nutley, NJ; Loral Electronic Systems, Yonkers, NY; Dalmo-Victor, Belmont, CA; STG Electrosystems, Inc., St Louis, MO; Sanders Associates, Nashua, NHY; IBM, Owego, NY; Sperry, Albuquerque, NM, Perkin-Elmer, Ambury, CT; BHTI, Ft Worth, TX; Teledyne Brown, Huntsville, AL.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable
2. **(U) SCHEDULE CHANGES:** Cameo Bluejay terminated
3. **(U) COST CHANGES:** FY 1991 funding reduction is a result of programming funds to support higher priority programs after termination of Cameo Bluejay program

F. (U) PROGRAM DOCUMENTATION: ROC DEC 1984

G. (U) RELATED ACTIVITIES: Prior to FY 1989, advanced development efforts were in PE #0603711A Project D653 (Aircraft Survivability Equipment). For FY 1989, both advanced development and engineering development projects are in PE #0604270A (EW Development).

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Aircraft Procurement, Army			
AZ3504	49474	97666	107890
AA0720	34791	7041	11453

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

J. (U) MILESTONE SCHEDULE: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604321A (TIARA)**
PE Title: **Joint Tactical Fusion Program** Budget Activity: **#4**

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D396 — TACSIM-Tactical Simulation:

(U) FY 1989 Accomplishments:

- **(U)** Developed and integrated additional sensor system modes as directed by the All Source Analysis System/Enemy Situation Correlation Element (ASAS/ENSCE) test community
- **(U)** Developed a baseline TACSIM of the portable ASAS ENSCE workstation (PAWS)
- **(U)** Established configuration management of this baseline

(U) FY 1990 Planned Program:

- **(U)** Continue to develop pre-planned product improvement (P^3I) of sensor models in accordance with changes to the sensor systems that are modeled in the TACSIM software
- **(U)** Fully integrate TACSIM into the ASAS to provide direct stimulus in training and RDTE environments
- **(U)** Complete development of an automated scenario generation system
- **(U)** Integrate TACSIM with the Joint Exercise Support System (JESS) and the Joint Wargaming System (JWS) as the intelligence module
- **(U)** Develop a requirement definition for an intelligence simulation system with vastly increased functionality, taking advantage of advanced computing technologies

(U) FY 1991 Planned Program:

- **(U)** Continue to develop P^3I of sensor models in accordance with changes to the sensor systems that are modeled in the TACSIM software
- **(U)** Develop system description for an intelligence simulation system with vastly increased functionality, taking advantage of advanced computing technologies

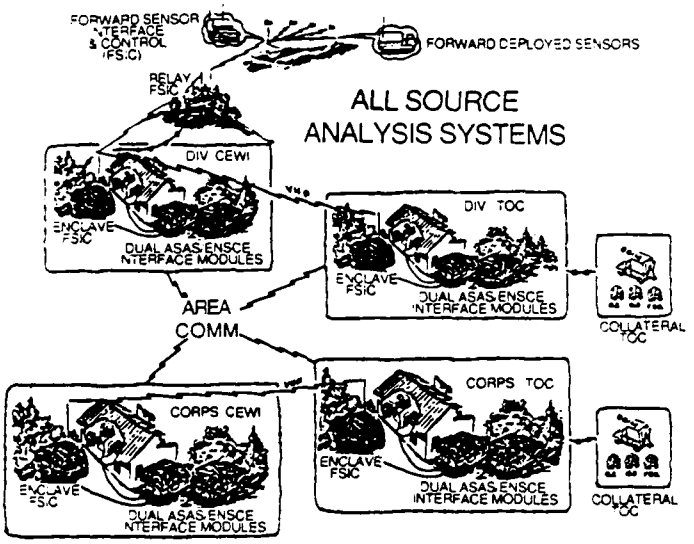
(U) Work Performed By: BDM Corporation, Ft Hood, TX (Software Development/Documentation); EATON Corporation, Ft Hood, TX and Denver, CO (Hardware Maintenance). In-house developing organizations are: US Army Communications-Electronics Command (CECOM); TRADOC Combined Arms Test Activity (TCATA), Ft Hood, TX; and Joint Tactical Fusion Program Office, McLean, VA.

(U) Related Activities: PE #0603745A (Tactical Electronic Support Measure (ESM) Systems). Extended coordination is conducted with the other services and agencies to avoid duplication of effort.

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **# 0604321A** Project Number: **# D926**
PE Title: **Joint Tactical Fusion Program** Budget Activity: **#4**
Project Title: **ASAS—All Source Analysis System Engineering Development**



POPULAR NAME: **ASAS**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This Project funds the Army portion of the development of the Army All Source Analysis System (ASAS) and the Air Force Enemy Situation Correlation Element (ENSCE). The successful execution of the AirLand Battle/Deep Attack requires an intelligence and targeting system that will provide both Army and Air Force commanders a common view of the battlefield at all levels. ASAS and ENSCE are tactically deployable ADP systems used to manage intelligence and electronic warfare (IEW) operations and to develop targets within Army Command and Control System and Air Force Tactical Air Control System, respectively. ASAS systems are located in Army divisions, corps, and echelons-above-corps (EAC) and ENSCE systems are located in Tactical Air Control Centers of numbered air forces. These systems are comprised of several hardware modules: Data Processor Set Module (Common name: ASAS/ENSCE Interface Module) (AIM) which processes intelligence data; Communications Control Set (Common name: Forward Sensor Interface & Control Set) (FSIC) module, which provides inter-enclave communications and security protection and which relays data from ground based sensors/sources in forward areas back to the data processing modules; FSIC upgrade during evolutionary development which provides interface between data processing modules and area communications network; Workstation Computer Graphics (Common name: Portable ASAS ENSCE Workstation) (PAWS), which is the primary user interface with the system, and, the Supplementary Equipment, Electronic (SE) module, which includes all support equipment required to connect the modules into an ASAS/ENSCE system. The development and acquisition strategy for this program is evolutionary in nature. A limited Capability Configuration, comprised of AIM, FSIC, PAWS, and SE modules is being developed and fielded before full production ASAS systems.

Program Element: # 0604321A
PE Title: Joint Tactical Fusion Program
Project Number: # D926
Budget Activity: #4

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Completed integration and testing of first release (RI)
- (U) Delivered R1 with the limited capability configuration (LCC) to III Corps and 2nd Armored Division at Ft Hood, TX
- (U) Completed testing of Intelligence Correlation Elements (ICE) software
- (U) Initiated testing, training, delivery and installation of ICE software at operational sites in U.S. Air Force Europe (USAFE)
- (U) Conducted system operator and maintainer training
- (U) Continued development of R2/R3 software design
- (U) Initiated fabrication of ASAS modules for initial operational test and evaluation (IOT&E)
- (U) Continued support of ASAS Brass Boards (ABB)

(U) FY 1990 Planned Program:

- (U) Complete R2/R3 detailed software design
- (U) Continue R2/R3 software coding
- (U) Complete testing, training, delivery & installation of ICE software at operational sites in USAFE
- (U) Develop training software
- (U) Continue support to LCC at III Corps
- (U) Initiate procurement of hardware for Life Cycle Software Support Center (LCSSC)
- (U) Initiate procurement of hardware for U.S. Army Intelligence Center and School (USAICS)
- (U) Initiate ENSCE module design & fabrication
- (U) Initiate ASAS Force Develoment Test and Experimentation (FDT&E)

(U) FY 1991 Planned Program:

- (U) Complete R2/R3 software coding
- (U) Complete delivery and installation of IOT&E ASAS hardware and R2/3 software to III Corps, Ft Hood, TX
- (U) Continue support to LCSSC
- (U) Continue support to USAICS
- (U) Hardware/software integration of R2/R3
- (U) Initiate R2/R3 software integration & test
- (U) IOT&E preparation
- (U) Continue ENSCE fabrication

D. (U) WORK PERFORMED BY: The Project Manager, ASAS/ENSCE within the Joint Tactical Fusion Program Management Office and under the PEO-CCS is responsible for development and acquisition of ASAS/ENSCE. The prime contractor is Jet Propulsion Laboratory, Pasadena, CA. Major subcontractors are: Martin Marietta Corp., Denver, CO; Ford Aerospace Corp., San Jose, CA; McDonald Douglas, Huntington Beach, CA; TRW, Redondo Beach, CA; and Mantech, Landover, MD.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.

Program Element: # 0604321A
PE Title: **Joint Tactical Fusion Program**
Project Number: # D926
Budget Activity: #4

2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** Not applicable.

F. (U) PROGRAM DOCUMENTATION:

Required Operational Capability (ROC) approved	1/86
ASAS/ENSCE Integrated Support Plan	1/84

G. (U) RELATED ACTIVITIES:

- PE #0603745A Tactical Electronic Support Measures (ESM) Systems which includes D406 (Single Source Processor — SIGINT) (SSPS) and D535 (Fusion Analysis Technology)
- Extended coordination is conducted with other Services and agencies to avoid duplication of effort
- PE #0604321A Project DB19 is the hardware Evolutionary Development line and DB20 is the software Evolutionary Development line related to the project to bring ASAS to ROC
- PE #0604716 Project D570 Digital Topographic Support System (DTSS) and Quick Reaction Multi-Color Printer (QRMP)

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable

J. (U) TEST AND EVALUATION DATA: All Source Analysis System (ASAS)/Enemy Situation Correlation Element (ENSCE) test and evaluation will be an iterative process to support evolutionary development and acquisition strategy. "Capstone" development tests called System Readiness Verification Tests (SRVT), during which soldiers/airmen operate the system, are conducted at the integrating contractor's facility prior to delivery to the user. Following initial Army deliveries, a field trial and early user tests will be conducted. US Army Operational Test and Evaluation Agency (USAOTEA) and US Air Force Test and Evaluation Center (AFOTEC) will conduct initial operational test and evaluation (IOT&E) on ASAS and ENSCE, respectively. A tactical simulator (TACSIM) will be used to provide realistic sensor input to systems being tested. Test results will be supplemented with simulation data provided by US Army TRADOC Analysis Center, White Sands Missile Range, NM. Follow-on operational test and evaluation (FOT&E) will be conducted as required. Development test and evaluation (DT&E) for the Data Processor Set (Common name: ASAS/ENSCE Interface Module) (AIM) and the Communications Control Set (Common name: Forward Sensor Interface and Control) (FSIC) module was October 1986. FDT&E of the limited capability configuration (LCC) will occur in early FY 1990. Operational test and evaluation field trial of AIM and FSIC modules was conducted at Ft Hood, TX, in 1986. The field trial was primarily an investigative test activity to determine how to conduct the ASAS/ENSCE IOT&E operational test and evaluation (IOT&E). The ASAS/ENSCE IOT&E pre-test activities will begin in FY 1991.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604321A (TIARA)**
PE Title: **Joint Tactical Fusion Program**
Project Number: **# DB19**
Budget Activity: **#4**

Project Title: **ASAS Block Improvement**

NO PICTURE AVAILABLE

POPULAR NAME: **ASAS**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The initial hardware block improvement for the ASAS system will focus on the transition of the modules from the current S250 shelter to the next generation of standard shelters — the Standard Integrated Command Post System (SICPS) shelter. Other minor changes will be evaluated to assess their cost effectiveness for implementation during this conversion; e.g., inclusion of an uninterruptible power supply capability. This is a new start.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments: None

(U) FY 1990 Planned Program: None

(U) FY 1991 Planned Program:

- **(U)** Definition of collateral enclave requirements through the System Design Review (SDR) as specified by DOD standard 2167A
- **(U)** Prepare draft functional requirement documentation for block II

(U) Program Plan to Completion:

- **(U)** Enhancement of hardware to implement Army mandated common hardware for initial operation test and evaluation (IOT&E)

D. (U) WORK PERFORMED BY: PM ASAS Mclean, VA. Contract to be awarded in FY91

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** The S250 shelter for the ASAS/ENSCE Interface Module (AIM)/Forward Sensor Interface & Control Set (FSIC) configurations will be upgraded to the SICPS shelter. Two prototypes of each version plus level 3 drawings will be deliverables.

Program Element: **#0604321A (TIARA)** Project Number: **# DB19**
PE Title: **Joint Tactical Fusion Program** Budget Activity: **#4**

2. **(U) SCHEDULE CHANGES:** The conversion to SICPs was not programmed until FY93-94. Software programmed for FY91-92 will be delayed until FY93-94 and the SICPs conversion will be moved forwrd for completion in FY92.
3. **(U) COST CHANGES:** $6.8M moved from line DB20 to line DB19 to cover the cost of the SICPs conversion. No more money is being requested, only a change from line to line was required.

F. (U) PROGRAM DOCUMENTATION: Not applicable

G. (U) RELATED ACTIVITIES:

- PE #0603745A Tactical Electronic Support Measures (ESM) Systms which includes D406 (Single Source Processor — SIGINT) (SSPS) and D535 (Fusion Analysis Technology)
- Extensive coordination is conducted with other Services and agencies to avoid duplication of effort
- PE #0604321A Project DB19 is the hardware Evolutionary Development line and DB20 is the software Evolutionary Development line related to this project to bring ASAS to ROC
- PE #0604716A Project D579 Digital Topographic Support System (DTSS) and Quick Reaction Multi-Color Printed (QRMP)

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

J. (U) TEST AND EVALUATION DATA: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604321A (TIARA)** Project Number: **#DB20**
PE Title: **Joint Tactical Fusion Program** Budget Activity: **#4**

Project Title: **ASAS Soft Block Improvement**

NO PICTURE AVAILABLE

POPULAR NAME: **ASAS**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Evolutionary Software Development portion of the US Army All Source Analysis System. Baseline system accomplishes approximately 20% of requirement. Block upgrades will provide new capability in automated support for Communication Intelligence (COMINT), Electronic Intelligence (ELINT), Image Intelligence (IMINT), Human Intelligence (HUMINT), Operational Security (OPSEC), Electronic Warfare (EW), and will update current capabilities in All Source/Situation Analysis, Collection Management and Target Analysis. The evolutionary software development will be accomplished using Ada. This project is a new start in FY 1991.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments: None

(U) FY 1990 Planned Program: None

(U) FY 1991 Planned Program:

- **(U)** *Definition of collateral enclave requirements through the System Design Review (SDR) as specified by DOD Standard 2167A*
- **(U)** Prepare draft functional requirement documentation for block II

(U) Program Plan to Completion:

- **(U)** Award contract for second intelligence module
- **(U)** Finalize request for proposal (RFP), A-Spec statement of work (SOW) for Full Block upgrade program
- **(U)** Initiate conversion of baseline system and security software to Ada
- **(U)** Review Current ASAS/ENSCE A-Spec

Program Element: **#0604321A (TIARA)** Project Number: **#DB20**
PE Title: **Joint Tactical Fusion Program** Budget Activity: **#4**

D. (U) WORK PERFORMED BY: PM ASAS Mclean, VA. Contract to be awarded in FY91

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None
2. **(U) SCHEDULE CHANGES:** Block upgrade program goes to contract Dec 92. Two intelligence applications will be contracted in Feb 91 and Dec 91 and be added to current baseline.
3. **(U) COST CHANGES:** $6.8M from DB20 line in FY 1991 was moved to DB19 line to incorporate upgrade of hardware previously programmed for upgrade in FY93-94.

F. (U) PROGRAM DOCUMENTATION:

- Acquisition Strategy 8/89
- A-Spec Draft 8/89
- Statement of Work Draft 11/89

G. (U) RELATED ACTIVITIES:

- PE #0603745A Tactical Electronic Support Measures (ESM) Systems which includes D406 (Single Source Processor — SIGINT) (SSPS) and D535 (Fusion Analysis Technology)
- Extended Coordination is conducted with other services and agencies to avoid duplication of effort
- PE #0604321 Project DB19 is the hardware Evolutionary Development line and DB20 is the software Evolutionary Development line related to this project to bring ASAS to ROC
- PE #0604716 Project D579 Digital Topographic Support System (DTSS) and Quick Reaction Multi-Color Printer (QRMP)

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

J. (U) TEST AND EVALUATION DATA: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604603A**
PE Title: **Nuclear Munitions Engineering Development** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element supports development of the improved 155mm nuclear projectile. The mission of the Nonstrategic Nuclear Force (NSNF) is to deter both nuclear and conventional attack by enemy forces, and, should deterrence fail, to support the defense of the theater. The current 155mm Artillery Fired Atomic Projectile (AFAP) is based on 1950's technology and needs to be modernized to provide increased effectiveness, safety, and security. Numerous comprehensive analyses by the Army, Office of the Secretary of Defense, Department of Energy, the Defense Science Board, and Supreme Allied Commander Europe (SACEUR) have concluded that both a modern 8-inch AFAP and a modern 155mm AFAP are essential to a credible battlefield nuclear capabiljty. The end of production of the modernized 8-inch nuclear projectile occurred in FY 1986. Additionally, development of the Survivability Overpack Container (SOC) to protect our AFAPs is critical. The threat to these weapons exists throughout the stockpile to target sequence, in peacetime, transition-to-war and wartime.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) FY 1989 Accomplishments:

- **(U)** Initiated and completed operational testing (OT) II
- **(U)** Completed ballistic firing tables for M198 howitzer
- **(U)** Initiated and completed joint ballistic firing test III
- **(U)** Initiated and completed joint ballistic firing test IV
- **(U)** Completed ballistic firing tables for M109A3 howitzer
- **(U)** Continued engineering development
- **(U)** Completed joint full functional testing II
- **(U)** Continued development testing (DT II)
- **(U)** Fuze/Rocket motor safety testing completed

(U) FY 1990 Planned Program:

- **(U)** Continue DT II
- **(U)** Continue engineering development
- **(U)** Design Review and Acceptance Group (DRAAG) continued
- **(U)** Initiate/complete pre-operational safety study
- **(U)** Complete ballistic firing tables for M109/M114A2 howitzer

(U) FY 1991 Planned Program:

- **(U)** Complete system development and validation (DEVA) III
- **(U)** Complete training development and validation (DEVA) III
- **(U)** Continue engineering development
- **(U)** Complete DT II

(U) Project D584 — Safety and Security Systems: This project funds the engineering development of the Survivability Overpack Container (SOC). The SOC is required to safeguard Artillery Fired Atomic Projectiles (AFAPs) against accidental or covert damage or loss.

(U) FY 1989 Accomplishments: Not Applicable.

(U) FY 1990 Planned Program:

- **(U)** Initiate full-scale engineering development (FSED)
- **(U)** Initiate drawings update

Program Element: **#0604603A**
PE Title: **Nuclear Munitions Engineering Development** Budget Activity: **#4**

- **(U)** Develop interim Technical Data Package (TDP)
- **(U)** Initiate development testing I (DT I)
- **(U)** Finalize engineering design
- **(U)** Fabricate limited hardware for engineering development

(U) FY 1991 Planned Program:

- **(U)** Continue systems engineering
- **(U)** Complete limited DT I
- **(U)** Conduct DT II
- **(U)** Finalize level III drawings (no formal configuration control)
- **(U)** Continue fabrication of engineering development hardware

(U) Work Performed By: In-house support includes: U.S. Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ; Harry Diamond Laboratories, Adelphi, MD; Army Materiel and Mechanics Research Center, Watertown, MA; Ballistics Research Laboratory, Aberdeen Proving Ground, MD; U.S. Army Electronic Warfare/Reconnaissance, Surveillance, and Target Acquisition Center, Ft. Monmouth, NJ; and Army Depots (at Seneca, NY and Herlong, CA). Locations of Department of Energy-Defense Program activities and contractors include: Germantown, MD; Albuquerque, NM; Amarillo, TX; Kansas City, MO; Los Alamos, NM; Las Vegas, NV; Livermore, CA; Denver, CO; and Aiken, SC. Contractor support includes: Ferrulmatics Inc., Patterson, NJ; Chamberlain Corporation, Waterloo, IA; and Motorola Incorporated, Scottsdale, AZ.

(U) Related Activities: PE #0603604A (Nuclear Munitions and Radiac-Advanced Development). Advanced development of the Survivability Overpack Container (SOC) is funded under PE #0603604A. No unnecessary duplication of effort in the Army or Department of Defense exists.

(U) International Cooperative Agreements: Not Applicable.

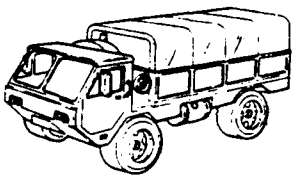
FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604604A** Project Number: **DH07**
PE Title: **Medium Tactical Vehicles** Budget Activity: **#4**
Project Title: **Family of Medium Tactical Vehicles (FMTV)**

FAMILY OF MEDIUM TACTICAL VEHICLES (FMTV)

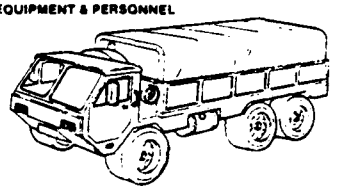
PRIMARY MISSIONS

- UNIT MOBILITY
- UNIT RESUPPLY
- TRANSPORT OF EQUIPMENT & PERSONNEL



CONFIGURATIONS — LIGHT VARIANT

- CARGO
- SHOP VAN
- CHASSIS



CONFIGURATIONS — MEDIUM VARIANT

- CARGO
- CARGO W/MHE
- LONG WHEEL BASE CARGO
- LONG WHEEL BASE CARGO W/MHE
- CHASSIS
- LWB CHASSIS
- EXPANSIBLE VAN
- TRACTOR
- DUMP
- WRECKER
- TANKER
- AMBULANCE

POPULAR NAME: **FMTV Family of Medium Tactical Vehicles**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones				ASARC III 3/91	
Engineering Milestones		Proto Fab Start 10/88	Proto Fab Compl 12/89		First Prod Veh 3Q/92
T&E Milestones			Proto Test Start 2/90	Proto Test Compl 2/90	
Contract Milestones		Award Proto Contracts 10/88	Prototype Delivery 12/89	Prod Contract Award 3/91	
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		23875	12848	7030	52989 (0)
Support Contract					
In-House Support		941	5245	0	6833 (0)
GFE/ Other					
Total		24816	18093	7030	59822 (0)

Program Element: **#0604604A** Project Number: **DH07**
PE Title: **Medium Tactical Vehicles** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: There is an urgent need to replace the aging 2 1/2 ton truck fleet and fill the current shortfall of the 5 ton truck fleet with state-of-the-art tactical wheeled vehicles. The requirement is for vehicles which are lighter and more mobile, reliable, supportable and deployable than the existing fleet of trucks. The FMTV variants will maximize commonality of components to reduce the logistics burden in the field.

System Capabilities	
Grade at Gross Vehicle Weight	60 percent
Grade at Gross Combined Weight	30 percent
Sideslope at Gross Vehicle Weight	30 percent
Highway speed at Gross Combined Weight	55 MPH
Fording Depth without Kit	30 Inches
Fording Depth with Kit	60 Inches
Convoy Range	300 Miles
Vertical Step at GVW	24 Inches
Vehicle Cone Index at GVW	25
Vehicle Cone Index at GCW	35
Reliability	2000-2200 Mean Miles Between Operational Failure (MMBOMF*)

* Varies with body style

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Awarded three contracts to provide prototype vehicles for competitive testing
- **(U)** Fabricated prototypes for competitive evaluation and testing

(U) FY 1990 Planned Program:

- **(U)** Prototypes will be delivered
- **(U)** Prototypes will be tested by the Government
- **(U)** Results of testing will support production source selection

(U) FY 1991 Planned Program:

- **(U)** Conduct Milestone III production decision review
- **(U)** Award Production Contract

D. (U) WORK PERFORMED BY: In-house effort will be accomplished by the US Army Tank-Automotive Command, Warren, Michigan. Contractors for the prototype phase include: Tactical Truck Corporation (GM-BMY), Stewart/Stevenson Services, and Teledyne-Continental Motors.

Program Element: **#0604604A** Project Number: **DH07**
PE Title: **Medium Tactical Vehicles** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None.
2. **(U) SCHEDULE CHANGES:** The test schedule has been extended two months; testing will now be completed in Dec 1990. Production contract award also slips two months but will still occur in 2nd Qtr FY 1991.
3. **(U) COST CHANGES:** The FY89 program was reduced by $.3M in support of the DA-wide initiative to fund Small Business Innovative Research (SBIR). Reprogramming actions are planned to this Project from PE #0604622A, Project D659, Palletized Load System to fund shortfalls created by higher than anticipated costs for the prototype contracts. This will involve reprogramming $.3M in FY89 and $3.999M in FY90.

F. (U) PROGRAM DOCUMENTATION:

Operational & Organizational Plan	9/84
Test Evaluation Master Plan	8/88
Joint Service Operational Requirement	9/87
Acquisition Plan	1/88
Program Baseline	1/88
Decision Coordination Paper	1/88

G. (U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Army or the Department of Defense. The Family of Medium Tactical Vehicles is an Army, Marine Corps, Air Force effort and tri-service joint working groups insure coordination among the services.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) TEST AND EVALUATION DATA: There have been no development test and evaluations conducted to date. Prototype testing is scheduled to begin 2Q FY90. The testing will include endurance, performance, reliability, mobility, and logistics testing. A separate Initial Operational Test and Evaluation will be conducted starting the 3Q FY90.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604609A** Project Number: **# D200**

PE Title: **Smoke, Obscurant Equipment Systems — Engineering Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Smoke/Obscurant Engineering Development

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
	5695	13024	10275	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program provides for the conduct of engineering development (ED) of smoke, obscurant and equipment defeating agents, munitions, and devices. The program supports the urgent need to provide smoke, obscurant and equipment defeating materiel to increase survivability of US forces by defeating or degrading threat surveillance and weapon system sights, guided munitions, directed energy weapons, and other weapon systems that operate in the full range of the electromagnetic spectrum. Improvements and new developments are required across the entire multispectral (MS) range from visual through IR (infrared) and millimeter (radar) wavelengths. These developments will be applied to projectile, rocket, missile, ground and air combat vehicular defense and large area obscuration/smoke systems. The XM55 and XM56 are mobile smoke systems that use a gas turbine engine as a power source to disseminate obscurants. All systems provide large area visual, infrared (IR), and millimeter wave (MMW) screening. The XM55 is mounted on the M1037 High Mobility Multi-purpose Wheeled Vehicle (HMMWV). The XM56 adds hot water decon capability for use by the Dual Purpose Smoke/ Decontamination Chemical Companies.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Conducted millimeter wave (MMW) grenade engineering design tests (EDT) and early user test and evaluation (EUT&E) and conducted design review of XM55, and XM56, smoke generators

(U) FY 1990 Planned Program:

- (U) Conduct engineering design tests (EDT) and early user test and evaluation (EUT&E) for XM56 smoke generator
- (U) Conduct logistics demonstration and reliability growth testing of XM56 smoke generator
- (U) Award engineering development contract for Multisalvo Smoke Grenade Launcher (MSGL)

(U) FY 1991 Planned Program:

- (U) Initiate production proveout test (PPT) and operational test and evaluation (OT&E) for XM55 and XM56 smoke generators
- (U) Initiate engineering design tests (EDT) and manufacture hardware for production proveout test (PPT) of Multisalvo Grenade Launcher (MSGL)
- (U) Award Engineering Development contract for Combat Vehicle Defensive Obscuration System (CVDOS) - Millimeter Wave (MMW) Grenade

D. (U) WORK PERFORMED BY: In-house work will be conducted by US Army Project Manager Smoke/ Obscurants, Chemical Research Development and Engineering Center and the US Army Test and Evaluation Command, all located at Aberdeen Proving Ground, MD; the Armament Research Development and Engineering Center, Dover, NJ; Belvoir Research, Development and Engineering Center, Ft. Belvoir, VA; the US Army Missile Command, Huntsville, AL; Dugway Proving Ground, Dugway, UT; and the US Army Medical Research

Program Element: #0604609A | Project Number: # D200
PE Title: **Smoke, Obscurant Equipment Systems — Engineering Development** | Budget Activity: #4

and Development Center, Ft. Detrick, Frederick, MD. Prime contractor on the XM55/56 is MRC Corp., located in Hunt Valley, MD. Prime contractors for the remaining program tasks are unknown at this time.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** XM57 portion of program taken out and incorporated into Large Area Mobile Projected Smoke System (LA/MPSS). User requested the mechanized version (XM57) be upgraded to include projected smoke
2. **(U) SCHEDULE CHANGES:** Testing slipped due to delay of test hardware delivery.
3. **(U) COST CHANGES:** Not applicable.

F. (U) PROGRAM DOCUMENTATION:

XM55/56:	
Operational and Organizational Plan	02/85
Acquisition Strategy	01/86
Acquisition Plan	12/86
Required Operational Capability	11/86
Decision Coordinating Paper	12/86
Test and Evaluation Master Plan	05/89
CVDOS MSGL:	
Operational and Organizational Plan	01/87
Acquisition Strategy	04/89
Test and Evaluation Master Plan	07/89
Acquisition Plan	08/89
CVDOS MMW GRENADE:	
Operational and Organizational Plan	01/87
Acquisition Strategy	04/89
Test and Evaluation Master Plan	07/89
Acquisition Plan	07/90

G. (U) RELATED ACTIVITIES:

- PE #0602622A, Chemical, Smoke and Equipment Defeating Technology
- PE #0603627A, Smoke and Equipment Defeating Systems — Advanced Development
- In order to meet other Service needs and to prevent unnecessary duplication of effort, coordination is maintained with other Services through joint participation in the Smoke and Aerosol Working Group of the Joint Technical Coordinating Group, symposia and reports.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) None.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

Program Element: **#0604609A** Project Number: **# D200**

PE Title: **Smoke, Obscurant Equipment Systems — Engineering Development** Budget Activity: **#4**

J. (U) MILESTONE SCHEDULE:

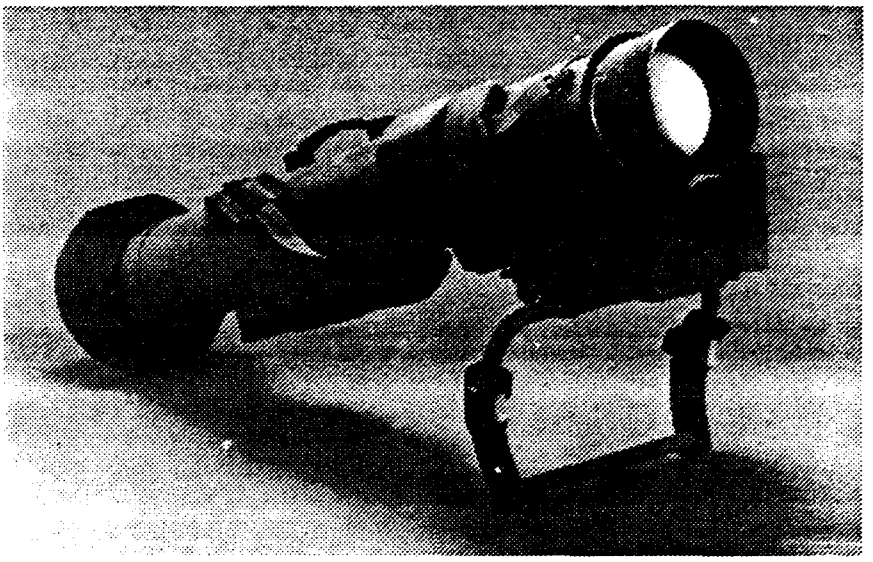
Milestone	Milestone Date		
XM55/56 Mobile Smoke Generator Systems:			
Initiate Technical Test II	05/91		
Complete Technical Test and User Testing	02/92		
Complete Type Classification In-Process Review (IPR)	09/92		
Combat Vehicle Defensive Obscuration System (CVDOS):	MSGL	MMW	GRENADE
Initiate Full Scale Engineering Development	05/92	10	/91
Complete development and user testing	03/94	03	/93
Conduct Type Classification IPR	08/94	08	/93

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604611A** Project Number: **D499**

PE Title: **Advanced Anti-Tank Weapon System—Engineering Development** Budget Activity: **#4**

Project Title: **Advanced Anti-Tank Weapon System — Medium**



POPULAR NAME: **AAWS-M**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		Milestone II Decision Review 9/89			MS IIIA 3Q92
Engineering Milestones		Preliminary Design Review 12/89 Begin Production Proveout Testing (PPT) 12/89	Critical Design Review 6/90 Continue PPT	Complete PPT 3/91 Begin PPQT Begin FDTE 5/91	
T&E Milestones					
Contract Milestones		FSD Contract Award 9/89			
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		83250	100490	48110	260232 (29962)
Support Contract		1307	3350	4100	10307 (1550)
In-House Support		18158	17831	13841	60469 (10639)
GFE/ Other		2445*	16190*	10761	30770 (1364)
Total		105170	137861	76812	361778 (43515)

* Includes Other Government Agency and Congressional/Administration Implementation

Program Element: **#0604611A** Project Number: **D499**
PE Title: **Advanced Anti-Tank Weapon System—Engineering Development** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program element (PE) provides for the engineering development of advanced antitank weapon systems for the combined arms team employment. The efforts funded in FY 1989 transition the Advanced Antitank Weapons System-Medium (AAWS-M) from the advanced development phase in PE #0603612A/D308 to the full-scale engineering development phase in this PE. The infantry must have the capability to defeat numerically superior armored forces. The present medium infantry antitank weapon is DRAGON. The system developed within this PE will replace the DRAGON. AAWS-M will have a high kill rate against threat armored vehicles of the 1990s at extended ranges under day/night, adverse weather conditions and in the presence of battlefield obscurants. This system will be hardened against countermeasures and will not require extensive training for effective employment.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- **(U)** Completed advanced development
- **(U)** Made source selection decision from three competing contractors
- **(U)** Awarded full scale development contract (selected fire-and-forget technology)
- **(U)** Conducted preliminary design review
- **(U)** Began production proveout testing (PPT)

(U) FY 1990 Planned Program:
- **(U)** Continue PPT
- **(U)** Critical design review

(U) FY 1991 Planned Program:
- **(U)** Complete PPT
- **(U)** Initiate pre-production qualification testing (PPQT)
- **(U)** Initiate procurement of production long-lead items
- **(U)** Initiate and complete force development test & experimentation (FDTE)

(U) Program Plan to Completion:
- **(U)** Complete PPQT
- **(U)** Initiate and complete IOT
- **(U)** Complete full-scale development (FSD)
- **(U)** Initiate low-rate initial production (LRIP) options

D. (U) WORK PERFORMED BY: In-house efforts are being performed by Advanced Antitank Weapon System (AAWS) Program Office, Program Executive Officer Fire Support, Redstone Arsenal AL. The prime contractor for the AAWS-M full-scale development phase is a joint venture consisting of Texas Instruments Inc., Denton TX, and Martin Marietta, Orlando Florida.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not Applicable.
2. **(U) SCHEDULE CHANGES:** None.
3. **(U) COST CHANGES:** FY90 and FY91 funds were adjusted to equal FY90 & 91 funding requirements established by the approved program baseline which was based on the fire-and-forget technology selected for entry into FSD.

Program Element: **#0604611A** Project Number: **D499**
PE Title: **Advanced Anti-Tank Weapon System—Engineering Development** Budget Activity: **#4**

F. (U) PROGRAM DOCUMENTATION:

Required Operational Capability (ROC)	07/85
Joint Services Operational Requirement (update)	11/88
Test and Evaluation Master Plan	09/88
(Revision of Temp Scheduled Dec 89)	
Requisition, Decision Memorandum (Milestone Decision Review II (MDR II))	06/89

G. (U) RELATED ACTIVITIES: Other related Program Elements are:

- #0603810A (Advanced Missile System — Heavy Demo)
- #0602303A (Missile Technology)
- #0603313A (Missile and Rocket Advanced Technology)
- #0603321A (Target Acquisition Counter/Counter-Countermeasures)
- #0602120A (Electronic Survivability and Fuzing Technology)
- #0602624A (Weapons and Munitions Technology)
- #0602618A (Ballistics Technology)

There is no unnecessary duplication of effort within the Army or other Services/Agencies within DOD. This is assured by continuous coordination with other Services/Agencies and oversight by the OSD-Level Conventional Systems Committee.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) TEST AND EVALUATION DATA: The AAWS-M full-scale engineering development (FSED) test program will begin in 4QFY89 and conclude in 3QFY92.

Full-scale engineering development testing will consist of the following:

(1) Production Proveout Test (Contractor Component/Subsystem/system testing/qualification).

(2) Preproduction Qualification Test (Contractor/Government System development testing/qualification)

(3) Force Development Test and Experimentation II (Government Training Concept Testing)

(4) Logistics Demonstration (Contractor/Government Evaluation)

(5) Live Fire Component Test (Contractor/Government)

(6) Initial Operational Test (Government)

FSD test program schedule:
Technical Test II (PPT, PPQT) — 1QFY90-1QFY92
User Test II (FDTE, IOT) — 2QFY91-3QFY92

Program Element: **#0604611A** Project Number: **D499**

PE Title: **Advanced Anti-Tank Weapon System—Engineering Development** Budget Activity: **#4**

System Characteristics:

Operational/Technical Characteristics	**Objectives**	**Demonstrated Performance**
Weight	Less than 45 lbs	
Range	Meet Requirement	
Configuration	1-man portable	
Countermeasure hardened	Yes	Component testing will commence late FY89

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604619A** Project Number: **#D088**
PE Title: **Landmine Warfare** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)
Project Title: Wide Area Mine System (WAM) Engineering Development

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
Wide Area Mine	- 0 -	21448	34684	Cont	Cont

*Prior advanced development efforts in PE #0603619A, Project D005

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project provides for engineering development and validation of landmine systems which will enhance the U.S. capability in mine warfare. The current program provides for the development of one of two competing wide area mine (WAM) systems which will use advanced sensor and warhead technology to develop the United States first smart mine. WAM is an anti-tank/anti-vehicle mine designed to detect and attack tanks and vehicles from a distance. It is intended to counter the lane breaching capability of the Soviet threat and provide autonomous covering fire by attacking threat vehicles from the top. WAM will have multiple delivery modes: hand emplaced, VOLCANO, and missile/artillery.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments: Not applicable

(U) FY 1990 Planned Program:
- **(U)** Initiate engineering system development for hand emplaced WAM
- **(U)** Initiate design of WAM components for technical test (TT) and user test (UT) hardware

(U) FY 1991 Planned Program:
- **(U)** Order longlead hardware for contractor test and TT/UT hardware
- **(U)** Continue engineering design and system development
- **(U)** Conduct end-to-end test
- **(U)** Program design review at end of FY 1991

D. (U) WORK PERFORMED BY: The Project Manager for Mines, Countermine and Demolitions, Picatinny Arsenal, NJ is assigned the responsibility for landmine, countermine and explosive demolition development. The major supporting labc ·ry is the Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ. Principal contrac r will be either Honeywell Inc. at Hopkins, MN or Textron at Boston, MA depending on competing concept selected.

Program Element: **#0604619A** Project Number: **#D088**
PE Title: **Landmine Warfare** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None
2. **(U) SCHEDULE CHANGES:** None
3. **(U) COST CHANGES:** Funding for this program was increased in FY 1990 and 1991 to cover increased costs of end-to-end testing and sublet design. There are no schedule changes.

F. (U) PROGRAM DOCUMENTATION: Not applicable

G. (U) RELATED ACTIVITIES:

- Program Element #0603619A (Landmine Warfare and Barrier—Advanced Development)
- Program Element #0603606A (Landmine Warfare and Barrier—Advanced Technology) relates to advanced development efforts and component work.

Mine and countermine efforts are closely coordinated to incorporate counter-countermeasures as applicable. The Project Manager for Mines, Countermine and Demolitions monitors related programs to ensure no unnecessary duplication of effort within the Army or DOD. Development information on mines is coordinated and exchanged among the Services by the Tri-Service Joint Technical Coordination Group for Unpowered Weapons. The Department of Defense's Land Warfare monitors the scatterable mine program to avoid Service duplication.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
WAM Milestone II	1Q90
Wide Area Mine (WAM)Engineer Design Initiation	2Q90
WAM First Unit-Equipped (FUE) (Hand Emplaced)	1QFY94
WAM Milestone IIIA LRIP	4Q92
WAM Milestone III/Type Classification	4Q93

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604630A**

PE Title: **Advanced Tank Cannon (ATAC) System** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
XB80 Advanced Tank Cannon (ATAC) System Ammunition	- 0 -*	- 0 -*	26537	Cont	Cont
XB81 Advanced Tank Cannon (ATAC) System	- 0 -*	- 0 -*	19800	Cont	Cont
PE TOTAL	- 0 -*	- 0 -*	46337	Cont	Cont

*Developmental efforts funded in PE #0602624A, PE #0603004A, and PE #0603790D

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Tank Main Armament System program develops improved capabilities in tank cannons, ammunition and fire control. This program is key to the successful prosecution of the close battle under the Airland Battle concept. The effort associated with this PE will result in a new tank main armament system capable of firing a variety of munitions, the fire control and gun stabilization components required for this weapon system, and an automatic loader capable of sustaining rates of fire in the 8-12 rounds per minute range.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604630A** Project Number: **#XB80**

PE Title: **Advanced Tank Cannon (ATAC) System** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Advanced Tank Cannon (ATAC) System Ammunition

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
ATAC AMMO	- 0 -*	- 0 -*	26537	Cont	Cont

*Developmental efforts funded in PE #0602624A and PE #0603004A.

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Development of the XM964 Armor Piercing Fin Stabilized Discarding Sabot-Tracer (APFSDS-T) and XM965 High Explosive Multi-Purpose Tracer (HEMP-T) munitions will provide the kinetic and chemical energy munitions required for use in the XM291 Gun. These munitions will defeat the Threat postulated for the late 1990s.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS: This effort is not a new start. Through FY 1989 there have been three iterations of XM964 munitions tested with good results. Additionally, the XM964 and XM965 have been designed in accordance with internationally harmonized parameters. Contracts have been awarded for fabrication of test cartridges. FY 1990 efforts are devoted to completing test firing, design, and fabrication necessary to conduct the scheduled proof-of-principle demonstration in 4th Qtr FY 1990. Transition to full scale development in FY 1991 will concentrate on ammunition ballistics, proof-firing, dispersion, and penetration testing against various range targets. Accomplishments and plans relating to this program element follow:

(U) FY 1989 Accomplishments: Not applicable

(U) FY 1990 Planned Program: Not applicable

(U) FY 1991 Planned Program:

- **(U)** Transition to full-scale development
- **(U)** Conduct ammunition ballistics and proof firing testing
- **(U)** Conduct dispersion and penetration testing against various range targets

D. (U) WORK PERFORMED BY: In-house work performed by Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ; PM, Tank Main Armament Systems, Picatinny Arsenal, NJ; Ballistics Research Laboratory, Aberdeen Proving Ground, MD; and Test and Evaluation Command, Aberdeen Proving Ground, MD.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable
2. **(U) SCHEDULE CHANGES:** Not applicable
3. **(U) COST CHANGES:** Not applicable

F. (U) PROGRAM DOCUMENTATION: Draft Required Operational Capabilities document in staffing.

G. (U) RELATED ACTIVITIES: Development of the XM291 Gun (PE #0604630A/XB81) and Abrams Block Improvement Program (PE #0203735A/D330).

Program Element: **#0604630A** Project Number: **#XB80**
PE Title: **Advanced Tank Cannon (ATAC) System** Budget Activity: **#4**

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Negotiations are currently underway with representatives of the United Kingdom, Federal Republic of Germany and France for a formal memorandum of understanding under the auspices of the Senior National Representatives (Army) Quadrapartite Tank Main Armament Interoperability Working Group.

J. (U) MILESTONE SCHEDULE:

Milestone	Milestone Date
Proof-of-principle demonstration	4th Qtr FY 1990
FSED initiation	1st Qtr FY 1991
Type classification	(Classified)
Initial operational capability (IOC)	(Classified)

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0604630A
PE Title: **Advanced Tank Cannon (ATAC) System**
Project Number: #XB81
Budget Activity: #4

A. (U) RESOURCES: ($ in Thousands)
Project Title: Advanced Tank Cannon (ATAC) System

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
Advanced Tank Cannon (ATAC) System	- 0 -*	- 0 -*	19800	Cont	Cont

*Developmental efforts funded in PE #0602624A and PE #0603004A.

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Development of this Tank Main Armament System—composed of gun, automatic loader, and fire control—is mandated by requirements to evolve the full potential of conventional armament systems. The objective of this program is to field a main armament system of sufficient capability to defeat threat tanks postulated to appear before the end of the century.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS: This effort is not a new start. Through FY 1989, all efforts have been accomplished under the auspices of the Armament Research, Development and Engineering Center (ARDEC). Among these are the design and fabrication of two more guns and components for two autoloaders. In FY 1990, efforts to incorporate the cannon, autoloader, and fire control into an Abrams tank will continue with emphasis on completion of test firing, design, and fabrication to complete the proof-of-principle demonstration scheduled for 1990. A major objective in FY 1990 will be to achieve interim safety release of the gun and autoloader. In FY 1991, transition to full-scale development will occur and the program emphasis will be oriented on integration of the armament system into a tank. Accomplishments and plans relating to this program element follow:

(U) FY 1989 Accomplishments: Not applicable

(U) FY 1990 Planned Program: Not applicable

(U) FY 1991 Planned Program:
- **(U)** Transition to full-scale development
- **(U)** Initiate integration of armament system into a tank

D. (U) WORK PERFORMED BY: Computing Devices of Canada, Ottawa, Ontario, Canada; Cadiallic Gage, Warren, MI; General Dynamics, Warren, MI; General Electric, Burlington, VT. In-house — PM, Tank Main Armament Systems, Picatinny Arsenal, NJ; Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ; and Tank-Automotive Command, Warren, MI.

Program Element: **#0604630A** Project Number: **#XB81**
PE Title: **Advanced Tank Cannon (ATAC) System** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable
2. **(U) SCHEDULE CHANGES:** Not applicable
3. **(U) COST CHANGES:** Not applicable

F. (U) PROGRAM DOCUMENTATION: Draft required operational capabilities document in staffing.

G. (U) RELATED ACTIVITIES: Development of XM964 and XM965 munitions (PE #0604630A/XB80) and Abrams Block Improvement Program (PE #0203735A/D330).

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) None at this time.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Negotiations are currently underway with representatives of the United Kingdom, Federal Republic of Germany and France for a formal memorandum of understanding under the auspices of the Senior National Representatives (Army) Quadrapartite Tank Main Armament Interoperability Working Group.

J. (U) MILESTONE SCHEDULE:

Milestone	Milestone Date
Proof-of-principle demonstration	4th Qtr FY 1990
FSED initiation	1st Qtr FY 1991
Type classification	(Classified)
Initial operational capability (IOC)	(Classified)

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604709A**

PE Title: **Identification-Friend-or Foe (IFF)—Engineering Development**

Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D355	Positive Hostile Identification (PHID) — ED				
	16204	- 0 -	- 0 -	- 0 -	
D356	Forward Area Air Defense PHID — ED				
	- 0 -	15914	13859	Cont	Cont
D530	Cooperative Identification — ED				
	4887	6858	- 0 -	- 0 -	13043
PE TOTAL	21091	22772	13859		

In FY 1990, efforts from Project D355, Positive Hostile Identification (PHID), transition to Project D356, Forward Area Air Defense PHID, within this PE.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This PE provides for engineering development (ED) of devices and equipment to meet Army Air Defense Identification requirements. Program elements include: 1) development of signal processing techniques, equipment and system interfaces to provide Non-Cooperative Target Recognition (NCTR) devices for installation on Air Defense weapons and sensors; and 2) Army unique development of interfaces and installation kits for adaptation of the tri-Service Mk XV IFF (NATO Question and Answer (Q&A) IFF interoperable) interrogators for Army Air Defense sensors and transponders for selected Army Aviation platforms. Within this program element in FY 1989, threat materiel may be acquired and exploited to support development. In FY 1990 and FY 1991 threat materiel acquisition/exploition has been programmed in PE #0605709A/DC28 and will be executed upon authorization/appropriation.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D355 — Positive Hostile Identification — ED: This project is directed toward engineering development of critical technologies, fabrication of prototypes and interfaces, and integration of prototypes on Air Defense weapon and sensor platforms to provide positive hostile identification of aircraft. The ability of Air Defense weapons, especially Forward Area Air Defense (FAAD) weapons, to engage hostile targets exceeds the capability to visually identify the hostile targets. Consequently, weapons are either not employed in accordance with their maximum capabilities or high levels of fratricide must be accepted when the weapons are employed at maximum, Beyond Visual (Identification) Ranges.

(U) FY 1989 Accomplishments:

- **(U)** Continued engineering development, integration and technical testing of positive hostile identification (ID) technologies
- **(U)** Began application of selected technologies to additional weapon/sensor platforms
- **(U)** Integrated test devices with weapon systems to conduct additional technical and initial operational tests.

Program Element: **#0604709A**

PE Title: **Identification-Friend-or Foe (IFF)—Engineering Development**

Budget Activity: **#4**

(U) FY 1990 Planned Program: Not Applicable, transitions to Project D356.

(U) FY 1991 Planned Program: Not Applicable.

(U) Project D530 — Cooperative Identification ED: The ability of weapons to detect and engage targets exceeds the capability to visually identify potential targets. Mk XV IFF devices provide the capability to cooperatively identify friendly aircraft. This project provides for the Army unique development of interfaces and installation kits for application of the tri-Service Mk XV IFF interrogators to PATRIOT and FAAD Ground Based Sensors and Mk XV IFF transponders to Army Special Electronic Mission Aircraft (SEMA), excepting EH-60 and fixed wing aircraft. HAWK and EH-60 application is being developed in the core tri-Service Mk XV program managed by the USAF's Combat Identification Directorate. The tri-Service core Mk XV program began in 1979 with the objective of developing a U.S. version of the NATO interoperable Cooperative, Question and Answer (Q&A), IFF system.

(U) FY 1989 Accomplishments:

- **(U)** Assisted in obtaining core Mk XV program Milestone Decision Review (MDR) III Defense Acquisition Board (DAB) approval and awarding the Full Scale Engineering Development (FSED) contract
- **(U)** Initiated core program's HAWK and EH-60 interface design
- **(U)** Executed full scale engineering development (FSED) contract options for development of Army unique applications: PATRIOT and FAAD Ground Base Sensors

(U) FY 1990 Planned Program:

- **(U)** Program office will draw down the effort while capturing the lessons learned and the products of the developmental effort to date so as to make this material available to the department for any future IFF developments

(U) FY 1991 Planned Program:

- **(U)** Program terminated

(U) **Work Performed By:** Management of NCTR/PHID effort is assigned to Program Executive Officer (PEO) — Air Defense and Product Manager — FAAD Ground Sensors/Identification at Redstone Arsenal, AL. Contract execution is performed by the Electronic Warfare/Reconnaissance, Surveillance and Target Acquisition Center at Ft Monmouth, NJ. Technical oversight provided by the Night Vision/Electro-Optical Laboratory at Ft Belvoir, VA.; Armament Research and Development Center at Picatinny Arsenal, NJ.; and Missile Research and Development Center at Redstone Arsenal, AL. Program transferred to PEO Intelligence and Electronic Warfare on 1 October 1989. A Deputy Product Manager for Cooperative Identification and small staff is stationed at Wright Patterson AFB in Dayton, OH, detailed to the USAF CISPO.
Contractors include: Scope Electronics of Reston, VA; Texas Instruments of Dallas, TX; Georgia Institute of Technology in Atlanta, GA; Hazeltine Corporation of Greenlawn, NY; RCA of Morristown, NJ; Martin Marietta of Orlando, FL; Northrop Corporation of Anaheim, CA; ESL, INC. of Sunnyvale, CA; Biodynamics of Eugene, OR; Westinghouse Electronics Corporation of Baltimore, MD; Hughes Aircraft Company of Los Angeles, CA; Allied Bendix, Baltimore, MD; and Raytheon, Bedford, MA.

Program Element: **#0604709A**

PE Title: **Identification-Friend-or Foe (IFF)—Engineering Development**

Budget Activity **#4**

(U) Related Activities:

PE #0604741A (FAAD C^2I)
PE #0604215N (Support Equipment)
PE #0604725F (Combat Identification Systems)
There is no unnecessary duplication of effort within the Army or DOD. All combat identification related development is overseen by a tri-Service General Officer steering committee to synchronize Service identification developments and signature collection to avoid unnecessary duplication of effort. In addition, Mk XV activities are coordinated by the core program's Joint USAF lead Combat Identification Directorate.

(U) Other Appropriation Funds: (S in Thousands) Not Applicable

(U) International Cooperative Agreements: Pursuant to the objectives of the Nunn Amendment two memoranda of Understanding have been concluded on the Mark XV/NATO Identification System (NIS). The ten nations MOU, signed on 21 Oct 1986, provides for a general information exchange in order to determine where cooperation on NIS might be possible. The five nation (FR GE, IT, UK, US) MOU, signed on 20 Oct 1987, provides for close collaboration between those nations actually investing in the development of NIS in order to achieve interoperability, reduce duplications of effort and conduct combined testing. An additional MOU is near completion with Italy that will establish a US/IT industrial teaming arrangement for the joint development of common boxes.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604709A**
PE Title: **Identification-Friend-or Foe (IFF) — Engineering Development**
Project Number: **# D356**
Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Forward Area Air Defense Positive Hostile Identification (PHID) Engineering Development

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
Non-Cooperative Target Recognition (NCTR)	0	15914	13859	Cont	Cont

In FY 1990, efforts from Project D355, Positive Hostile Identification (PHID), transitions to Project D356, Forward Area Air Defense PHID, within PE

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The ability of weapons to detect and engage targets exceeds the capability to visually identify the targets. Positive Hostile Aircraft Identification devices developed will enable Air Defense Artillery, particularly Forward Area Air Defense (FAAD) weapons, to identify targets Beyond Visual (Identification) Range (BVR) and thus engage the targets at the maximum effective range of the weapon system. Emphasis is placed on passive technologies for Non-cooperative Target Recognition (NCTR) to enhance the weapon system effectiveness by employing the element of surprise

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments: Not Applicable

(U) FY 1990 Planned Program:

- **(U)** Conduct engineering development and integration of positive hostile identification (ID) application
- **(U)** Begin engineering development for additional FAAD weapon and sensor applications and high and medium altitude air defense applications
- **(U)** Conduct additional technical and operational tests
- **(U)** Award engineering contract

(U) FY 1991 Planned Program:

- **(U)** Continue engineering development and conduct additional operational tests for the initial applications to verify readiness for initial production
- **(U)** Continue development for additional applications
- **(U)** Prepare for transition to Low Rate Initial Production (LRIP) Electronic Support Measures (ESM) Signature Recognition for HAWK and Radar Signature Recognition for Pedestal Mounted Stinger (PMS)
- **(U)** Conduct development and operational testing

(U) Program Plan to Completion:

- **(U)** Conduct Production Verification Testing
- **(U)** Complete development and testing for additional weapon system applications

Program Element: #0604709A | Project Number: # D356
PE Title: **Identification-Friend-or Foe (IFF) — Engineering Development** | Budget Activity: #4

D. (U) WORK PERFORMED BY: The Electronic Warfare/Reconnaissance, Surveillance and Target Acquisition Center, Fort Monmouth, NJ, and Night Vision/Electro-Optical Laboratory, Fort Belvoir, VA are the principle laboratories. Program Management of PHID in full scale development and/or production, which will be used on air defense weapons, is performed by the Product Manager, Forward Area Air Defense (FAAD) Sensors and Identification, assigned the Program Executive Officer, Air Defense, Redstone Arsenal, AL

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not Applicable.
2. **(U) SCHEDULE CHANGES:** Not Applicable.
3. **(U) COST CHANGES:** $6.5 million was reprogramed from the Air Defense Non-Cooperative Target Recognition (NCTR) procurement program because of a delay in contract award

F. (U) PROGRAM DOCUMENTATION: Annex to Forward Area Air Defense Command, Control and Intelligence Required Operational Capability 08/86.

G. (U) RELATED ACTIVITIES:

- PE #0604215N (Support Equipment)
- PE #0604725F (Combat Identification Systems)
- PE #0603740A (Air Defense Command, Control and Intelligence (C2I — Advanced Development)
- PE #0604741A (Air Defense Command, Control and Intelligence Engineering Development)
- PE #0603790A (NATO Research and Development)

All combat identification related development is overseen by a tri-Service General Officer steering committee to synchronize service identification efforts and avoid unnecessary duplication of effort. The Mark XV IFF tri-Service chartered effort is designed to avoid duplication of cooperative identification efforts. Programs are coordinated by the Joint Combat Identification Systems Program Office (CISPO) with Air Force lead. A Trilateral Memorandum of Understanding to exchange technical information on the design and development of the NATO Identification System (NIS) was signed in May 1980 with the United Kingdom and the Federal Republic of Germany.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
Field Demonstrations/Evaluations/ Testing	2QFY1991
Field Demonstrations/Evaluations/ Testing	4QFY 1991

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0604710A
PE Title: Night Vision Systems — Engineering Development
Project Number: #DL70
Budget Activity: #4

A. (U) RESOURCES: ($ in Thousands)

Project Title: Night Vision Devices Engineering Development (ED)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DL70 — Night Vision devices Engineering Development	16381	19060	17726	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Night vision equipment provides the Army with the capability to locate, identify and engage targets under all battlefield conditions and at extended standoff ranges. The threat of numerical superiority is countered through exploitation of darkness and reduced visibility as an advantage on the battlefield. Efforts funded by this program element include the development of thermal devices for use with individual and crew served weapons, anti-armor missile systems, track vehicles and aircraft, and eyesafe laser range finders. Within this program element in FY 1990, threat materiel may be acquired and exploited to support development. In FY 1991 threat materiel acquisition/exploitation has been programed in Program Element #0605709A/DC28 and will be executed upon authorization/appropriation.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Continued engineering development (ED) for AN/VAS-3 Drivers Thermal Viewer (DTV)
- **(U)** Continued ED of the Miniature Eyesafe Laser Infrared Observation Set (MELIOS)

(U) FY 1990 Planned Program:

- **(U)** Complete ED for DTV
- **(U)** Continue ED for MELIOS
- **(U)** Prepare solicitation for Thermal Sight

(U) FY 1991 Planned Program:

- **(U)** Award ED contract for Thermal Weapon Sight (TWS)
- **(U)** Complete MELIOS ED
- **(U)** Initiate and complete technical and user test for MELIOS
- **(U)** Continue TWS ED

D. (U) WORK PERFORMED BY: In-house efforts accomplished by US Army Communications and Electronics Command (CECOM), Ft. Monmouth, NJ and the Center for Night Vision and Electro Optics (C/NVEO), Ft. Belvoir, VA. Government management responsibility is the Program Executive Officer for Intelligence and Electronics Warfare (PEO-IEW) and the Product Manager for Night Vision and Electro Optics (PM-NVEO). DTV is developed by Hughes Aircraft Corporation, El Segundo, CA. MELIOS is developed by Optic Electronics Corp. (OEC), Dallas, TX. Other contractors are to be determined.

Program Element: #0604710A | Project Number: #DL70
PE Title: **Night Vision Systems — Engineering Development** | Budget Activity: #4

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** Not applicable.

F. (U) PROGRAM DOCUMENTATION:

Drivers Thermal Viewer (DTV) — Materiel needs statement from the M1A1 Block 2 improvement	5/82
Miniature Eyesafe Laser Infrared Observation Set (MELIOS) — Required operational capability (ROC)	2/87
— Acquisition plan (AP)	11/87
Thermal Weapon Site (TWS) — Letter of agreement between Center for Night Vision and Electo Optics and U.S. Army Infantry School	5/83
-Acquisition plan	5/89
-Operational and organization (O&O) plan	9/89

G. (U) RELATED ACTIVITIES:
Program Element #0603710A (Night Vision Advanced Technology)
Program Element #0603774A (Night Vision Systems Advanced Development)
Program Element #0605709A (Exploitation of Foreign Items)
There is no unnecessary duplication of effort within the Army or Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) MILESTONE SCHEDULE: DTV — Transition into production in FY 1991
MELIOS — Engineering development contract from FY 1988 to mid FY 1991; testing from middle FY 1990 to middle FY 1991
TWS — Engineering development contract from FY 1990-FY 1993; testing from FY 1992-93

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604713A**

PE Title: **Combat Feeding, Clothing, and Equipment** Budget Activity **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D548 Military Subsistence Systems	984	1120	712	Cont	Cont
D668 Soldier Enhancement Program	- 0 -	17735	- 0 -	0	[illegible]
DC40 Unit/Organizational Equipment	- 0 -	688	1005	Cont	Cont
DL40 Clothing and Equipment	1447	3047	2711	Cont	Cont
PE TOTAL	2431	22590	4428		

B. (U) BRIEF DESCRIPTION OF ELEMENT: Develop improved unit/organizational equipment, clothing, individual equipment, fabric shelters, field service equipment, food and food service equipment to enhance soldier battlefield efficiency, survivability, and sustainment. New food items and food service equipment will be developed to meet high nutrition requirements and reduce total food service logistics support requirements for all services. Individual clothing and unit/organizational equipment items will be developed to lighten soldier loads, increase mobility and provide improved protection against environmental extremes and modern battlefield hazards. The hazards include chemical, biological, laser, thermal, and detection by state-of-the-art night vision devices. Initiate the Soldier Enhancement Program, per the direction of Congress, to accelerate the evaluation, test, and development of food, clothing, equipment and small arms which are lighter, sturdier, more comfortable, less complex to use and more likely to perform reliably under the rigors of combat.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D548 — Military Subsistence Systems: Develop, produce and field improved subsistence and subsistence preparation items to enhance soldier mobility, efficiency, sustainment and survivability.

(U) FY 1989 Accomplishments:

- **(U)** Type classified Mounted Ration Heating Device and Canteen Cup Stand components of Army Field Feeding System
- **(U)** Type classified the one burner, multi-fuel squad stove
- **(U)** Conducted technical feasibility test (TFT) of Multi-fuel Burner for field feeding to provide safe diesel fuel capability for field kitchens
- **(U)** Conducted operational testing of USMC Tray Ration Heating System

(U) FY 1990 Planned Program:

- **(U)** Type classify remaining components of Army Field Feeding System (AFFS)
- **(U)** Type classify joint Service multi-fuel (XM-3) burner system for field feeding
- **(U)** Transition Tray Ration Heating System to Marine Corps for procurement
- **(U)** Design and deliver prototype of Joint Service Medical Food Service System

Program Element #0604713A
PE Title **Combat Feeding, Clothing, and Equipment** Budget Activity #4

(U) FY 1991 Planned Program:

- (U) Conduct development test/operational test (DT/OT) of Joint Service Medical Food Service System
- (U) Design and develop improved food service equipment for Navy forces in the 1990's
- (U) Conduct engineering development of improved heating of Meals Ready To Eat (MRE) in the field (Joint Service)
- (U) Transition Joint Service Medical Food Service System to the Services for procurement

(U) Project DC40 — unit/organizational equipment: Develop new unit/organizational equipment and tentage to improve soldier mobility, sustainability and survivability. Work on unit/organizational equipment was previously accomplished in Project DL40. Projects have been restructured to segregate unit/organizational equipment from individual equipment.

(U) FY 1989 Accomplishments:

- (U) See project DL40 below

(U) FY 1990 Planned Program:

- (U) Begin development of new family of tents
- (U) Begin development of Maintenance Shelter
- (U) Begin development of Five Soldier Crew Tent (FSCT)
- (U) Begin development of nuclear/biological/chemical pre-planned product improvements (NBC-P3I)

(U) FY 1991 Planned Program:

- (U) Continue development and type classify the FSCT
- (U) Complete development of the SMT
- (U) Continue development of the new family of tents
- (U) Continue development of NBC-P3I

(U) Project DL40 — Clothing and Equipment: Develop new clothing and equipment items to improve soldier mobility, efficiency, (lighten the soldiers load) and survivability.

(U) FY 1989 Accomplishments:

- (U) Type classified Aircrew Uniform Integrated Battlefield (AUIB), 40mm Grenade Vest, Extreme Cold Weather Canteen and several other projects
- (U) Began development of Auxiliary Aviation Lighting
- (U) Completed engineering design of Intermediate Cold Wet Boot, and Aircrew Cold Weather Clothing System
- (U) Conducted physiological test of Mask Drinking System — Interim
- (U) complete technical test/user test (TT/UT) of several projects — Aircrew Battle Dress Uniform (BDU); Survival Armor Recovery System (SARVIP); Suit, Contamination Avoidance and Liquid Protection (SCALP); and Soldier Ground Insulator (SGI)

(U) FY 1990 Planned Program:

- (U) Type classify Aircrew BDU, SCALP, SGI and SARVIP
- (U) Conduct TT/UT on Non Prescription Eye Armor, Mask Drinking System, Communications/Aural Protective System (CAPS), Interim Cold/Wet Boot and 4 other projects
- (U) Initiate work on body armor system; individual countermine; Sun, Wind & Dust Goggles; Special Purpose TAP Hood; combat footwear; desert and Auxiliary Communications Aural Protective System (ACAPS)

Program Element: #0604713A
PE Title: **Combat Feeding, Clothing, and Equipment** Budget Activity: #4

(U) FY 1991 Planned Program:

- (U) Type classify Aircrew Cold Weather Clothing System, CAPS, Intermediate Cold/Wet Boot, Eye Armor Non-Prescription, Mask Drinking System Interim and Combat Soldiers Sleeping Bag
- (U) Conduct test on Special Purpose Toxicological Agent Protective (TAP) Hood; Sun, Wind & Dust Goggles; Auxiliary Aviation Lighting and combat footwear, desert
- (U) Begin engineering development on Multiple Threat Body Armor (MTBA), Intermediate Cold/Wet Glove

(U) Project D668 — Soldier Enhancement Program — to accelerate the identification, test, and evaluation, of food, clothing, equipment and small arms systems currently in the developmental process, and to identify alternate candidates to improve the survivability and leathality of ground combat soldiers. All candidates that successfully complete the primary evaluation stage and have a link to existing efforts will be transitioned into those efforts. Those candidates that are new within the developmental process, or require additional evaluation will be continued within this project

(U) FY 1989 Accomplishments: Not applicable.

(U) FY 1990 Planned Program:

- (U) Begin development and evaluation of the Laser Alarm Device for the Individual Soldier (LADIS)
- (U) Begin development and evaluation of ethnic rations and flameless ration heating devices. Initiate development/procurement of lightweight, improved ballistic/laser eye protection devices, helmets, body armor, chemical protection items and items to better protect the soldier in environmental extremes. Survey, in coordination with the U.S. Marine Corps, available state-of-the-art individual equipment used by the armies of the world. Procure promising candidates for field evaluation
- (U) Begin evaluation of commercial flashlights. Begin development and evaluation of methods to clear, destroy or neutralize antipersonnel mines and booby traps and two other programs
- (U) Begin development and evaluation of optics for rifles and the Assault Pack for the M-249 Squad Automatic Weapon (SAW) and three other programs

(U) FY 1991 Planned Program:

- (U) Transition the Assault Pack for the M-249 Squad Automatic Weapon to PE #0603802A, Weapons and Munitions Advanced Development
- (U) Complete concept evaluation of LADIS
- (U) Conduct field evaluation of ethnic and other rations
- (U) Conduct field evaluations of clothing, equipment and eye protection systems
- (U) Complete evaluation of commercial flash lights
- (U) Transition promising candidates for destruction/neutralization of antipersonnel mines, booby traps to PE #0603802A, for follow-on technical demonstrations

(U) **Work Performed By:** In-house work performed by US Army Natick Research, Development and Engineering Center, Natick, MA; The Project Manager for Clothing and Individual Equipment Woodbridge, VA; Project Office, Army Field Feeding, Ft. Belvoir, VA; US Army Aviation Research Laboratory, Fort Rucker, AL; Ballistic Research Laboratory, Aberdeen Proving Ground (APG), MD; US Army Test and Evaluation Command, APG, MD; US Army Chemical Research, Development and Engineering Center, APG, MD; U.S. Army Armament, Munitions and Chemical Command, Rock Island Arsenal, Il; U.S. Army Communications and Electronics Command, Ft. Monmouth, NJ Contractors are: Kem-Tek Inc., Linwood, PA; American Optical Corp., South Bridge, MA, Safetech Inc., Newton, PA; and Research Inc., Waynesville, NC.

Program Element: **#0604713A**

PE Title: **Combat Feeding, Clothing, and Equipment** Budget Activity: **#4**

(U) Related Activities:

PE #0601102A (Defense Research Sciences) relates to basic research

PE #0602786A (Logistics Technology) relates to exploratory development of clothing subsistence food, food service equipment and organizational equipment

PE #0603747A (Soldier Support Survivability) provides advanced development of clothing and individual equipment items, food, food service equipment and [illegible]

PE #0203751A (Special Operations Forces SOF Equipment) relates to development of clothing and equipment items, food and food service items

PE #0603802A, Weapons and Munitions Advanced Development

The DOD Food and Nutrition Research, Development, Test, Evaluation, and Engineering Program is established by DODD 3235.2-R. The Army is the Executive Agent for management of the tri-Service coordinated with Services effort. To prevent duplication, close coordination is maintained through joint Service working groups, joint Service agreements and circulation of requirements documents of clothing and individual equipment item development. DOD Explosive Ordnance Disposal Board is joint Service monitor of Self Contained Toxic Environment Protective Outfit (STEPO). Ballistic/Laser Eye Armor is coordinated with the DOD Laser Hardened Materiels and Structures Group, Multi-Service Program for Advanced Concepts in Laser Eye Protection, and Annual Conference on Lasers on the Modern Battlefield.

(U) Other Appropriation Funds: ($ in Thousands) Not applicable.

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604715A**

PE Title: **Non-System Training Devices — Engineering Development** Budget Activity **#4**

A. (U) RESOURCES: (S in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D241 Non-System Training Devices Combined Arms	15034	7672	16825	Cont	Cont
D573 Project Manager Training Devices and Naval Training Systems Center Support	7190	8171	8984	Cont	Cont
D574 Combined Arms Tactical Trainer	- 0 -	- 0 -	6581	Cont	Cont
PE TOTAL	22224	15843	32390		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This continuing program provides for engineering development of Non-System Training Devices to support general military training and training on more than one item/system, as compared with System Devices that are developed in support of a specific item/system. Modern weapon systems are being integrated into the force at unprecedented rates, and the Army is faced with increased constraints on people, dollars, time and real estate in a training environment where ammunition and fuel costs continue to rise. Training devices and training simulation provide force multipliers that can improve combat effectiveness by providing realistic training scenarios while helping to control rapidly escalating costs. Maintaining the combat effectiveness of Army personnel is the key to maintaining a ready force. This combat effectiveness can best be achieved by innovative, efficient and results oriented training. The major thrust in development of new training devices is to maximize the transfer of knowledge, skills and experience from the training situation to a combat situation. Improved training devices, available through modern technology, must continue to be developed to provide the training required to prepare US soldiers to fight and defeat a numerically superior adversary. The Combined Army Tactical Trainer Program (D574) is not a new start as it was previously programmed within the Procurement Appropriation. The program has been transferred to RDT&E consistent with an Army/audit agency finding concerning Non Developmental Item (NDI) acquisition.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D573 — Project Manager for Training Devices and Naval Training Systems Center Support: This continuing project funds the support of Project Manager for Training Devices (PM TRADE) personnel and a proportionate Army share of the operating costs of the Naval Training Systems Center (NTSC) through an Inter-Service Support Agreement which is reviewed annually.

(U) FY 1989 Accomplishments:

- **(U)** Continued funding PM TRADE personnel and NTSC support

(U) FY 1990 Planned Program:

- **(U)** Continue funding PM TRADE personnel and NTSC support

(U) FY 1991 Planned Program:

- **(U)** Continue funding PM TRADE personnel and NTSC support

(U) Project D574 – Combined Arms Tactical Trainer: The Combined Arms Tactical Trainer (CATT) is a concept which envisions a training environment where all the elements of the combined arms battlefield can be simulated and exercised at one time. The simulated environment selectively emulates equipment capabilities and establishes an environment which gives maneuver forces the opportunity to practice the art of sychronizing all applications of combat power without regard

Program Element: #0604715A

PE Title: **Non-System Training Devices — Engineering Development** Budget Activity: #4

for peacetime restrictions of environment, economics, or safety. It further envisions a training strategy in which units can conduct training at home station between field exercises. The Army will not buy CATT. It will buy a family of trainers based on proponent requirements. The common element will be interoperability on the network and database. Thus, helicopter modules at Fort Rucker will be able to operate, via long haul network, with tank and Bradley modules at Fort Knox or Grafenwoehr. These trainers will allow soliders to practice, repetitively, techniques which if performed on real equipment, would be too hazardous, time-consuming, and expensive. These trainers enhance training realism and allow soldiers and units to learn tactical combat lessons on maneuver, command and control, and how to shoot without being killed, lessons heretofore learned only at the cost of soldiers' lives. The first two trainers in the CATT series are the Close Combat Tactical Trainer (CCTT) and the Aviation Combined Arms Tactical Trainer (AVCATT). Others will be added as proponents define their requirements.

(U) FY 1989 Accomplishments:

- **(U)** Completed DARPA proof-of-principle

(U) FY 1990 Planned Program:

- **(U)** Perform in-house effort leading to full scale engineering development contract award in FY 91. This program is not a new start as it was previously programmed within the procurement appropriation. An Army Audit Agency finding determined that a non-developmental item (NDI) integration strategy is inappropriate. In addition, the significance of the changes in the requirements documents necessitate an RDT&E effort. Procurement funds have been transferred to perform the effort

(U) FY 1991 Planned Program:

- **(U)** Initiate full-scale engineering development

(U) Work Performed By: SIMNET — DARPA; CCTT — to be selected.
In-house activities are performed by personnel of the Project Manager for Training Devices (PM TRADE) and the Naval Training System Center, Orlando, FL.

(U) Related Activities:
PE #0602727A (Non-System Training Device Technology)
To preclude duplication of effort, this project is closely coordinated with other Services through Training and Personnel Technology Conferences, a Joint Service Technical Coordinating Group, worldwide staffing of Training Device Requirements, and collocation of the Project Manager for Training Devices with the Naval Training Systems Center and the Defense Training and Performance Data Center in Orlando, FL. There is no unnecessary duplication of effort within the Army or the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not applicable.

(U) International Cooperative Agreements: Not applicable..

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604715A** Project Number: **D241**

PE Title: **Non-System Training Devices — Engineering Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Non-System Training Devices Combined Arms

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
NSTD Combined Arms	15034	7672	16825	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This continuing project is used to develop prototype training devices to support combined arms (Infantry, Armor, Aviation, Air Defense, Artillery, Engineer, Chemical, and support troops) training and multisystem training within the Army, to include the Reserve Components. The purpose of this project is to improve the effectiveness and efficiency of Army training. This is done by developing training devices which transfer to trainees the knowledge, ability, and experience required to fight outnumbered and win on the modern battlefield; (e.g. the Corps Battle Simulation is a command and control system used to train corps commanders, major subordinate commanders and major subordinate elements in the conduct of Deep Operations/Air Land battle operations; and Simulated Area Weapons Effects for Nuclear, Biological and Chemical (NBC) which provides tactical engagement interface with Multiple Integrated Laser Engagement System and individual and unit training in various NBC type environments.) Additionally, this project provides for the development of maintenance simulators such as the Signal Intelligence/Electronic Warfare Maintenance Trainer. This simulator will provide individual training for the maintenance of complex, computer based strategic signal intelligence systems. Devices developed under this project will enable the Army to train the collective unit to obtain the synergistic results which occur when a unit's weapons and support systems are employed in their respective battlefield roles. Utilizing modern technology, these devices will enhance training effectiveness while minimizing the requirements for scarce resources.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Completed development of the Simulated Area Weapons Effects For Mine Effects Simulator (SAWE-MES)
- **(U)** Continued development of the Guard Unit Armory Device For Full Crew Interactive Simulation-Armor/Artillery (GUARDFIST)
- **(U)** Continued development of the Deep Battle Integration Training (DBIT)
- **(U)** Continued development of Air Ground Engagement System (AGES) II
- **(U)** Completed development of Simulated Area Weapons Effects For Indirect Fire-Radio Frequency (SAWE-RF)
- **(U)** Initiated development of the Nuclear Biological Chemical Persistent Chemical Agent Simulant/Chemical Agent Disclosure Solution (PCAS/CADS)
- **(U)** Initiated development of the Simulated Area Wpns Effects for Indirect Fire- Global Positioning System (SAWE-GPS)

(U) FY 1990 Planned Program:

- **(U)** Complete development of the AGES II
- **(U)** Complete development of the GUARDFIST
- **(U)** Continue development of the SAWE-GPS
- **(U)** Complete development of the DBIT
- **(U)** Initiate development of the Sigint/EW Maintenance Trainer (SEMT)

Program Element: #0604715A | Project Number: D241
PE Title: **Non-System Training Devices — Engineering Development** | Budget Activity: #4

- (U) Continue development of the PCAS/CADS

(U) FY 1991 Planned Program:

- (U) Complete development of PCAS/CADS
- (U) Continue development of the SEMT
- (U) Initiate development of Combat Service Support Training Simulation System (CSSTSS)
- (U) Initiate development of the Simulated Area Weapons Effects for Nuclear Biological Chemical for Casualty Assessment System (CAS)

D. (U) WORK PERFORMED BY: In-house activities are performed by the Naval Training Systems Center Orlando, FL. Contractors are Fairchild, Syosset, NY; Jet Propulsion Laboratories Pasadena CA and Daedalean, Inc., Woodbine, MD.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Program has been restructured in line with fiscal and program priorities. These changes necessitated a deferral of program starts and a stretching of program schedules.
2. **(U) SCHEDULE CHANGES:** Described above.
3. **(U) COST CHANGES:** Described above.

F. (U) PROGRAM DOCUMENTATION: Not applicable. It is not feasible to list program documentation because of the quantity and variety of training devices in this project.

G. (U) RELATED ACTIVITIES:

- PE #0602727A (Non-System Training Device Technology)
  To preclude duplication of effort, this project is closely coordinated with other Services through Training and Personnel Technology Conferences, a Joint Service Technical Coordinating Group, worldwide staffing of Training Device Requirements, and collocation of the Project Manager for Training Devices with the Naval Training Systems Center (NTSC) and Defense Training and Performance Data Center (TPDC) in Orlando, FL. There is no unnecessary duplication of effort within the Army or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Other Procurement, Army (NA0100)	98799	123835	101423

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

	Contract Award	Test Complete	Ready For Use
• (U) SAWE-NBC-I	4Q90	3Q92	2Q93
• (U) SAWE-GPS	3Q89	1Q91	4Q92
• (U) DBIT	Various subprograms with multiple milestones		
• (U) SEMT Phase I	2Q90		NA
Phase II	2Q91	2Q92	2Q92
• (U) SAWE-NBC-II	Various subprograms with multiple milestones		

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0604716A (TIARA)
PE Title: **Terrain Information — Engineering Development**
Project Number: #D579
Budget Activity: #5

A. (U) RESOURCES: ($ in Thousands)
Project Title: Field Army Mapping Systems — Engineering Development

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DTSS/QRMP	6412	12731	10757	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This PE funds development of two systems, the Digital Topographic Support System (DTSS), and the Quick Response Multicolor Printer (QRMP). The current terrain analysis, topographic support and reproduction support, provided by Army Engineer Terrain Teams, are slow, labor intensive processes. These current processes do not and cannot meet the needs of the battlefield commander for rapid terrain information and graphic product generation. The DTSS will automate the updating and processing of terrain information into terrain analysis products for rapid dissemination within the Command and Control System. The QRMP will provide rapid reproduction of up-to-date hard copy topographic documents.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- (U) DTSS & QRMP full scale engineering development (FSED) contracts continued
- (U) DTSS software critical design review (CDR) #2
- (U) DTSS hardware integration
- (U) Developed DTSS software code
- (U) Conducted DTSS Reliability Quality Assurance Test
- (U) Initiated DTSS hardware environmental testing
- (U) Initiated DTSS software testing

(U) FY 1990 Planned Program:
- (U) DTSS & QRMP FSED contracts continue
- (U) Complete Digital Topographic Support System (DTSS) hardware environmental testing
- (U) Complete DTSS software testing
- (U) Quick Response Multicolor Printer (QRMP) preliminary design review (PDR)
- (U) Integrate and test DTSS software/hardware
- (U) Initiate DTSS Pre-Planned Product Improvement (P^{3}I) program
- (U) Conduct DTSS government technical test
- (U) Initiate DTSS operational test

(U) FY 1991 Planned Program:
- (U) DTSS & QRMP full scale engineering development (FSED) contracts continue
- (U) Complete DTSS operational test
- (U) Continue DTSS P^{3}I program
- (U) Conduct DTSS production decision in-process review (IPR)
- (U) Quick Response Multicolor Printer (QRMP) critical design review

Program Element: #0604716A (TIARA) Project Number: #D579
PE Title: **Terrain Information — Engineering Development** Budget Activity: #5

D. (U) WORK PERFORMED BY: In-house work for the DTSS and the QRMP is accomplished at the U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA. The DTSS contractor is Loral Defense Systems Division, Akron, OH. The QRMP contractor is Xerox Corp., Pasadena CA.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not Applicable.
2. **(U) SCHEDULE CHANGES:** Not Applicable.
3. **(U) COST CHANGES:** Not Applicable.

F. (U) PROGRAM DOCUMENTATION:

Document	DTSS
Letter of Agreement (LOA)	01/82
Operational & Organizational (O&O) Plan	08/85
Acquisition Stragtegy	12/85
Decision Coordinating Package (DCP)	10/86
Required Operational Capability (ROC)	10/86
Integrated Logistic Support Plan (ILSP)	05/87
Test & Evaluation Master PLAN (TEMP)	04/88

Document	QRMP
Letter of Agreement (LOA)	08/79
Operational & Organizational (O&O) Plan	07/85
Required Operational Capability (ROC)	12/86
Integrated Logistic Support Plan (ILSP)	02/87
Acquisition Stragtegy	09/87
Test & Evaluation Master PLAN (TEMP)	09/87
Decision Coordinating Package (DCP)	09/87

G. (U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within DOD.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
Digital Topographic Support System (DTSS):	
—Reliability/Quality Test	4QFY89
—System Delivery	3QFY90
—Technical Test	3QFY90
—Initial Operation Test & Evaluation	4QFY90
—Type Classification In-Process Review (IPR)	3QFY91
—Production Contract	1QFY92
—First Article Test	1QFY93
—First Unit Equipped	3QFY93
Quick Response Multicolor Printer (QRMP):	
—System Delivery	4QFY92
—Technical Test	2QFY93

Program Element: **#0604716A (TIARA)** Project Number **#D579**

PE Title: **Terrain Information — Engineering Development** Budget Activity **#5**

—Initial Operation Test & Evaluation	3QFY93
—Type Classification IPR	1QFY94
—Production Contract	3QFY94
—First Article Test	3QFY95
—First Unit Equipped	1QFY96

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604723A (TIARA)**
PE Title: **Special Purpose Detectors** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DL79 Mobile Army Ground Imagery Interpretation Center (MAGIIC)	477	478	507	Cont	Cont

B. (U) BRIEF DESCRIPTION OF ELEMENT: This PE supports developmental software improvements (Product Improvement Program (PIP)) to the Mobile Army Ground Imagery Interpretation Center (MAGIIC), AN/TYQ-11(V)4, procured as an add-on to an Air Force procurement in FY 1978. The MAGIIC consists of automated light tables with associated optics, a measuring system, a map and overlay display unit and a computer for message preparation and data storage/manipulation. The MAGIIC is used to automate hardcopy imagery intelligence (IMINT) interpretation and exploitation functions. Upon transition to Air Force softcopy sensors, functional responsibility of MAGIIC's mission and capabilities will transition into the Joint Service Imagery Processing System (JSIPS). The combat information is provided to tactical intelligence fusion systems. Six MAGIIC systems currently exist, of which five support Intelligence and Security Command's (INSCOM) Echelons above corp (EAC) IMINT operations and one is in support of XVIII Airborne Corps. Improvements to the MAGIIC software are required to make the MAGIIC totally compatible with the Joint Interoperability of Tactical Command and Control Systems (JINTACCS), interoperable with the All Source Analysis System/Center, and to ensure that all hard copy imagery intelligence (IMINT) from photographic, radar, and infrared sensors of enemy threat activities can be exploited.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project DL79 — MAGIIC
This project supports developmental software improvements to the Mobile Army Ground Imagery Interpretation Center (MAGIIC), AN/TYQ-11(V)4. Improvements to the MAGIIC software are required to make the MAGIIC totally compatible with the recent interface change proposals (ICPs) to US message text formats and KG-84A crypts upgrade.

(U) FY 1989 Accomplishments:

- **(U)** Continued baseline support funding for joint software support provided by HQ Tactical Air Command (TAC) of the US Army Intelligence and Security Command (INSCOM) assigned and manned Mobile Army Ground Imagery Interpretation Center (MAGIIC)'s
- **(U)** Continued to maintain Army unique software support, configuration control and interface upgrades for the MAGIIC in support of XVIII AB Corps

(U) FY 1990 Planned Program:

- **(U)** Provide minimum essential development and interface baseline configuration control and software maintenance support for continuity of operations

(U) FY 1991 Planned Program:

- **(U)** Provide minimum essential development and interface baseline configuration control and software maintenance support for continuity of operations.

(U) Work Performed By: Contractor: COMTEC, Inc., Langley, VA. In-house development agencies: Electronic Warfare/Reconnaissance, Surveillance and Target Acquisition Center (EW/RSTA) of the US Army Electronics Communication and Electronics Command (CECOM) is responsible for the in-house development effort with guidance from the Center for Software Engineering (CSE),

Program Element: **#0604723A (TIARA)**
PE Title: **Special Purpose Detectors** Budget Activity: **#4**

CECOM, Ft. Monmouth, NJ. Software maintenance for the baseline master system is provided by the Software Support Center, HQ, Tactical Air Command (TAC) (USAF), Langley, VA.

(U) Related Activities:
This effort is a joint program with the US Marine Corps Program Element #0206626M (Marine Air Command/Control/Communications Systems) and US Air Force Program Element #0207431F (Tactical Air Intelligence System Activities). Control of software changes is managed under the Computer Program Configuration Sub Board (CPCSB) chaired by the Air Force, which meets quarterly to review and approve changes to the system software. Implementation of changes is accomplished by the Software Support Center at Headquarters, TAC, Langley AFB, Va. This work is coordinated throughout the Department of Defense and National Intelligence agencies to assure no unnecessary duplication of effort. MAGIIC efforts do not duplicate or conflict with Joint USAF/USA/USMC program for Joint Service Imagery Processing System (JSIPS).

(U) Other Appropriation Funds: ($ in Thousands) Not applicable.

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604740A (TIARA)**
PE Title: **Tactical Surveillance System-Engineering Development** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF ELEMENT: This PE supports engineering development (ED) work directed at meeting the deep intelligence and targeting needs of tactical commanders as stated in Field Manual (FM) 100-5 and airland battle tactics to fight outnumbered and win. Specific tactical imagery exploitation developments are under the Army's Tactical Exploitation of National Capabilities (TENCAP) program. Efforts include: the upgrade of the XVIII Airborne Corps' Imagery Exploitation System (IES) (formally Digital Imagery Test Bed (DITB)) which has supported the contingency missions of the XVIII Airborne Corps since 1979 to include a new display van with three imagery analyst-softcopy work stations and upgrade of communications capabilities; upgrade the U.S. Army Europe (USAREUR) IES (formally Echelon Above Corps Imagery Test Bed (EACTB)) with the installation of electronic counter countermeasure equipment (ECCM); and continuing the development and testing of the Tactical Radar Correlator (TRAC). Efforts to develop a secondary dissemination system which allows for the transmission of IES and the Imagery Processing and Dissemination System (IPDS) products to remote locations will continue. Additional program content requires special access. Further details may be found at the TOP SECRET Special Access level in the Tactical Intelligence and Related Activities (TIARA) Congressional Justification Book (CJB), Volume VI, and the TENCAP Master Plan.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) FY 1989 Accomplishments:

- **(U)** Completed conversion to new data dissemination system for both IES
- **(U)** Initiated efforts on developing and testing a secondary dissemination capability having minimum essential functions and options

(U) FY 1990 Planned Program:

- **(U)** Continue modifications to include installation of success radios for secondary imagery dissemination capabilities to the tactical force
- **(U)** Install new display (softcopy) van at the XVIII ABN Corps' IES
- **(U)** Additional program detail requires special access and may be obtained per paragraph B above

(U) FY 1991 Planned Program:

- **(U)** Conduct User Testing of the initial (ADV DEV) model of TRAC
- **(U)** Perform product improvement on fielded IES to include supportable Tactical Satellite Communication System (TSCS) at XVIII ABN Corps' IES

(U) Work Performed By: In-house development agency: US Army Engineer Topographic Laboratories, Ft Belvoir, VA. Contractors: Aerospace Corp., El Segundo, CA; DBA, Inc., Melbourne, FL and SAIC, Dayton, OH.

(U) Related Activities:
Program Element #0603730A (Tactical Surveillance System-Advanced Development)
Technological developments designed to shorten the time required to collect and disseminate information are related to this activity. These areas include automated reconnaissance procedures, communications technologies, tactical identification and positioning, and use of satellite communications. This work is closely coordinated with the offices of the Secretary of Defense, Navy and Air Force TENCAP offices, the National Security Agency, Defense Intelligence Agency, and the Army Materiel Command to preclude duplication of effort.

Program Element: **#0604740A (TIARA)**

PE Title: **Tactical Surveillance System-Engineering Development** Budget Activity **#4**

(U) Other Appropriation Funds: (S in Thousands) Not applicable

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604741A**

PE Title: **Air Defense Command, Control and Intelligence — Engineering Development**

Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D126	FAAD Command and Control Engineering Development				
	87502	49103	86687	Cont	Cont
D421	FAAD Aerial Sensor Engineering Development				
	1	- 0 -	- 0 -		
PE TOTAL	87503	49103	86687		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Forward Area Air Defense Command and Control (FAAD C^2) program includes the command and control (C^2) software development and the effort required to integrate this software with (1) Army Tactical Command and Control Systems Common Hardware/Software (ATCCS CHS) processors, displays and associated peripherals, (2) Army Data Distribution Systems (ADDS), (3) air defense sensors, (4) FAAD weapon systems, and (5) combined arms interfaces. *The Forward Area Air Defense Command, Control, and Intelligence (FAAD C^2I)* system will provide command and control of FAAD weapon systems, track information to combined arms, and will enable the integration of air defense assets to counter the low altitude air threat over and beyond a division's area of operations. The command and control architecture integrates command posts, weapons (Line-of-Sight, Non Line-of-Sight, air-defense capable combined arms), air defense sensors (ADS) (ground and masked target, using passive and active technologies) with their aircraft identification equipment (active and passive, friendly and hostile identification), and required communications to provide an integrated FAAD system capable of protecting the division from air attack. This architecture supports the commander's scheme of maneuver through vertical integration with force level control systems. Previously this PE included all FAAD Sensor Systems but the Program has been separated and is as displayed in PE #0604820A for FY 1990 and beyond. Within this program element in FY 1989, threat materiel may be acquired and exploited to support development. In FY 1990 and FY 1991 threat materiel acquisition/exploition has been programed in PE #0605709A/DC28 and will be executed upon authorization/appropriation.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D421 — FAAD Aerial Sensor Engineering Development:

(U) FY 1989 Accomplishments:

- **(U)** Continuation of system definition efforts

(U) FY 1990 Planned Program: No funded program

(U) FY 1991 Planned Program: No funded program

(U) Work Performed By: Program Management is performed by the Project Manager, Air Defense Command and Control Systems (ADCCS), assigned to the Program Executive Officer, Command and Control Systems (PEO CCS), Ft Monmouth, NJ. Concept Definition/System Design is performed by the Army Missile Laboratory at US Army Missile Command (MICOM). Other contracted efforts will be performed by competitively selected contractor(s). Air Defense Sensors full scale development will be managed by Program Executive Officer, Intelligence and Electronic Warfare, Vint Hill Farms, Warrenton, VA.

Program Element: **#0604741A**

PE Title: **Air Defense Command, Control and Intelligence — Engineering Development**

Budget Activity **#4**

(U) Related Activities:

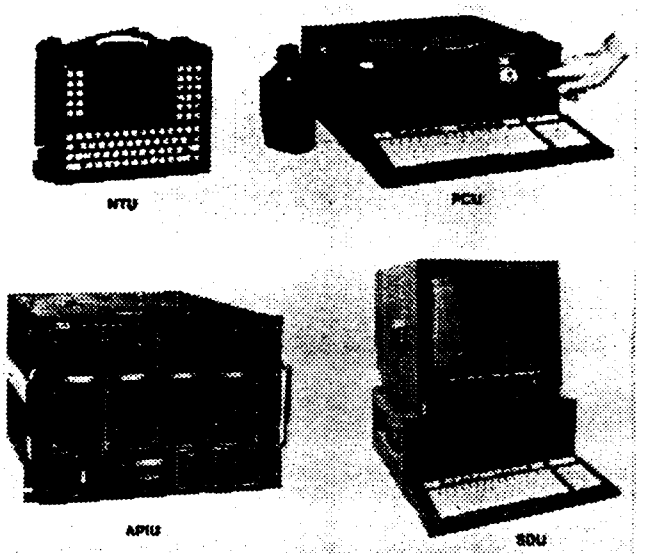
Program Element #06037440A (Air Defense C^2I Advanced Development)
Program Element #0603757A (FAAD Systems)
Program Element #0603706A (Identification-Friend-or-Foe (IFF) — Advanced Development)
Program Element #0604709A (IFF — Engineering Development)
Program Element #0203739A (Air Defense C^2I Modifications)
Program Element #0604820A (Air Defense Sensors)
Program Element #0203746A (PATRIOT modifications)
Program Element #0203731A (SAM HAWK/HAWK Improvement Program)
Program Element #0604702A (Joint Tactical Information Distribution System)

(U) Other Appropriation Funds: ($ in Thousands) Not applicable

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604741A**
PE Title: **Air Defense Command, Control and Intelligence-Engineering Development**
Project Number: **D126**
Budget Activity: **#4**
Project Title: **FAAD Command and Control Engineering Development**



POPULAR NAME: **FAADC²**

A. (U) SCHEDULE/BUDGET INFORMATION: *($ In Thousands)*

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		Program Restructure Letter Contract Jan 90	Definitize Letter Contract Award Apr 90		MDR III May 93
Engineering Milestones		Critical Design Walk Through (CDW) I Mar 89/II May 89	CDW III Dec 89	CDR I Nov 90 CDR II Jul 91 PCA I Jul 91	PCA II Jun 92 PCA III Jun 93
T&E Milestones				JTIDS 2M IOTE - Jun 91	EUT&E Mar 93 IOTE Mar 94
Contract Milestones					FSP C/A Mar 95
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		42294	31112	41987	
Support Contract		13064	9700	22100	
In-House Support		10994	6000	9700	
GFE/ Other		21150	2291	12900	
Total		87502	49103	86687	Cont

Program Element: #0604741A
PE Title: **Air Defense Command, Control and Intelligence-Engineering Development**
Project Number: **D126**
Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Forward Area Air Defense (FAAD) Command and Control (C^2) program addresses the need for automated command and control. Because of the improved capabilities of both the threat aircraft and FAAD weapons, the present Division Air Defense manual control capability does not support the force commander's need to manage air defense forces and use air defense weapons effectively. The shortfalls in the flow of air battle information is the result of incomplete and inaccurate engagement information to FAAD gunners by FAAD commanders and poor quality sensor data for the entire system. The impact of these shortfalls is missed opportunities to engage enemy aircraft and increased risk to friendly aircraft. A FAAD command and control system is necessary to improve the effectiveness of FAAD weapons and overcome present shortfalls by integrating weapons, sensors and aircraft identification systems through an automated command and control system. The FAAD C^2 will consist of nondevelopmental computers, displays, and printers that are common to the Army Tactical Command and Control System (ATCCS), nondevelopmental ground sensors and required software. The system will be fully integrated with other FAAD elements and ATCCS and will use the Army Data Distribution System (ADDS) for data transfer. The system will provide automation for exchange of Air Defense Artillery (ADA) force operations information, dissemination and acknowledgement of ADA engagement operations data and air track data (alerting and cueing) from dedicated and remote sensors sources.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** FAADC^2: Effort continued on the detailed system design and development around the ATCCS Common Hardware delivered in Dec 88. The development program was restructured to provide fielding of an initial system capability (Engagement Operations) to be fielded in CONUS.
- **(U)** Ground Based Sensor (GBS): The Request for Proposal (RFP) was issued and one proposal received. After evaluating the proposal the Government terminated the solicitation and is initiating a new RFP
- **(U)** Initiated action to separate GBS funding from FAADC2 funding.

(U) FY 1990 Planned Program:

- **(U)** FAADC^2:
  - System hardware and software development effort will continue
  - Production ATCCS Common Hardware to support the development effort is scheduled for delivery in Mar 90
  - Laboratory demonstration of an early version of the software
- **(U)** GBS: *See Program Element #0604820A (Air Defense Sensors)*

(U) FY 1991 Planned Program:

- **(U)** Begin assembly and test of subsystems and integration with weapon systems
- **(U)** Conduct initial C^2 Technical Test
- **(U)** Continue Range Data Distribution System Support
- **(U)** Prepare for Logistics Demonstration
- **(U)** Perform the initial Formal Qualification Test
- **(U)** Conduct Critical Design Review (CDR) II
- **(U)** Accept delivery of the 1st and 2nd mobile Post Deployment Realtime Interactive Simulator System (PRISS)

Program Element: #0604741A | Project Number: D126
PE Title: **Air Defense Command, Control and Intelligence-Engineering Development** | Budget Activity: #4

(U) Program Plan to Completion:

- (U) Technical Testing and Operational Testing will be completed
- (U) Milestone III Decision Review will be conducted
- (U) First Unit Equipped (FUE) for initial system is scheduled for FY 1993
- (U) FUE for the objective system is scheduled for FY 1994

D. (U) WORK PERFORMED BY: Program Management is performed by the Project Manager, Air Defense Command & Control Systems (ADCCS), assigned to the Program Executive Officer, Command & Control Systems (PEO CCS) Ft. Monmouth, N.J. FAADC^2 Systems Integration and Software Development Contractor is TRW, Redondo Beach, CA. Ground Based Sensor Product Management performed by PM-Ground Based Sensor and Identification Systems, Program Executive Officer Intelligence & Electronic Warfare Systems, Vint Hill Farms, Warrenton, VA.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** In Nov 1988, the Office, Secretary of Defense (OSD) authorized the restructuring of the FAAD C^2 FSD program to allow for a fieldable system vice a demonstration system.
2. **(U) SCHEDULE CHANGES:** The schedule milestones reflect the restructured program.
3. **(U) COST CHANGES:** The change in the FY 1990 budget from $71,691 to $49,103 was a result of a Congressional reduction. Funding adjustments have been made to accommodate the increased scope of the restructured program in FY 91 and 92.

F. (U) PROGRAM DOCUMENTATION:

FAAD C2I Required Operational Capability (ROC)	7/86
Decision Coordinating Paper (DCP)	7/86
Secretary of Defense Decision Memorandum (SDDM)	8/86
Acquisition Decision Memorandum (ADM) restructuring program	3.89

G. (U) RELATED ACTIVITIES:

- PE #0604820A (Air Defense Sensors)
- PE #0603740A (Air Defense C^{2}I — Advanced Development)
- PE #0603757A (FAAD System)
- PE #0603706A (IFF — Advanced Development)
- PE #0604709A (IFF — Engineering Development)
- PE #0203739A (Air Defense C^{2}I Modifications)
- PE #0604818A (Army Tactical C3I Systems Engineering)
- PE #0603713A (Army Data Distribution System — ADDS)

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable

J. (U) TEST AND EVALUATION DATA: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604746A**
PE Title: **Automatic Test Equipment Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D537 Intermediate Forward Test Equipment (IFTE)	4709	1092	913	- 0 -	
DL10 Electro-Optic Test Equipment	1164	3795	3007	Cont	Cont
DL59 Test Program Sets Transfer	1928	4232	4398	Cont	Cont
PE TOTAL	7801	9119	8318		

B. (U) BRIEF DESCRIPTION OF ELEMENT: State-of-the-art weapon and support system electronic circuitry has rapidly outpaced the capability of the Army's present inventory of Test, Measurement and Diagnostic Equipment (TMDE) to adequately test weapon systems. To meet required operational readiness standards in sophisticated systems, state-of-the-art, modular, reconfigurable automatic test equipment (ATE) that can satisfy the largest possible test requirements across each equipment commodity area is needed. A requirement exists at Unit level of maintenance for ATE capable of fault isolating to line replaceable units (LRU) in combat vehicles. ATE must be simple to operate and expandable across the combat vehicle commodity line. An urgent requirement exists for maintenance at Division and Echelons Above Corp (EACs) to support complex communications and electronics-intensive commodities such as missiles, aircraft and combat vehicles. This ATE must be capable of repairing LRUs as well as screening Printed Circuit Boards. In addition, maintenance units must be capable of dispatching contact teams to forward areas with portable automatic test equipment to perform on-line testing and diagnosis of weapon systems to the LRU level. The Contact Test Set will perform this mission. The Integrated Family of Test Equipment (IFTE) Project and the Electro-Optic Test Facility Project will meet this mission need in the 1990-1999 timeframe. To meet the Army's requirement for general purpose testers at division level maintenance, non-developmental approaches are utilized to determine requirements, identify and evaluate candidate commercial items for acquisition. To conserve the Army's investment in Test Program Sets (TPS) and maintenance methods/procedures, state-of-the-art technologies in expert systems and artificial intelligence are being developed for application to paperless maintenance and trouble shooting manuals as well as battlefield electronic displays.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D537 — Intermediate Forward Test Equipment (IFTE): This project supports the development of automatic test equipment that provides automated testing of electronic-intensive weapon systems at maintenance in Divisions and echelons above Corps (EACs). IFTE will automatically test and verify the operation of line replacement units and screen shop replaceable units. In FY 1989, full-scale engineering development was completed and a low-rate initial production (LRIP) contract awarded.

(U) FY 1989 Accomplishments:

- (U) Completed cost analysis
- (U) Completed cost and operational effectiveness analysis
- (U) Conducted Milestone IIIa in-process review (IPR)
- (U) Awarded low-rate initial production (LRIP) contract, utilizing leader/follower acquisition strategy

Program Element: **#0604746A**

PE Title: **Automatic Test Equipment Development** Budget Activity: **#4**

(U) FY 1990 Planned Program:

- **(U)** Delivery of first production unit
- **(U)** Conduct first article test
- **(U)** Exercise FY 1990 production option
- **(U)** Demonstrate spread spectrum capability

(U) FY 1991 Planned Program:

- **(U)** Select follower for production
- **(U)** Conduct Milestone 3B in-process review
- **(U)** Conduct follow on test and evaluation
- **(U)** First unit equipped (FUE)
- **(U)** Award hardware option for FY 1991 requirements

(U) Project DL10 — Electro Optic Test Equipment: This project supports the full-scale engineering development of the electro-optic test equipment (EOTE) which will be the standard automatic tester for electro-optic maintenance applications. EOTE will provide the Army a modern and enhanced replacement for the land combat support system, a technologically obsolete and difficult to maintain system. In FY 1990 a FSED contract will be awarded with development test/operational test (DT/OT) II taking place in FY 1991. Phase I, 3Qtr FY 1990 will design systems requirements; Phase II, 3Qtr FY 1992, will use system development to prove design concept and build and test hardware.

(U) FY 1989 Accomplishments:

- **(U)** Updated acquisition plan and strategy
- **(U)** Awarded M1 Electro-Optical Contact Test Set (EO-CTS) effort
- **(U)** Completed cost analysis (COEA/AA)
- **(U)** Approved addendum to Intermediate Forward Test Equipment (IFTE) required operational capability (ROC)

(U) FY 1990 Planned Program:

- **(U)** Develop depot system Electro-Optic Test Station

(U) FY 1991 Planned Program:

- **(U)** Continue development of depot system Electro Optic Test Station

(U) Project DL59 — Test Program Sets Transfer: This project supports full-scale development and non-developmental item (NDI) for expert/diagnostic systems and general purpose test equipment. Included in this program are market surveys of commercially available general purpose electronic test equipment (GPETE); evaluation/validation of test-equipment performance and requirements envelopes; development of diagnostic hardware and software with system-specific databases and tools; interface/host software on targeted hardware; and evaluation of Test Program Sets (TPSs) for conversion to new standard automatic test equipment. State-of-the-art technologies in expert systems and artificial intelligence, use of paperless maintenance and troubleshooting manuals, battlefield use of electronics displays, and soldier friendly equipment will be developed to meet identified requirements.

(U) FY 1989 Accomplishments:

- **(U)** Converted Ground Vehicle/Locator Laser Designator (GV/LLD), Laser Target Designator (LTD), SINCGARS, AN/ARC-164 and M1 Test Program Sets (TPSs) from current generation test equipment to IFTE hardware
- **(U)** Began commercial development of Army IFTE transition plan to identify and schedule conversion of potential candidates for IFTE support

Program Element: **#0604746A**

PE Title: **Automatic Test Equipment Development** Budget Activity: **#4**

- **(U)** Developed a set of ASAS test software, including an expert system, intrusive testing, and electronic remove-and-replace instructions
- **(U)** Commenced style guide for the authoring and presentation of Electronic Technical Manuals (ETM) and Expert Diagnostic Systems (EDS)
- **(U)** Modified and expanded capabilities of the USAF authoring system (AFS) for Army equipment
- **(U)** Analyzed the ability of Contact Test Set (CTS) to provide organizational-level testing for the M1 Abrams fleet

(U) FY 1990 Planned Program:

- **(U)** Complete conversion of GV/LLD, SINCGARS, AN/ARC-164, and M1 TPS and convert TPSs off other systems with immediate direct support/general support (DS/GS) requirements
- **(U)** Continue evaluation of DS/GS TPS for potential IFTE conversion
- **(U)** Complete IFTE transition plan including workload, schedules, interim support and asset availability database.
- **(U)** Develop knowledge-based software to reduce cost of converting TPSs to IFTE
- **(U)** Analyze capability of CTS to download tactical software into the M1 and top perform organizational-level testing of M2/3; develop implementation plan and initiate prototype software development
- **(U)** Analyze capability of CTS to provide for APACHE, Explosive Ordinance Disposal, LHX, HIP and MLRS at organizational-level and M1 engine diagnostics at DS level
- **(U)** Complete the style guide for authoring and presentation of ETM and EDS
- **(U)** Complete integration of the AFS for Army equipment

(U) FY 1991 Planned Program:

- **(U)** Implement the IFTE Transition Plan, continue conversion of DS/GS TPS based on the final plan, develop knowledge-based software to aid conversion
- **(U)** Analyze depot TPS workloads
- **(U)** Commence prototype development of expert system software for APACHE, Explosive Ordinance Disposal, LHX, HIP and MLRS
- **(U)** Analyze ability of the CTS to diagnose additional major weapon systems and initiate software development to support weapons at DS level
- **(U)** Field electronic manuals with ASAS

(U) Work Performed By: In-house efforts will be accomplished by Communications-Electronics Command, Fort Monmouth, NJ. Major contractor is Grumman Aerospace Corporation, Bethpage, Long Island, NY.

(U) Related Activities:

PE #0603001A (Logistics Advanced Technology)

There is no unnecessary duplication of effort within the Army or Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Other Procurement, Army			
IFTE KA4000	37493	39679	33587

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0604766A (TIARA) Project Number: #D909
PE Title: **Tactical Electronic Surveillance System — Engineering Development** Budget Activity: #4

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Completed development of three additional Tactical High Mobility Terminals (THMTs)
- (U) Continued integration of Tactical Data Information Exchange System-B/Tactical Receive Equipment (TADIX-B/TRE) capabilities into existing fielded systems
- (U) Continued integrated logistics support to fielded systems
- (U) Continued joint programs to exploit National capabilities for tactical force enhancements

(U) FY 1990 Planned Program:

- (U) Integrate capabilities to exploit new National capabilities into existing fielded systems as appropriate
- (U) Continue integration of TADIXS-B/TRE capabilities into existing systems
- (U) Continue integrated logistics support to fielded systems
- (U) Continue joint programs to exploit National capabilities for tactical force enhancements, to include Collection Management Support Tools (CMST) efforts with the Navy

(U) FY 1991 Planned Program:

- (U) Complete the integration of TADIXS-B/TRE capabilities into fielded TENCAP systems
- (U) Continue Army lead for refinement and integrated support to fielded full-scale development (FSD) systems in conjunction with USAF TENCAP Systems
- (U) Initiate Engr Dev on specific emitter identification (SEI) techniques to support deep battle targeting
- (U) Continue to support field exercises and demonstrations for operational requirements and tactical utilization of TENCAP capabilities

(U) Program Plan to Completion:

- (U) Continue evolutionary development of tactical exploitation multi-spectral sensor products.

D. (U) WORK PERFORMED BY: In-house development agencies: US Army Information Systems Command, Fort Huachuca, AZ. Contractors: Aerospace Corporation, El Segundo, CA.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** No significant change.

F. (U) PROGRAM DOCUMENTATION: Not applicable.

G. (U) 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, tactical identification and positioning, and data reduction and filtering. The use of satellite communications is being considered. The initial efforts to provide the technical basis for the equipment

Program Element: **#0604766A (TIARA)** Project Number: **#D909**
PE Title: **Tactical Electronic Surveillance System — Engineering Development** Budget Activity: **#4**

and techniques are addressed under PE #0603766A (Tactical Electronic Surveillance System — Advanced Development). Work is coordinated with the National Security Agency, Defense Intelligence Agency, Navy TENCAP offices, Army Materiel Command, and other classified agencies at the national level to avoid duplication of effort.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

J. (U) MILESTONE SCHEDULE: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604770A (TIARA)**

PE Title: **Joint Surveillance and Target Attack Radar System** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D202	Army J/STARS Joint Surveillance and Target Attack Radar System				
	22905	25916	38278	Cont	Cont
DB44	Ground Control Station				
	- 0 -	6495	- 0 -		
DB62	Small Aerostat Surveillance System (SASS)				
	- 0 -	7231	7555	Cont	Cont
PE TOTAL	22905	39642	45833		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is a TIARA program. Commanders must have the capability to detect, locate, classify, and track moving and stationary targets on the battlefield. Joint Surveillance and Target Attack Radar System (STARS) is key to the successful execution of Air Land Battle doctrine and operational concepts. Corps and division commanders require a near real-time wide area surveillance moving and fixed target indication radar capability. Joint STARS provides battle management and targeting of enemy second-echelon units at critical times and places so commanders can employ their organic forces and firepower. The joint program objective is to develop a radar, datalink and E-8A (Militarized Boeing 707) airframe that will provide the capability to locate, track, and classify tracked and wheeled vehicles, beyond ground line of sight during the day and night and under most weather conditions. Radar data is distributed to ground station modules via a secure surveillance and control data link. The Army will develop the ground components of Joint STARS and this Army submission will focus on those portions of the overall program for which the Army is responsible.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project DB44 — Ground Control Station: Efforts associated with this project are included in Project D202.

(U) Project DB62 — Small Aerostat Surveillance System (SASS): The SASS is a small tethered aerostat platform equipped with a modified AN/APG-66 (F-16) radar which is mounted on a ship or flatbed trailer and can track small watercraft, low flying aircraft and overland vehicular traffic at less cost than a manned aircraft.

(U) FY 1990 Planned Program:

- **(U)** Start development of the militarized land based version of the SASS and begin radar enhancements for the Ground Moving Target Indicator (GMTI) mode

(U) FY 1991 Planned Program:

- **(U)** Complete development and field test the militarized land based system and complete/test the enhancements for the SASS radar system

(U) Work Performed By:

DB62 — In-house efforts accomplished by the U.S. Army Communications and Electronics Command (CECOM), Ft. Monmouth, NJ. Government Mangement responsibility is the Program Executive Officer for Intelligence and Electronics Warfare (PEO-IEW) and the Project Manager for Radar. Contractor is Westinghouse, Baltimore, MD.

Program Element: **#0604770A (TIARA)**

PE Title: **Joint Surveillance and Target Attack Radar System** Budget Activity: **#4**

(U) Related Activities: The Airborne Radar Demonstrator System (ARDS) is a NATO Cooperative R&D effort in D202. ARDS is an ongoing effort in support of the FY 1986 Nunn Amendment Legislative Program.

(U) Other Appropriation Funds: ($ in Thousands) Not applicable.

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604770A (TIARA)** Project Number: **#D202**

PE Title: **Joint Surveillance and Target Attack Radar System** Budget Activity: **#4**

Project Title: **Army Joint STARS**

NO PICTURE AVAILABLE

POPULAR NAME: **Army Joint STARS**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		Conventional Sys Committee			Milestone IIIA 2Q/93
Engineering Milestones		FSD-SAR/FTI Radar	Opnl Fld Demon for GSM/Radar	Integration Block I GSM	
T&E Milestones		Grd Sta Module Tech Test 1Q92	SLPV	Joint IOTE	Blk I TT/UT 1Q-4Q92
Contract Milestones	Limited Proc 9/87	FSD-SAR/FTI Radar & Block I			
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		16412	26859	32559	138375 (85682)
Support Contract		2248	3022	3271	22619 (12524)
In-House Support		3440	1660	1055	30582 (4515)
GFE/ Other		805	870	1393	15344 (5178)
Total		22905	32411*	38278	206920 (107899)

*Includes funding for Project DB44

Program Element: **#0604770A (TIARA)** Project Number: **#D202**
PE Title: **Joint Surveillance and Target Attack Radar System** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The US Army must upgrade its capability to locate, track and attack targets beyond ground line of sight. This is a significant operational requirement. The speed of modern combat makes it critically important that the division and corps commanders have a responsive, near real-time capability to detect, locate, and target enemy second-echelon units to allow concentration of friendly combat power at critical times and places and to employ their organic firepower at maximum ranges. The Army will develop the ground components of the Joint Surveillance and Target Attack Radar System (Joint STARS). The joint program objective is to develop a radar mounted on the E-8A (formerly C-18) airframe that will provide the capability to locate, track, and classify tracked and wheeled vehicles beyond ground line of sight during the day, night, and under most weather conditions. Target data will be distributed to ground station modules via a secure surveillance and control data link. Joint STARS is a Battle Management and Targeting System which detects, locates, tracks, classifies, and assists in attacking both moving and stationary targets beyond the Forward Line of Troops (FLOT). The Army is responsible for the ground station module (GSM), acting as a tactical data processing and evaluation center that links the Joint STARS radar carried aboard the Air Force E-8A Aircraft to Army GSM Command, Control, Communications and Intelligence (C3I) nodes at the corps and division levels. The GSM program has been restructured to accommodate required operational capabilities (ROC) and operational and organizational (O&O) revisions, schedule adjustments in the Air Force (E-8A) portion of the joint program, and to allow for technology growth. Major points of the restructured program are: First unit equipped (FUE) will receive five (5) of the current eight (8) full-scale development (FSD) systems. When fielded in FY 1994, these systems will be known as interim Joint STARS GSMs. Development of this objective GSM (full ROC compliance) began in FY 1989 and will be achieved in two improvement block phases. Block I develops hardware and software capable of simultaneous multi-sensor reception/processing display, enhanced bit, imbedded training, full Joint STARS mission data storage, multi-sensor mission/sensor, and other mission improvements beyond the capabilities of the interim GSM. Another major goal of Block I development is to reduce mission payload weight 800 lbs (visa-vis known interim GSM weight). The weight reduction purpose is to accommodate payload integration, if desired, into a standard hardened Army tactical shelter (HATS) M923 (5 ton) configured system. Block II integrates the block I system into an electronic fighting vehicle system (EFVS) which will include a full nuclear, biological, chemical (NBC) ballistic hardened enclosure mounted on a Bradley Fighting Vehicle System (BFVS) M2/M3 Carrier. Alternatives for block II include the Family of Armored Vehicles, Intelligence Electronic Warefare (IEW) System and/or the HATS/5-ton truck combination.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Incremental testing program (test- fix- test) for interim GSM
- **(U)** Software development contract award for embedded training, remote display, and spotlight MTI: 15 Jun 89
- **(U)** Contract award for Tactical Fire (TACFIRE) version 9: 20 Dec 88
- **(U)** Contract award masthead configuration/mechanical upgrade: 29 Dec 88
- **(U)** Contract award for full-scale development (FSD) block I: 22 Sep 89

(U) FY 1990 Planned Program:

- **(U)** Participation in operational field demonstration (OFD) for Ground Station Module (GSM) and E-8 Radar in Europe
- **(U)** Preliminary design review/critical design review for block I full scale development (FSD) GSM
- **(U)** Completion of masthead configuration and mechanical upgrade for interim GSM

Program Element: #0604770A (TIARA) Project Number: #D202
PE Title: **Joint Surveillance and Target Attack Radar System** Budget Activity: #4

(U) FY 1991 Planned Program:

- (U) GSM will participate in Joint STARS initial operational test and evaluation (IOT&E)
- (U) Begin integration of block II GSM prototype

(U) Program Plan to Completion:

- (U) Completion of block I detailed design
- (U) Initial deliveries of FSD GSM Block I
- (U) Early operational capability FY 92
- (U) Block I technical test/user test (TT/UT) 3QFY92
- (U) Block I production decision in FY93 based on TT/UT results
- (U) Interim GSM FUE FY 94
- (U) Limited block II production award FY 95
- (U) Interim GSM type classified limited procurement (LP-T) based on IOT&E
- (U) Block II contract award (FSD) FY 92
- (U) Block II test 3QFY94
- (U) Block II production contract award FY 95

D. (U) WORK PERFORMED BY: The Army ground station is being developed by Motorola, Incorporated, Tempe, AZ. Army efforts involve the Army Materiel Command and the Army Communications and Electronics Command. The Air Force prime mission equipment (platform, radar, data link) is being developed by Grumman Aerospace, Melborne, FL, Norden Systems Division of United Technologies, Norwalk, CT, and Cubic Corporation, San Diego, CA. The Air Force effort is directed by the Electronic Systems Division of the Air Force Systems Command. Program Management responsibility for JSTARS is with Project Manager Joint Stars, Ft. Monmouth, NJ. SASS management responsibility is with Product Manager SASS under Project Manager RADAR, Ft. Monmouth, NJ. Both Project Managers are under the Program Executive Officer for Intelligence and Electronic Warfare, Vint Hill Farm Station, Warrenton, VA.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** Efforts associated with Ground Control Station (project D844) have been incorporated into the Ground Station Module project D202.

F. (U) PROGRAM DOCUMENTATION:

USD (RDT&E) Memo	5/82
(Formed the Joint Program Office)	
Air Force/Army MOU	4/85
Operational and Organizational (O&O)	9/88
Joint Services Operational Requirement (JSOR)	12/84
Required Operational Capability (ROC)	11/85
Integrated Logistic Support Plan (ILSP)	5/87
Test and Evaluation Master Plan (TEMP)	12/88
Decision Cordinating Paper (DCP) Army Annex:	2/88
DA Interfaces Review	6/88
Conventional System Committee Review	12/88

Program Element: **#0604770A (TIARA)** Project Number: **#D202**
PE Title: **Joint Surveillance and Target Attack Radar System** Budget Activity: **#4**

G. (U) RELATED ACTIVITIES:

- The Joint STARS program combined the Army's Battlefield Data System project and the Air Force's PAVE MOVER project
- The Airborne Radar Demonstrator System (ARDS), a NATO Cooperative R&D FY 1986 Nunn Amendment Legislative Program
- The Airborne hardware is funded in PE #0604770F (Joint Surveillance/Target Attack Radar System (Joint STARS))
- This merger ensures that there is no duplication of effort within either the Army, Air Force, or the Department of Defense
- The Program Manager is appointed by the Air Force; the Deputy Program Manager by the Army
- The Program Office is manned jointly, ensuring that day-to-day Army/Air Force coordination is maintained

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Airborne Radar Demonstration System (ARDS) NATO Contract (Awarded Sept 87).

J. (U) TEST AND EVALUATION DATA:

1. Test and Evaluation Activity:

The Army test community including Army Materiel Systems Analysis Activity (AMSAA) Test and Evaluation Command (TECOM) and the Operational Test Evaluation Agency (OTEA) will be involved in all test efforts. Test Integration Working Group (TWIG) procedures are being utilized in coordinating the Army test community actions.

2. Test and Evaluation Schedule:

Test and Evaluation Activity (Past 12 Months)

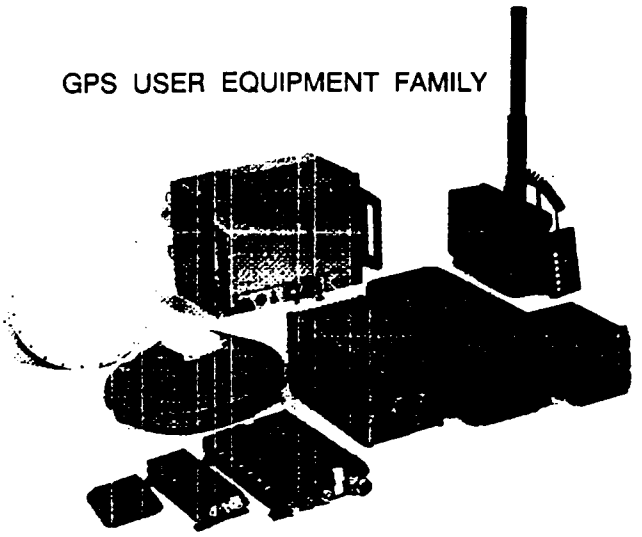
Event	Planned Date	Actual Date	Remarks
Continuous evaluation	Mar 1986	Ongoing	Continuous comprehensive evaluation is being conducted with a GSM in Korea
Technical testing/user testing	FY 92		The block I GSM will undergo formal TT/UT and receive test evaluations from OTEA/ TECOM/AMSAA

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604778A**
PE Title: **Navstar Global Positioning System (User Equipment)**
Project Title: **Navstar GPS Equipment**

Project Number: **#D168**
Budget Activity: **#5**

GPS USER EQUIPMENT FAMILY



POPULAR NAME: **GPS**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		Conduct Rel Demo Test	DAB IIIB 6/90 (5-ch sets)	DAB III B 1/2 ch sets (C^3I Sys Committee) 2 Dimension satellite capability	FUE 6/93
Engineering Milestones		Rotor/Fixed AC integr., 3S Recvr Int. Watercraft			
T&E Milestones		Ground & A/C SLGR Demo	IOT&E		Acceptance Test 2nd Source 2/92
Contract Milestones		Opt. 5 6/89	New Contract 4QFY90		
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		4847	2120	2246	65584 (0)
Support Contract		0	516	1250	18777 (0)
In-House Support		971	1235	2212	38148 (0)
GFE/ Other		2787	3762	677	34753 (0)
Total		8605	7633	6385	157262 (0)

Program Element: **#0604778A** Project Number: **#D168**
PE Title: **Navstar Global Positioning System (User Equipment)** Budget Activity: **#5**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: To increase effectiveness on the battlefield, an improved capability to navigate and determine the position of weapons systems and fighting units under conditions of adverse weather, day or night in all environmental conditions, worldwide is needed. The Navstar GPS will provide the Army that capability at a significant expected reduction in life cycle cost. GPS will consist of 24 satellites, a satellite control segment, and user equipment (UE) sets for combat and combat support vehicles, aircraft (rotary/fixed-wing), manpacks, and watercraft. The system will provide global, highly accurate information which will satisfy a significant portion of Army navigation and positioning missions. This is a joint program. The Air Force is developing and procuring the satellites and control segment, and the Services are jointly developing a family of user equipment to satisfy Joint Service needs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Continued production and integration of aircraft/manpack sets
- **(U)** Completed field and in-plant reliability growth testing
- **(U)** Supported operational testing
- **(U)** Supported life cycle software facility development
- **(U)** Delivered Low Rate Initial Production (LRIP) units
- **(U)** Supported Small Lightweight GPS Receiver (SLGR) demonstration/contract award
- **(U)** Continued cost and operational effectiveness analysis (COEA) & independent cost estimate (ICE) process

(U) FY 1990 Planned Program:

- **(U)** Defense Acquisition Board (DAB) Milestone III B (five-channel receivers) 6/90
- **(U)** Continue to expand and develop SLGR Required Operational Capability (ROC)
- **(U)** Continue delivery of LRIP units
- **(U)** Continue logistics support
- **(U)** Develop depot repair capability
- **(U)** Complete second source selection
- **(U)** Accomplish enhanced technology updates

(U) FY 1991 Planned Program:

- **(U)** Initiate Milestone IIIB Army Systems Acquisition Review Committee
- **(U)** DAB III B (1/2 channel receivers — C^3I Systems Committee)
- **(U)** Finalized logistics support
- **(U)** Continue enhanced technology update implementation
- **(U)** Continue integration into various aircraft through Army Aviation Modernization Program
- **(U)** Current development program completed in FY 1991

D. (U) WORK PERFORMED BY: Competitive full scale engineering development (FSED) and production contract for the Joint Service user equipment was awarded in April 1985 to Rockwell/Collins, Cedar Rapids, Iowa. Second source contract for NDI Manpack/Vehicle (M/V) set was awarded January 1988 to Texas Instruments, Plano, Texas. Second source contract for aircraft sets awarded in October 1988 to Canadian Marconi and SCI of Huntsville, Alabama. Internal Army program support and development is provided by the US Army Communications-Electronic Command (CECOM) at Ft. Monmouth, NJ.

Program Element: **#0604778A** Project Number **#D168**

PE Title: **Navstar Global Positioning System (User Equipment)** Budget Activity **#5**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** No change.
2. **(U) SCHEDULE CHANGES:** No change.
3. **(U) COST CHANGES:** No change.

F. (U) PROGRAM DOCUMENTATION:

Decision Concept Paper (DCP)	05/86
Decision Concept Paper (DCP) Update	10/89
Test and Evaluation Master Plan (TEMP)	11/87
TEMP Update	TBD
TRADOC Positioning/Navigating (POS/NAV) Laydown	08/88
POS/NAV Update	02/90

G. (U) RELATED ACTIVITIES:

- Program Element (PE) #0604777N (Navstar GPS)
- PE #0305164F (Navstar GPS User Equipment)
- PE #0305165F (Navstar GPS Space and Control Segments)

This is a joint program with participation by all the Armed Services. The Air Force is the executive agent for Navstar GPS. There is no unnecessary duplication of effort within DOD for this program.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
PROCURMENT			
Other Procurement, Army KA4300	14007	17021	29383

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: A Memorandum of Understanding with ten NATO nations was signed on 6 June 1984 and amended on 14 April 1987. This memorandum provides for the exchange of information, coordination of developments, and joint test and evaluation activities.

J. (U) TEST AND EVALUATION DATA:

(U) FY 1989 Accomplishments:

- **(U)** Complete technical testing
- **(U)** Operational assessment completed
- **(U)** Conduct Reliability Demo Test (RDT) Phase I

(U) FY 1990 Planned Program:

- **(U)** Conduct Reliability Demo Test (RDT) Phase II
- **(U)** Conduct Initial Operational Test & Evaluation

(U) FY 1991 Planned Program:

- **(U)** None

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604801A**

PE Title: **Aviation — Engineering Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D275 Synthetic Flight Training System	26	4576	3927	Cont	Cont
DC45 Aviation Life Support System—Engineering Development	4122	5040	5116	Cont	Cont
DE70 Aviation Non-System Training Devices	4367	6039	10333	Cont	Cont
PE TOTAL	8515	15655	19376		

B. (U) BRIEF DESCRIPTION OF ELEMENT: Funds engineering developments to support programs associated with Synthetic Flight Training Systems (SFTS), Aviation Life Support Equipment (ALSE), and Aviation Non-Systems Training Devices. SFTS (Project D275) supports development of a family of high-fidelity flight, weapon, and mission helicopter simulators to support initial entry helicopter pilot training, transition training, and combat operational training. ALSE (Project DC45) makes battlefield survivability possible and enhances the air crew's ability to return to fight again through new protective clothing ensembles, aviator protective masks, laser protective visors, survival kits, restraint systems, integrated flight helmets, and microclimate cooling devices. Aviation Non-System Training Devices (Project DE70) supports development of aviation training devices that are applicable to more than one aviation system.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D275 — Synthetic Flight Training System:

(U) FY 1989 Accomplishments:

- **(U)** Initiated definition of configuration changes requirements

(U) FY 1990 Planned Program:

- **(U)** Continue flight simulator upgrades to ensure same configuration as operational aircraft
- **(U)** Begin full-scale development (COBRA and CH-47)

(U) FY 1991 Planned Program:

- **(U)** Continue flight simulator upgrades to ensure same configuration as operational aircraft (UH-60)

(U) Project DC45 — Aviation Life Support System—Engineering Development

(U) FY 1989 Accomplishments:

- **(U)** M43 CB Protective Mask P3I critical design review completed
- **(U)** Begin fabrication of technical test (TT)/user test (UT) test articles
- **(U)** Human factors review completed
- **(U)** Aircraft Modular Survival System in-house review completed

(U) FY 1990 Planned Program:

- **(U)** Complete fabrication of TT/UT test articles
- **(U)** Initiate/complete TT, begin UT testing of M43 Protective Mask-P3I
- **(U)** Initiate protection factor testing

Program Element: #0604801A

PE Title: **Aviation — Engineering Development** Budget Activity: #4

- (U) Initiate engineering development of Aircrew Integrated Helmet System
- (U) Initiate engineering development of laser protective devices in support of Aircrew Integrated Helmet System
- (U) Conduct follow-on human factors review
- (U) Initiate engineering development of Aircrew Microclimatic Cooling System

(U) FY 1991 Planned Program:

- (U) Complete UT test and Milestone III in-process review for M43 Protective Mask-P3I
- (U) Fabricate prototype aircrew integrated helmets, integrating laser protective devices, nuclear flash protection, improved crash protection and night vision sighting devices, and all other subsystems
- (U) Fabricate and test prototype laser protective devices in support of Aircrew Integrated Helmet Program
- (U) Continue engineering development of Aircrew Microclimatic Cooling System, fabricate prototypes and initiate technical testing

(U) Work Performed By: Link Flight Division, CAE Binghamton, NY; GENTEX, Inc, Carbondale, PA; American Optical, Southbridge, MA; Midwest Research Institute, Kansas City, MO; Scott Aviation, Sierra Madre, CA; Honeywell, Minneapolis, MN; Flight Dynamics, Portland, OR; Conax Florida Corp, St. Petersburg, FL; and LME, Inc, Alexandria, VA. In-house work by AATD, Ft. Eustis. VA; CRDEC, APG, MD; NRDEC, Natick, MA; AVSCOM, St. Louis, MO; LAIR; San Francisco, CA; USAARL, Ft. Rucker, AL; AVRADA, Ft. Monmouth, NJ; NADC, Warminster, PA; WPAFB, Dayton, OH; CNVEO, Ft. Belvoir, VA; HEL, APG, MD; and MTL, Watertown, MA.

(U) Related Activities: Aviation life support equipment programs are coordinated through several tri-service and allied working groups and steering committees; appropriate Army, Air Force, and Navy development commands; and aircraft PMs in order to prevent duplication of effort and ensure proper priority of efforts. For coordination of training device technology with the Air Force and the Navy, the Army Project Manager for Training Devices is located at the Navy Training Systems Center and has an Air Force liaison officer. Program elements #0603003A (Aviation Advanced Technology) and #0602727A (Nonsystem Training Devices Technology) perform flight simulation component research and development. Many joint projects are effected between the services to prevent duplication of in-flight simulator development efforts.

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Aircraft Procurement, Army AZ03800	- 0 -	9841	10426

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604801A** Project Number: **# DE70**

PE Title: **Aviation — Engineering Developmen'** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Aviation Non-System Training Devices

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
	4367	6039	10333	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISS.ON REQUIREMENT AND SYSTEM CAPABILITIES: This project funds development of aviation training devices which are applicable to more than one aviation system. During the FY 1988-FY 1991 timeframe, project DE70 continues and completes full-scale engineering development of AIRNET. AIRNET is the DARPA "proof-of-principle" project which provides the framework for the objective system called Aviation Combined Arms Tactical Trainer (AVCATT). AIRNET provides a means to explore and rapidly receive feedback on developmental/doctrinal issues, including: air-to-air testing; human factors engineering; systems integration; cockpit configuration; LHX development; scout/attack mix; warfighting model evaluation; weapons systems development. Additionally, AIRNET will provide a viable developmental and testing vehicle to aid in the timely acquisition and fielding of future aircraft systems. AIRNET will also provide a means by which the Army can evaluate and adapt current and future doctrine to meet an ever-changing threat environment.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Continued full-scale engineering development on AIRNET

(U) FY 1990 Planned Program:

- **(U)** Continue full-scale engineering development on AIRNET

(U) FY 1991 Planned Program:

- **(U)** Complete full-scale engineering development on AIRNET

D. (U) WORK PERFORMED BY: In-house activities are performed by the Project Manager for Training Devices and the Naval Training Systems Center, Orlando, FL. Full-scale engineering development work is performed by the Defense Advanced Research Projects Agency (DARPA) and various commercial contractors such as BBN Laboratories, Inc., Cambridge, MA and Perceptronics, Inc., Woodland Hills, CA.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable
2. **(U) SCHEDULE CHANGES:** Not applicable
3. **(U) COST CHANGES:** Not applicable (No changes in total cost, only in year funded.)

F. (U) PROGRAM DOCUMENTATION: AIRNET is supported by DA directed action dated 29 August 1985, Subject: Simulation Networking (SIMNET) Funding-Action Memorandum.

G. (U) RELATED ACTIVITIES: PE #0603003A (Aviation Advanced Tech) and #0602727A (Nonsystem Training Device Technology). These activities are engaged in flight simulation component research and development. Close coordination with the Air Force and Navy is maintained by the Army through the co-location of the Army's Project Manager for Training Devices with the Navy Training Systems Center and an Air Force liaison office. Many joint projects are effected between the Services to prevent unnecessary duplication in the flight simulation arena.

Program Element: **#0604801A** Project Number: **# DE70**
PE Title: **Aviation — Engineering Development** Budget Activity: **#4**

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
Contract award for fully reconfigurable devices	12/87
Fully reconfigurable devices delivered	06/88
Testing of reconfigurable devices completed	09/89
Contract award of prototype devices	03/90
Prototype devices delivered	08/91

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604802A**

PE Title: **Weapons and Munitions-Engineering Development**

Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D031 25mm Ammunition Development	4271	8932	6499	- 0 -	
D284 Individual Soldier Weapons Engineering Development	- 0 -	5419	- 0 -	- 0 -	5419
D285 60mm Mortar Training Ammunition	- 0 -	985	- 0 -	- 0 -	985
D286 Field Artillery Ammunition (NATO) Engineering Development	316	289	456	Cont	Cont
D613 120mm Mortar	7214	6893	4151	- 0 -	49500
PE TOTAL	11801	22518	11106		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This effort provides coordinated programs in direct fire combat and indirect fire support for airland battle operation. Specifically, the program:

- **(U)** Improves 25mm cartridge by enhancing kill probability at all effective ranges and increases vehicle survivability for the Bradley Fighting Vehicle
- **(U)** Develops artillery fuzes for all calibers and types of projectiles (specific efforts in project D175 completed in FY 1988)
- **(U)** Ensures US/NATO howitzer and ammunition compatibility
- **(U)** Completes development of a family of enhanced 120mm mortar ammunition (HE, smoke and illumination) and conducts a follow-on evaluation of the enhanced ammunition in the nondevelopmental item 120mm mortar system. The 120mm mortar system will replace the World War II vintage 4.2-inch mortar as the organic indirect fire support in heavy battalions.
- **(U)** Qualifies Short Range 60mm Mortar Practice Cartridge
- **(U)** Completes proof-of-principle for Multi-Purpose Individual Munition

Within this PE in FY 1989, threat materiel may be acquired and exploited to support development. In FY 1990 and FY 1991 threat materiel acquisition/exploitation has been programed in PE #0605709A/DC28 and will be executed upon authorization/appropriation.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D031 — 25mm Ammunition Development: 25mm Cartridge Project supports increases in kill probability at effective ranges.

(U) FY 1989 Accomplishments:

- **(U)** M910
  - Completed qualification of 2nd source for full-scale production
- **(U)** XM919
  - Completed shoot-off to select 2nd source contractor
  - Conducted pre-qualification tests

Program Element: #0604802A
PE Title: **Weapons and Munitions-Engineering Development** Budget Activity: #4

- Obtained type classification-limited production approval
- Final technical data package (TDP) prepared
- Initiated technical test (TT) II testing

(U) FY 1990 Planned Program:

- (U) Product improve M910 projectile to ballistically match XM919
- (U) XM919
  - Issue/award limited procurement (LP) contract
  - Complete TT II testing
  - Conduct in-process review (IPR) for type classification (TC) standard A
  - Initiate low vulnerability ammunition (LOVA) propellant feasibility studies
  - Initiate trade-off studies for performance improvements

(U) FY 1991 Planned Program:

- (U) XM919
  - Product improve to incorporate LOVA propellants
  - Product improve to increase penetration capabilities

(U) Project D284 — Individual Soldier Weapons Engineering Development: Supports development of Multi-Purpose Individual Munition (MPIM) to provide the individual soldier a lightweight munition capable of defeating armored personnel carriers, brick and concrete structures, and field fortifications.

(U) FY 1989 Accomplishments: Not applicable.

(U) FY 1990 Planned Program:

- (U) Complete proof-of-principle (POP) program
- (U) Complete test firings and user testing

(U) FY 1991 Planned Program: No planned program.

(U) Project D285 — 60mm Mortar Training Ammunition: Project supports qualification of the Short Range 60mm Mortar Practice Cartridge (XM840)

(U) FY 1989 Accomplishments: Not applicable.

(U) FY 1990 Planned Program:

- (U) Support in-house technical team
- (U) Conduct test to determine viability of round to enter production
- (U) Type classification 3Q FY 1990

(U) FY 1991 Planned Program:

- (U) Program completed in FY 1990

(U) Project D286 — Field Artillery Ammunition (NATO) Engineering Development: Project supports US/NATO howitzer and ammunition capability

(U) FY 1989 Accomplishments:

- (U) Convened 5th Quadrilateral Management Board
- (U) Revised memorandum of understanding for extended range ordnance (ERO) by Quadrilateral Group
- (U) Initiated Federal Republic of Germany Dual-Purpose Improved Conventional Munition (DPICM) testing at Yuma using both conventional and baseburn projectiles

Program Element: #0604802A
PE Title: **Weapons and Munitions-Engineering Development** Budget Activity: #4

- (U) Conducted interchangeability testing of French ammunition
- (U) Completed L15A2 firing table check testing
- (U) Continued ERO ordnance and national unicharge testing

(U) FY 1990 Planned Program:

- (U) Continue interchangeability ERO testing with quadrilateral partners (ordnance, projectiles and unicharges)
- (U) Continue participation in Quadrilateral Management Board and Working Group meetings
- (U) Continue Federal Republic of Germany DPICM testing at Yuma
- (U) Prepare interface drawings for configuration management

(U) FY 1991 Planned Program: Continue NATO ammunition interchangeability firings under a NATO quadrilateral memorandum of understanding (MOU).

(U) Project D613 — 120MM Mortar System: Project supports qualification of nondevelopmental 120mm Mortar weapon and completes development of a family of enhanced ammo.

(U) FY 1989 Accomplishments:

- (U) Completed Arsenal Act Analysis — Watervliet Arsenal won all onshore weapon production
- (U) Completed operational test of towed weapon and retest of nondevelopmental (NDI) ammo
- (U) Initiated operational test of carrier weapon

(U) FY 1990 Planned Program:

- (U) Type classify towed weapon and NDI ammo and field to 9th Infantry Division
- (U) Type classify carrier weapon and start production at Watervliet Arsenal
- (U) Complete development of enhanced ammunition and conduct technical testing

(U) FY 1991 Planned Program:

- (U) Conduct follow-on operational test of enhanced ammo with final carrier weapon configuration

(U) **Work Performed By:** In-house efforts will be accomplished by the Project Manager for Howitzer Improvement Program (PM-HIP), the US Army Armament Research, Development and Engineering Center (ARDEC), Dover, NJ and Yuma Proving Grounds, Yuma AZ; PM Mortars, Picatinny, NJ; Combat Systems Test Activity, Aberdeen Proving Ground, MD; Watervliet Arsenal, Watervliet, NY; Advanced Anti-Tank Weapons Systems Project Office; and the Program Executive Office for Fire Support, Redstone Arsenal, AL. Major contractors are Ford Aerospace Communications Corp.; Aerojet Ordnance, Downey, CA; Honeywell, Hopkins, MN; Aerojet Electrical Systems, Inc., Azuza CA; Motorola, Inc., Scottsdale AZ; Martin Marietta, Bethesda, MD; Soltam, Israel; Israeli Military Institute, Israel; FMC, Detroit, MI; Pocav Industries, Inc., Moscow, PA; Marquardt Corporation, Van Nuys, CA; McDonnell Douglas Corporation, Titusville, FL; and Brunswick Corporation, Costa Mesa, CA.

(U) Related Activities:

- PE #0603802A, (Weapons and Munitions — Advanced Development)
- There is no unnecessary duplication of effort within the Army or Department of Defense.

Program Element: **#0604802A**

PE Title: **Weapons and Munitions-Engineering Development** Budget Activity: **#4**

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Weapons and Tracked Combat Vehicles, Army, G02100 (120mm mortar)	5000	10854	12326
Ammunition Procurement, Army, E08200, E25501, E25502, E25504, E61200, E76300	112807	73453	99925

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604803A** Project Number: **DF95**
PE Title: **Chemical Systems-Engineering Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)
Project Title: Lethal Chemical Missile Warheads

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
Multiple Launch Rocket System Binary Chemical Warhead (MLRS-BCW)	33314	30966	27806	3095	118000

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program responds to national security policy direction to accelerate efforts to replace the chemical warfare deterrent munition stockpile with safer, modern binary chemical munitions. Potential enemy forces are capable of initiating a major offensive characterized by multiple attacks by armored and mechanized units with excellent chemical protection, decontamination capability, and training. These attacks will be supported by strong artillery and air support with an exceptional chemical weapons capability that is superior to current U.S. or allied retaliatory capability. Multiple Launch Rocket System Binary Chemical Warhead (MLRS-BCW) on target will produce a semipersistent agent causing immediate casualties and extended potential hazard to enemy troops forcing them to assume a protective posture.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- (U) Completed full scale reactor testing. Finalized agent specifications
- (U) Initiated full-scale development (FSD) flight, dissemination, and ground tests
- (U) Continued injector assembly long-term surveillance testing
- (U) Conducted flight tests of XM450 FSD fuzes
- (U) Initiated warhead pilot line
- (U) Initiated construction and equipping of Pine Bluff Arsenal (PBA) fill and close line
- (U) Test and Evaluation Master Plan Approved

(U) FY 1990 Planned Program:
- (U) Complete FSD flight and ground testing
- (U) Continue injector assembly long-term surveillance testing
- (U) Complete warhead pilot line and initiate prove out
- (U) Conduct user and technical testing
- (U) Continue construction and equipping of PBA fill and close line

(U) FY 1991 Planned Program:
- (U) Complete warhead pilot line prove-out and fabricate production qualification test (PQT) hardware
- (U) Complete initial injector assembly surveillance program
- (U) Conduct PQT flight testing
- (U) Complete construction and equipping of PBA fill and close line

Program Element: **#0604803A** Project Number: **DF95**
PE Title: **Chemical Systems-Engineering Development** Budget Activity: **#4**

D. (U) WORK PERFORMED BY: The Project Manager for Binary Munitions, Aberdeen Proving Ground, MD is responsible for lethal binary munitions and nonlethal incapacitating munitions. Support will be provided by the Project Manager Multiple Launch Rocket System (MLRS), Redstone Arsenal, AL; U.S. Army Chemical Research, Development and Engineering Center, APG, MD; U.S. Army Test and Evaluation Command (TECOM), APG, MD; U.S. Army Dugway Proving Ground, Dugway, UT; U.S. Army Pine Bluff Arsenal, Pine Bluff, AR; and U.S. Army White Sands Missile Range, White Sands, NM. Contractors participating in this program are LTV Aerospace and Defense, Dallas, TX; R. M. Parsons Company, Pasadena, CA; and KDI Incorporated, Cincinnati, OH.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** Not applicable.

F. (U) PROGRAM DOCUMENTATION:

Letter of Agreement (LOA)	8/81
Best Technical Approach (BTA)	1/84
System Concept Paper (SCP)	4/84
Required Operational Capability (ROC)	8/88
Integrated Logistics Support Plan (ILSP)	6/88
Decision Coordinating Paper (DCP)	7/88
Test and Evaluation Master Plan (TEMP)	8/89

G. (U) RELATED ACTIVITIES:

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

- PE #0603803A, (Chemical Systems — Advanced Development)
- This program is not duplicated by other programs within the Department of Defense.

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
Milestone II in-process review	7/88
Engineering development contract	8/88
Engineering development flight test	4/89 - 1/90
Dissemination test program	5/89 - 11/89
Ground test program	4/89 - 4/90
Milestone III in-process review and type classify MLRS-BCW	3/92

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: #0604804A

PE Title: **Logistics and Engineer Equipment — Engineering Development**

Budget Activity: #4

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D194	Engine Driven Generators Engineering Development				
	1284	881	730	Cont	Cont
D279	Airdrop Equipment Engineering Development				
	1621	4658	5191	Cont	Cont
D429	Tactical Rigid Wall Shelters Engineering Development				
	4007	1819	2723	- 0 -	
D461	Marine Oriented Logistical Equipment Engineering Development				
	- 0 -	15026	7737	Cont	Cont
DH01	Combat Engineer Equipment Engineering Development				
	4334	5573	8675	Cont	Cont
DH14	Logistics Support Equipment Engineering Development				
	1	700	48	Cont	Cont
DL39	General Support Equipment Engineering Development				
	972	1402	1415	Cont	Cont
DL41	Fuels Handling Equipment Engineering Development				
	466	991	967	Cont	Cont
PE TOTAL	12686	31050	27486		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program supports Engineering Development (ED) of new and advanced general combat support and combat service support equipment. The tactical bridging provides military load Class 70 bridging for the Abrams Tank for dry and wet bridging requirements, as well as light forces bridging which is air transportable in C-141 aircraft. The tactical rigid wall shelters, environmental control equipment, and microclimatic cooling system components increase the efficiency and survivability of mobile shelter mounted systems and provide protection for personnel and equipment necessary to sustain operations in nuclear, biological, and chemical (NBC) environments. Materiels and container handling equipment, water and petroleum distribution systems, containers, and marine craft developed provide efficient delivery of ammunition, water, food, medical supplies, and fuel from supply ships through existing ports and forward to combat forces. Improved water purification capabilities, including the ability to desalinate sea water, meet critical operational requirements in arid environments. This program funds engineering development of tactical electric power generation equipment and associated equipment. The Engine Driven Generator project will provide generators with reduced noise and thermal signatures, increased fuel efficiency, improved mobility and improved reliability. Additionally, the development of personnel and cargo parachutes, airdrop containers, and associated support equipment is included in this program. This program addresses critical deficiencies in survivability of air delivery systems, the ability to insert fighting-ready airdrop forces and materiel, and the ability to airdrop large fire and combat support systems. This program fulfills essential airdrop mission and technology needs of many allied countries.

Program Element: **#0604804A**

PE Title: **Logistics and Engineer Equipment — Engineering Development** Budget Activity: **#4**

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D194 — Engine Driven Generators Engineering Development. Develop and transition to procurement a series of diesel engine powered generators.

(U) FY 1989 Accomplishments:

- **(U)** Continued system and technical performance assessment efforts as required
- **(U)** Completed Milestone IIIA in-process review (IPR) and awarded contract for 3 kilowatt (kw) Tactical Quiet Generator Set (TQGS)
- **(U)** Initiated efforts to develop, fabricate and test auxiliary power units (APU's) based on TQGS hardware for Standard Integrated Command Post System (SICPS) & M577 vehicle
- **(U)** Established program plans and initiated analysis of options for a 15kw, 1twt, wheel mounted TQGS towable by the Commercial Utility Cargo Vehicle (CUCV) and High Mobility Multipurpose Wheeled Vehicle (HMMWV)

(U) FY 1990 Planned Program:

- **(U)** Develop functional purchase description, conduct Milestone IIIA IPR and award contract for low profile APU to mount on M577
- **(U)** Continue system tech performance assessments
- **(U)** Develop functional purchase description and conduct Milestone IIIA IPR for 100kw through 200kw Tactical Quiet Generator (TQG) sets
- **(U)** Complete testing of SICPS APU demonstrator hardware
- **(U)** Conduct market survey and testing of representative hardware to assess capabilities for 0.5-2.kw generator sets
- **(U)** Initiate development & fabrication of APU family based on SICPS demonstrator hardware & TQGS basic components
- **(U)** Award contract for 100-200kw TQGS
- **(U)** Continue development & testing of lightweight 15kw power unit
- **(U)** Develop functional purchase description and conduct Milestone IIIA IPR for a low power (0.5-2kw) TQGS
- **(U)** Initiate materiel change management development for TQGS

(U) FY 1991 Planned Program:

- **(U)** Continue system technical performance assessments
- **(U)** Conduct IPR for SICPS APU and complete testing of APU family
- **(U)** Complete development and testing of lightweight 15kw power unit
- **(U)** Continue materiel change management for TQGS

(U) Project D279 — Airdrop Equipment Engineering Development: Develop and transition to procurement cargo parachutes, air drop containers and associated equipment.

(U) FY 1989 Accomplishments:

- **(U)** Began flight tests of 60,000 lbs capacity Linked Platform System
- **(U)** Type classified Airdrop Controlled Exit System
- **(U)** Awarded development contract for Drop Zone Assembly Aids System
- **(U)** Continued support of USAF C-17 development program

(U) FY 1990 Planned Program:

- **(U)** Begin development of Tactical Assault Personnel Parachute
- **(U)** Complete development of Stinger Missile Jump Pack

Program Element: #0604804A
PE Title: **Logistics and Engineer Equipment — Engineering Development** Budget Activity: #4

- (U) Continue development of 60,000 lbs capacity airdrop system

(U) FY 1991 Planned Program:

- (U) Award contract for tactical assault personnel parachute test quantities
- (U) Complete development of parachutist individual equipment-rapid release
- (U) Complete development of all purpose weapons equipment container
- (U) Continue support of USAF C-17 development program

(U) Project D429 — Tactical Rigid Wall Shelter Engineering Development (ED): Develop and transition to procurement a series of nuclear, biological, chemical (NBC) hardened rigid wall shelters

(U) FY 1989 Accomplishments:

- (U) Awarded ED contract for Modular Extendable Rigid Wall Shelter (MERWS)
- (U) Completed ED of Shelter Complexing Kit and Chemical Biological/Electro Magnetic Impulse (CB/EMI) Nonexpandable Shelter
- (U) Began testing of CB expandable shelters
- (U) Completed fabrication of the EMI expandable prototypes and began production prove out testing
- (U) Conducted worldwide testing of tent Command Post

(U) FY 1990 Planned Program:

- (U) Fabricate SICPS shelter prototypes and conduct technical tests
- (U) Complete development of Chemically Hardened Expandable Rigid Wall Shelter
- (U) Continue development of SICPS shelter
- (U) Complete development of SICPS tent
- (U) Begin development of chemically hardened shelters for medical use
- (U) Continue development of MERWS and EMI Protected Expandable Shelter (PES)

(U) FY 1991 Planned Program:

- (U) Complete development and type classify MERWS and EMI PES
- (U) Complete development of SICPS first generation shelter
- (U) Continue pre-planned product improvement (P3I) of SICPS tent and shelter
- (U) Type classify shelter complexing/alignment kits

(U) Project D461 — Marine Oriented Logistic Equipment Engineering Development: The Lighter, Amphibian, Heavy Lift (LAMP-H) will operate as an interface between anchored vessels and the shore by providing an air cushion lighter capable of transporting heavy tracked and wheeled vehicles, containers and other heavy/outsized items to approximately 70% of the world's beaches where beach gradients and bottom conditions preclude the use of other lighterage. The LAMP-H will be capable of transporting a minimum 70 ton payload over the water at a speed of 8-12 knots; operate in sea state 3; negotiate a 5 ft plunging surf; traverse a grade of 1 foot in 25 and clear ground obstacles 3 ft high.

(U) FY 1989 Accomplishments: Unfunded program

(U) FY 1990 Planned Program:

- (U) Conduct Milestone I/II in-process review (IPR)
- (U) Award prototype contract
- (U) Conduct design to cost effort

Program Element: #0604804A

PE Title: **Logistics and Engineer Equipment — Engineering Development** Budget Activity: #4

(U) FY 1991 Planned Program:

- (U) Conduct developmental test/operational test (DT/OT) testing
- (U) Conduct Milestone III IPR

(U) Project DHO1 — Combat Engineer Equipment Engineering Development: Develop and transition to procurement a military load class 70 wet gap crossing capability for the Abrams Tank as well as a mobile assault bridge for the light forces.

(U) FY 1989 Accomplishments:

- (U) Conducted technical and user tests (TT/UT) of Light Assault Bridge (LAB)
- (U) Continued preparation of LAB production technical data (TDP)
- (U) Completed fabrication and initiated engineer design tests (EDT) of Improved Ribbon Bridge (IRB) prototype transporter
- (U) Completed fabrication and initiated EDT of prototype IRB ramp bay
- (U) Continued fabrication of IRB interior bay prototypes

(U) FY 1990 Planned Program:

- (U) Complete user LAB user testing
- (U) Conduct Milestone III review and type classify (TC) LAB standard
- (U) Complete technical data package (TDP) for LAB production
- (U) Complete EDT of IRB ramp bay and transporter
- (U) Complete fabrication of IRB interior, ramp bays and transporters

(U) FY 1991 Planned Program:

- (U) Conduct IRB technical testing and initiate user testing
- (U) Continue preparation of IRB production TDP
- (U) Initiate Heavy Assault Bridge (HAB) user testing
- (U) Continue preparation of Abrams chassis TDP for HAB production
- (U) Continue preparation of HAB Bridge/Launcher production TDP

(U) Project DH14 — Logistics Support Equipment Engineering Development: Develop and transition to procurement series of material handling equipment.

(U) FY 1989 Accomplishments:

- (U) Started development of 6K Front/Side Loader (6K F/SL) Rough Terrain Forklift Truck

(U) FY 1990 Planned Program:

- (U) Award contracts for engineering development of 6K Front/Side Loader (6K F/SL)

(U) FY 1991 Planned Program:

- (U) Conduct testing of 6KF/SL
- (U) Conduct Milestone II IPR for Universal Self-Deployable Cargo Handler (USDCH)
- (U) Conduct Milestone III IPR for 6KF/SL
- (U) This is a continuing program

(U) Project DL39 — General Support Equipment Engineering Development: Develop and transition to procurement water purification and environmental control equipment.

(U) FY 1989 Accomplishments:

- (U) Completed selection and evaluation of Water Quality Analysis Unit-Purification (WQAU-P) components and initiated technical test II

Program Element: **#0604804A**

PE Title: **Logistics and Engineer Equipment — Engineering Development** Budget Activity: **#4**

- **(U)** Completed Extreme Environmental Water Supply (EEWS) performance testing of cold weather kit for 600 GPH Reverse Osmosis Water Purification Units (ROWPU) and initiated antifreeze study for transportation of 600 GPH ROWPU in cold
- **(U)** Completed performance testing of 600 GPH ROWPU as a 900 GPH ROWPU. Initiated testing of preservatives for reverse osmosis (RO) elements. Developed purchase description for six-inch RO elements

(U) FY 1990 Planned Program:

- **(U)** Initiate evaluation of EEWS cold weather storage and distribution kit. Approve EEWS cold weather kit for 600 ROWPU
- **(U)** Conduct pre-planned product improvement (P3I) for ROWPU family of water supply equipment
- **(U)** Complete technical test II of WQAU-P and conduct initial operational test and evaluation of WQAU-P

(U) FY 1991 Planned Program:

- **(U)** Continue EEWS effort on cold weather kit for storage and distribution equipment
- **(U)** Continue P3I evaluation of water supply equipment for ROWPU family

(U) Project DL41 — Fuels Handling Equipment Engineering Development: Develop and transition to procurement petroleum distribution systems.

(U) FY 1989 Accomplishments:

- **(U)** Conducted market investigation for lightweight forward area refueling components

(U) FY 1990 Planned Program:

- **(U)** Initiate the pre-planned product improvement (P3I) of the Arctic Forward Area Refueling Equipment (AFARE)
- **(U)** Field test and evaluate improved FARE systems
- **(U)** Develop and coordinate program management documents and performance specification for lightweight, Tactical Four Point Aviation Refueling System

(U) FY 1991 Planned Program:

- **(U)** Conduct arctic field test of P3I AFARE
- **(U)** Implement P3I of AFARE
- **(U)** Complete prototype testing of AFARE
- **(U)** Complete TDP for AFARE
- **(U)** This a continuing program

(U) Work Performed By: In-house efforts will be accomplished by US Army Troop Support Command, Belvoir Research, Development and Engineering Center, Fort Belvoir, VA and Natick Research, Development and Engineering Center, Natick, MA; Yuma Proving Ground, Yuma, AZ. Major contractors include AAI Corp, Towson, MD; Pioneer Parachute, Manchester, CT; E Systems, Salt Lake City, UT; Brunswick Corp., Marion, VA; Budd Co, Minneapolis, MN; VSE, Alexandria, VA; and Foster-Miller Inc., Waltham, MA; Libby Corp. Kansas City, MO; Fermont Div, Bridgeport, CT.

(U) Related Activities:

- PE #0603804A (Logistics and Engineer Equipment — Advanced Development)
- PE #0602705A (Electronics and Electronic Devices)
- PE #0602786A (Logistics Technology)
- PE #0603001A (Logistics Advanced Technology)

Program Element: **#0604804A**

PE Title: **Logistics and Engineer Equipment — Engineering Development** Budget Activity: **#4**

- PE #0604804A (Logistics and Engineer Equipment — Engineering Development) Coordination to avoid duplication of effort with other Services and Agencies is accomplished through the Department of Defense Joint Intermodular Steering Group Joint Committee on Tactical Shelters, Program Advisory Group for Bulk Petroleum Fuels Distribution, DoD Executive Agent for Land Based Water Resources, the Water Resources Management Action Group, Interagency Advance Power Group, and the DoD Project Manager for Mobile Electric Power.

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Other Procurement, Army:			
Project DH14—			
M41300			
M48900		14115	18152
	21891	21321	20034

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604805A**

PE Title: **Command, Control and Communications Systems — Engineering Development**

Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D282 SINCGARS-V Engineering Development	9214	11686	1404	- 0 -	63500
D487 Tactical Multi-Channel Communications	3388	- 0 -	- 0 -	- 0 -	123625
PE TOTAL	12602	11686	1404		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program funds full scale engineering development (FSED) and test evaluation of Army tactical communications equipment. Included are the Very High Frequency (VHF) Single Channel Ground and Airborne Radio System (SINCGARS), integrated communications security (COMSEC) design for SINCGARS, the Battlefield Electronic Communications Electronic Operating Instruction (CEOI) System (BECS), and items associated with other tactical radios which are not a part of SINCGARS such as the frequency hopping multiplexer. Also included is engineering development of Improved High Frequency (IHF) radios, fiber optic transmission systems, telephone/data/record traffic terminals, data distribution systems, antenna configurations, multichannel radio/multiplexer/technical control assemblages and ancillary equipment that increase the reliability, extend the useful life, and/or improve interoperability of current inventory equipment. Current funding for Project D487 ends in FY 1989. Any planned follow-on activities will occur in Project D107 Program Element #0208010 after FY 1989.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D487 — Tactical Multichannel Communications: Program rolls into PE #0208010/D107 in FY 1990. This program provides for in-house matrix and contractor program support in preparation for Non-Developmental Item (NDI) production award of the Digital Group Multiplexer (DGM) Antenna Mast Program/Family of Quick Erect Antennas. Also provides for prototype development and concept evaluation of multi-channel improvements.

(U) FY 1989 Accomplishments:

- **(U)** Continued program support for Family of Antenna Masts and Fiberoptic Transmission Systems (FOTS) Long Haul
- **(U)** Prepared solicitation documentation and performed market survey for the Vehicular Intercommunication System

(U) FY 1990 Planned Program:

- **(U)** Not funded

(U) FY 1991 Planned Program:

- **(U)** Not funded

(U) Work Performed By: Program management is provided by Project Manager, Single Channel Ground and Airborne Radio System (SINCGARS) reporting to the Program Executive Officer for Communications at Fort Monmouth, New Jersey (NJ) with support from the U.S. Army Communications-Electronics Command (CECOM). Major contractors are International Telephone & Telegraph (ITT), Fort Wayne, Indiana and Nutley, NJ; General Telephone & Electric (GTE), Needham, Massachusetts; Hughes Aircraft Corporation, Fullerton, California (CA); and General Dynamics, San Diego, CA.

Program Element: **#0604805A**

PE Title: **Command, Control and Communications Systems — Engineering Development** Budget Activity: **#4**

(U) Related Activities: There is no unnecessary duplication of effort within the Army or Department of Defense.

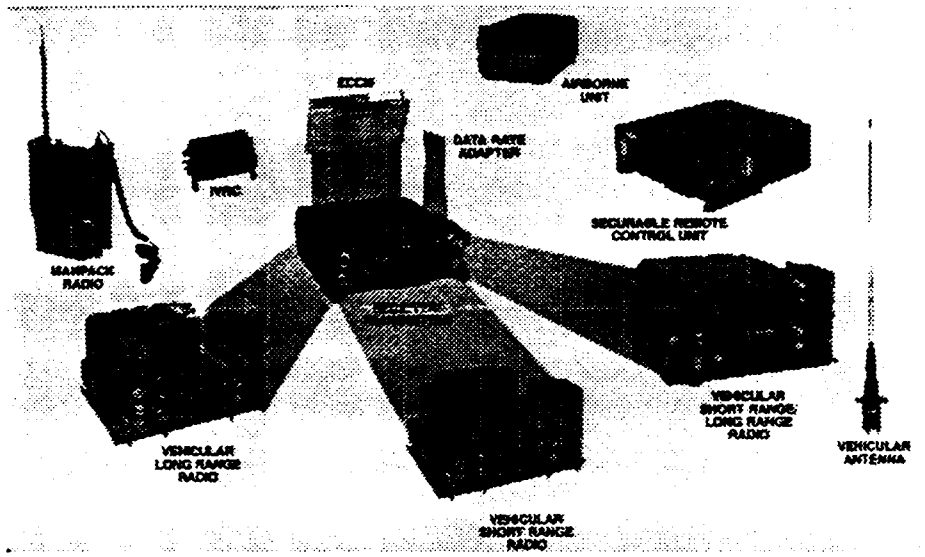
(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Other Procurement, Army SSN BB1550	500	4152	- 0 -

(U) International Cooperative Agreements: None

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604805A**
PE Title: **Command, Control and Communications Systems — Engineering Development**
Project Number: **D282**
Budget Activity: **#4**
Project Title: **SINCGARS-V Engineering Development**



POPULAR NAME: **SINCGARS-V Engineering Development**

A. (U) SCHEDULE/BUDGET INFORMATION: (S In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		DAB IIIB 2/89	ICOM IIIB 9/90	ICOM IIIC 7/91	
Engineering Milestones					
T&E Milestones			ICOM IOTE (ITT) 6/90	ICOM IOTE (GD) 3/91	
Contract Milestones		Cont DEV. ITT Ground OPT 3 AWD 6/89 OPT 2 DEL 6/89. ITT Airborne Basic DEL 11/88 OPT 2 AWD 4/89 OPT 1 DEL 7/89	Cont DEV Complete IK redesign. OPT 3 DEL 7/90. ITT Airborne—OPT 3 AWD 2/90 OPT 2 DEL 5/90	ITT Grnd—Opt 3 Cmpl/ITT Grnd—OPT 4 AWD 5/91 SRCU, cmpl. ITT Abn—OPT 3 DEL 5/91. GD—OPT 1 AWD 12/90 DEL 7/91	
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		7489	8955	439	50991 (0)
Support Contract		420	1422	365	4183 (0)
In-House Support		1305	1309	600	6180 (0)
GFE/ Other		- 0 -	- 0 -	- 0 -	2146 (0)
Total		9214	11686	1404	63500 (0)

Program Element: **#0604805A** Project Number: **D282**

PE Title: **Command, Control and Communications Systems — Engineering Development** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project provides engineering development support for the Single Channel Ground and Airborne System (SINCGARS) production radio. Tasks include the completion of efforts deferred during the advanced development phase such as vehicle installation kits (IK) the SINCGARS Remote Control Unit (SRCU), and the design changes needed to integrate communications security (COMSEC) in the production radio and the initiation of preplanned product improvement (P3I) initiatives. The funding associated with this project is reported in the SINCGARS Selected Acquisition Report (SAR). Included as part of the SINCGARS program is the Battlefield Electronic Communication Electronic Operating Instruction (CEOI) System (BECS) Development effort. It is a frequency management system designed to meet the critical requirement for a centralized and automated process to generate both single channel and frequency hopping CEOI information. SINGARS is a new family of electric-counter-counter-measure capable Very High Frequency — Frequency Modulated (VHF-FM) combat net radios which provides the primary means of command and control for Infantry, Armor and Artillery Units.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Provided a technical data package (TDP) and maintenance documentation (ILS) for the BECS
- **(U)** Continued ICOM effort for Phase III ground and airborne radios
- **(U)** Initiated installation kit (IK) redesign

(U) FY 1990 Planned Program:

- **(U)** Complete IK redesign
- **(U)** Complete COMSEC efforts for SINCGARS remote control unit and airborne radios
- **(U)** Identify and initiate preplanned product improvement (P3I) effort

(U) FY 1991 Planned Program:

- **(U)** Complete integrated COMSEC for airborne phase III
- **(U)** Complete P3I effort
- **(U)** Continue and complete SRCU development efforts

D. (U) WORK PERFORMED BY: Production contracts for the ground and airborne radios were competitively awarded to the Aerospace and Optical Division of International Telephone & Telegraph (ITT) Corp., Fort Wayne, Indiana., in December 1983 and 1985, respectively. A second source production contract for the ground ICOM version was awarded competitively in July 1988, to General Dynamics, San Diego California. Single Channel Ground and Airborne Radio System (SINCGARS) is a major program managed by a Program Manager reporting to the Program Executive Officer for Communications at Fort Monmouth, NJ with support from the Communications-Electronics Command (CECOM).

Program Element: **#0604805A** Project Number: **D282**

PE Title: **Command, Control and Communications Systems — Engineering Development** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** No change.
2. **(U) SCHEDULE CHANGES:** No change.
3. **(U) COST CHANGES:** No change.

F. (U) PROGRAM DOCUMENTATION:

Required Operational Capability (ROC)	12/74	10/86
Decision Coordinating Paper (DCP)	07/84	3/89
Test and Evaluation Master Plan (TEMP)	02/88	09/87

G. (U) RELATED ACTIVITIES: This project was covered under Program Element #0604751A (Single Channel Ground and Airborne Radio System (SINCGARS) — Engineering Development) in FY 1987 and by Program Element #0603746A SINCGARS Advanced Devel. No duplication of effort within the Department of the Army or other elements of the Department of Defense are known to exist.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Other Procurement, Army SSN BW0006 SINCGARS Family	237464	100029	311325

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) TEST AND EVALUATION DATA:

Test and Evaluation Activity (Past 12 Months)

Event	Planned Date	Actual Date	Remarks
Airborne non-Integrated Comsec (ICOM) Early User Test and Effectiveness Evaluation (EUTE)		Mar-May 88	Validated Operational
Ground non-Icom Follow On Test and Evaluation (FOTE)		Mar-May 88	Validated Operational Effectiveness and Suitability

Program Element: **#0604805A** Project Number: **D282**

PE Title: **Command, Control and Communications Systems — Engineering Development** Budget Activity: **#4**

Test and Evaluation Activity (Past 12 Months) — Continued

Event	Planned Date	Actual Date	Remarks
Mutual Interference Test (MINT)		May-Jun 88	Gathered field data to confirm models
Federal Communications Commission Test		Jul 88	To gain approval of frequency hopping channel use throughout the United States
Korean Government Interference Test		Jun 88	Validated Hopset to prevent TV interference
Ground non-ICOM 1000 hour Reliability Test	n/a	Jul-Sep 88	Validated Mean Time Between Failure Rate
Airborne Non-ICOM First Article Test	same	Jul 87-Jul 88	Assured quality conformance of production equipment. (first production year buy).
Integrated COMSEC (ICOM) Early User Test and Experimentation		Oct-Nov 88	ICOM Operational Effectiveness
Integrated COMSEC Pilot Production		Apr-Oct 89	Validation of production process.
BECS Development Test		Oct-Dec 88	Validation of BECS hardware and software.
BECS Operational Test		Jan-Mar 89	Validation of Operational effectiveness and suitability.
Manpack Non-ICOM Reliability		Nov 89	To assess the ruggedization improvements to the SINCGARS.

Test and Evaluation Activity (Next 12 Months)

Event	Planned Date	Remarks
Natural Environmental Tests (Ground)	FY90-91	Natural environment test of tactical communications, RAM, use of manpack and MANPRINT.
ICOM IOTE	Jun 90	To validate Operational Effective-and Suitability of ICOM radio.
General Dynamics (GD) IOTE	Jan 91	To qualify the SINCGARS Second Source.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604806A**

PE Title: **Chemical/Biological Defense Equipment — Engineering Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D017 Collective Protection Materiel	1200	1608	- 0 -	- 0 -	—
D019 Chemical/Biological Individual Protection Materiel	- 0 -	1513	402	Cont	Cont
D020 Chemical Detection and Warning Material	10613	28986	45306	Cont	Cont
D517 Radiac Equipment Engineering Development	1	2201	3946	Cont	Cont
DF97 Chemical/Biological Decontamination Materiel	- 0 -	4652	7637	Cont	Cont
PE TOTAL	11814	38960	57291		

B. (U) BRIEF DESCRIPTION OF ELEMENT: Provides for the conduct of engineering development of radiological, chemical, biological detection and warning systems, individual collective protection, and decontamination systems. Department of Defense (DOD) Directive 5160.5 tasks the Army to be Executive Agent for Chemical Warfare (CW) and Chemical Biological Defense (CBD) research and development. The program supports the urgent need to provide all Services with detection and warning systems to alert individuals and combat units to the presence of radiological contamination, chemical/biological/toxin agents, and to provide defensive materiel to protect and decontaminate individuals and equipment from threat chemical-biological agents. This program develops improvements in detection, protection, radiac, and decontamination equipment that are more effective yet less detrimental to individuals and units and enhance military performance and readiness.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D017 — Collective Protection Materiel: This development provides materiel which permits personnel to conduct vital operations inside contamination-free protective enclosures while operating on a contaminated battlefield. Use of these protective enclosures ranges from rest facilities and command centers to complete operating field hospitals.

(U) FY 1989 Accomplishments:

- **(U)** Initiated M20 Simplified Collective Protection Equipment (SCPE) preplanned product improvement (P3I)

(U) FY 1990 Planned Program:

- **(U)** Complete engineering development on P3I of the M20 Simplified Collective Protection Equipment (SCPE)
- **(U)** Conduct technical tests and user tests for M20 P3I

(U) FY 1991 Planned Program:

- **(U)** Program not funded

(U) Project D019 — Chemical/Biological Individual Protection Materiel: This project completes the full-scale development P3I of the M40 protective mask for ground soldiers.

Program Element: #0604806A

PE Title: **Chemical/Biological Defense Equipment — Engineering Development** Budget Activity: #4

(U) FY 1989 Accomplishments: No funded program — P3I for M40 protective mask was delayed until FY90

(U) FY 1990 Planned Program:

- (U) Conduct engineering development for P3I in communications, headharness, and single lense peripheral vision for M40 mask
- (U) Initiate technical tests/user tests for M40 P3I

(U) FY 1991 Planned Program:

- (U) Complete technical tests/user tests for M40 P3I

(U) Project D517 — Radiac Equipment: Provides for engineering development of personal and vehicle-mounted radiation detection and warning material.

(U) FY 1989 Accomplishments:

- (U) No funded program

(U) FY 1990 Planned Program:

- (U) Initiate full-scale development of Advanced Airborne Radiac System (AARS)

(U) FY 1991 Planned Program:

- Complete technical test, initiate user test on AARS
- Initiate full-scale development on PDR-75 Radiac Trainer

(U) Project DF97 — Chemical/Biological Decontamination Materiel: Conduct engineering development to increase capabilities for personal, vehicle and equipment decontamination of chemical, biological and radiological battlefield contamination.

(U) FY 1989 Accomplishments:

- (U) No funded program

(U) FY 1990 Planned Program:

- (U) Initiate full-scale development on the Multipurpose Chemical/Biological Decontaminant

(U) FY 1991 Planned Program:

- (U) Initiate full-scale development on the Non-Aqueous Equipment Decontamination System (NAEDS) Mobile
- (U) Award full-scale development contract and conduct critical design review on Multi-purpose Chemical/Biological Decontaminant

(U) **Work Performed By:** For all services, the Project Manager for NBC Defense Systems, Aberdeen Proving Grounds (APG), Maryland, is responsible for development and fielding of chemical/radiological defense equipment. Major laboratories and developing centers include Chemical Research, Development and Engineering Center (CRDEC), Aberdeen Proving Ground (APG), MD; Test and Evaluation Command, APG, MD; Army Materials and Mechanics Research Center, Watertown, MA; Army Tank-Automotive Command, Warren, MI; Human Engineering Laboratory, APG, MD; and Electronic Warfare Laboratory, Ft Monmouth, NJ. Contractors include Honeywell, Inc, Orlando, FL; Brunswick Corporation, Deland, FL; All-Bann Enterprises, Anaheim, CA, Graseby Ionics, Ltd, United Kingdom; and Environmental Analytical Systems Incorp (EASI), Towson, MD.

(U) **Related Activities:**

Program Element #0602622A (Chemical, Smoke and Equipment Defeating Technology)
Program Element #0603806A (Chemical/Biological Defense Equipment — Advanced Development)

Program Element: **#0604806A**

PE Title: **Chemical/Biological Defense Equipment — Engineering Development** Budget Activity: **#4**

Department of Defense Directive 5160.5 assigns the Army responsibility for research and development in chemical-biological defense for joint requirements of the Army with the other Services in order to meet other Services' needs and to prevent unnecessary duplication of effort. Execution of this responsibility is coordinated through the Joint Chemical Warfare/ Chemical-Biological Defense Research, Development, and Acquisition Plan; Joint Services Radiac Working Group; and Joint periodic reviews of the Joint Chemical-Biological Research, Development, Test and Evaluation Program. Coordination and cooperation are maintained with allied countries via data exchange agreements and through meetings of the North Atlantic Treaty Organization (NATO) AC/225 (Panel VII).

(U) Other Appropriation Funds: ($ in Thousands) Not applicable.

(U) International Cooperative Agreements: None

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604806A** Project Number: **#D020**

PE Title: **Chemical/Biological Defense Equipment — Engineering Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Chemical Detection and Warning Materiel

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
NBC Reconnaissance, Detection and Identification (RDI)	10613	28986	45306	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project is vital to the full-scale development (FSD) of new manned and unmanned nuclear, biological and chemical (NBC) detectors and alarms that will greatly enhance the U.S. capability to detect, provide alarm, and identify threat agents on the battlefield. The project will provide a first time dedicated NBC Reconnaissance System (NBCRS) (The XM93) and smaller, more dependable systems that will detect, locate, mark and identify contamination. The new systems will also evaluate the effectiveness of the decontamination of personnel and equipment. The completion of development of long range laser detectors for ground employment will greatly improve the U.S. capability to avoid contaminated areas and provide timely early warning of NBC attack. This project will complete the development of a new generation of point sampling detectors with increased sensitivity and expanded capabilities over current equipment.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Conducted initial operational test and evaluation (IOTE) for XM21 Remote Sensing Chemical Agent Alarm (RSCAAL)
- **(U)** Initiated program to upgrade interim NBCRS to meet full requirements
- **(U)** Conducted Congressionally mandated competitive NBCRS XM93 shoot-off test and evaluation to select candidate for interim system production and further development
- **(U)** Initiated test and evaluation of interim XM93 NBCRS

(U) FY 1990 Planned Program:

- **(U)** Conduct technical tests/user tests (TT/UT) for XM21 RSCAAL
- **(U)** Initiate full-scale development and fabricate engineering prototypes for XM22 Automatic Chemical Agent Detection Alarm (ACADA)
- **(U)** Select XM93 NBCRS competitive shootoff winner, initiate full scale development to upgrade selected system to fully meet required operational capability (ROC), fabricate two prototype test systems & conduct initial engineering design test (EDT).
- **(U)** Type classify/limited procurement urgent (TC/LPU) the interim XM93 NBCRS
- **(U)** Award system improvement phase contract for XM93 NBCRS

(U) FY 1991 Planned Program:

- **(U)** Type classify XM21 Remote Sensing Chemical Agent Alarm (RSCAAL)
- **(U)** Complete design of full capability NBCRS, conduct full system EDT, initiate fabrication of additional 8 systems for TT/UT
- **(U)** Conduct first article/initial production tests on interim XM93 NBCRS
- **(U)** Initiate TT/UT of XM22 Automatic Chemical Agent Detection Alarm (ACADA)
- **(U)** Conduct engineering design test on system improvement phase of the NBCRS

Program Element: **#0604806A** Project Number: **#D020**

PE Title: **Chemical/Biological Defense Equipment — Engineering Development** Budget Activity: **#4**

D. (U) WORK PERFORMED BY: Project Manager for NBC Defense Systems, Aberdeen Proving Ground (APG), MD; US Army Chemical, Research, Development, and Engineering Center (CRDEC), APG, MD; Test and Evaluation Command (TECOM), APG, MD; Night Vision Electro-Optics Lab (NVEOL), Fort Belvoir, VA; and Communications/Electronics Command (CECOM), Fort Monmouth, NJ. The current contractor for part of D020 is Brunswick Corp.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** Not applicable.

F. (U) PROGRAM DOCUMENTATION: Not applicable.

G. (U) RELATED ACTIVITIES: Activities are coordinated through PE #0603806A, Chemical Detection and Warning Concepts, and PE #0602622, Chemical and Smoke Munitions, A553 CB Defense Exploratory Development. No duplication of effort exists within the Army or Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands)

1. **(U) PROCUREMENT:** Not applicable.
2. **(U) MILITARY CONSTRUCTION:** Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
XM22 ACADA	
MS III Type Classification (TC)	4/93
XM21 RSCAAL	
MS III TC	7/91
XM93 NBC Recon System	
MS III TC Limited Procurement — Urgent	11/89
MS III TC Standard A	3/93

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604807A**

PE Title: **Medical Materiel/Medical Biological Defense Equipment Engineering Development** Budget Activity: **#4**

A. (U) RESOURCES: (S in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D832 Combat Medical Materiel Engineering Development	3140	3695	3744	Cont	Cont
D847 Medical Biological Defense Engineering Development	6134	7562	9458	Cont	Cont
D848 Medical Chemical Defense Life Support Materiel	5626	3236	3092	Cont	Cont
D849 Infectious Diseases Drug and Vaccine — Engineering Development	2365	2809	3264	Cont	Cont
PE TOTAL	17265	17302	19558		

Project D848 was formerly managed under PE #0604757A (Medical Chemical Defense Life Support Materiel).

B. (U) BRIEF DESCRIPTION OF ELEMENT: This full-scale development program funds improved medical equipment and drugs essential to counteracting lethal and human performance degrading effects of chemical threats, and medical equipment essential to meeting medical requirements on the integrated battlefield with emphasis on high mobility, yet supporting large numbers of combat casualties. Additionally, foreign medical materiel may be procured for exploitation of advanced technology and development to meet Army medical defense goals. This program also supports the full scale development of vaccines, prophylactic and therapeutic drugs, resuscitation fluids and drug products, rapid identification and diagnostic systems, and arthropod vector repellent systems for the prevention of naturally occurring diseases and medical defense against biological threats.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D832 — Combat Medical Materiel Engineering Development: Supports advanced development to field new and improved medical materiel essential for combat casualty care to reduce logistical support requirements and improve the return to duty rate.

(U) FY 1989 Accomplishments:

- **(U)** Continued full-scale development (FSD) of laser eye protection for pilots
- **(U)** Continued FSD of advanced field sterilizer

(U) FY 1990 Planned Program:

- **(U)** Initiate FSD of Resuscitative Fluids Production System (REFLUPS)
- **(U)** Initiate technical testing and engineering development of REFLUPS
- **(U)** Transition morphine autoinjector to procurement
- **(U)** Transition hypertonic saline blood expander to FSD studies
- **(U)** Complete FSD of advanced field sterilizer

(U) FY 1991 Planned Program:

- **(U)** Continue hypertonic saline blood expander field studies
- **(U)** Conduct user testing of REFLUPS

Program Element: **#0604807A**

PE Title: **Medical Materiel/Medical Biological Defense Equipment Engineering Development** · Budget Activity: **#4**

(U) Project D847 — Medical Biological Defense Engineering Development: Use of biological agents by adversaries would have an adverse impact on individual survivability and operational capabilities of U.S. troops on the integrated battlefield. A system of medical defense against biological agents is required to provide individual soldier protection, sustain individual performance in a biological environment and provide for self-aid/buddy-aid and medical treatment of biological agents. This project, which addresses joint Service and Army-unique requirements, provides engineering development of medical countermeasures against biological agents to include life support equipment and vaccines.

(U) FY 1989 Accomplishments:

- **(U)** Transitioned Rift Valley fever vaccine to production
- **(U)** Conducted field efficacy study of Argentine hemorrhagic fever vaccine in Argentina

(U) FY 1990 Planned Program:

- **(U)** Continue field efficacy study of Argentine hemorrhagic fever vaccine in Argentina
- **(U)** Initiate full-scale development (FSD) of Q-fever vaccine

(U) FY 1991 Planned Program:

- **(U)** Conduct efficacy study of Chikungunya vaccine
- **(U)** Initiate FSD of vectored vaccines for viral equine encephalitis threats
- **(U)** Initiate field efficacy study of Lassa Fever immune globulin
- **(U)** Initiate field study of Rift Valley Fever Vaccines

(U) Project D848 — Medical Chemical Defense Life Support Materiel: This project addresses joint Service and Army-unique requirements for the development of medical materiel necessary to field an effective capability for medical defense against chemical agents for U.S. forces.

(U) FY 1989 Accomplishments:

- **(U)** Completed prove-out of the skin decontamination production process
- **(U)** Initiated FSD of convulsant antidote for nerve agent
- **(U)** Transitioned the chemical agent resistant dressing cover and patient protective wrap to procurement

(U) FY 1990 Planned Program:

- **(U)** Initiate FSD of the Life Detector
- **(U)** Complete clinical testing of nerve agent convulsant antidote
- **(U)** Transition the oral nerve agent pretreatment and skin decontamination kit to production
- **(U)** Complete FSD of the Individual Chemical Resuscitation Device
- **(U)** Initiate production and deployment of 1.5 million skin decontamination kits

(U) FY 1991 Planned Program:

- **(U)** Complete FSD of the Field Medical Oxygen Generation and Distribution System (FMOGDS)
- **(U)** Transition the multichambered autoinjector to production

(U) Project D849 — Infectious Diseases Drug and Vaccine Engineering Development: Designed to complete development and field testing of rapid identification systems, drugs and vaccines required to sustain readiness posture of U.S. Forces and provide medical defense against naturally occurring infectious diseases of military significance.

Program Element: #0604807A

PE Title: **Medical Materiel/Medical Biological Defense Equipment Engineering Development** Budget Activity: #4

(U) FY 1989 Accomplishments:

- (U) Initiated field immunogenicity study of inactivated hepatitis A vaccine
- (U) Completed phase III efficacy study of Meningitis B vaccine in Chile
- (U) Completed clinical studies of malaria treatment drug-Halofantrine

(U) FY 1990 Planned Program:

- (U) Initiate field efficacy study of anti-leishmanial drugs
- (U) Complete field immunogenicity study of inactivated hepatitis A vaccine
- (U) Initiate phase II efficacy study of Meningitis B vaccine in Chile
- (U) Transition antimalarial drug Halofantrine to production

(U) FY 1991 Planned Program:

- (U) Initiate field efficacy study of inactivated hepatitis A vaccine
- (U) Complete field efficacy study of anti-leishmanial drugs

(U) Work Performed By:

D832 — Work is performed in-house by US Army Medical Materiel Development Activity, Fort Detrick, MD; US Army Bioengineering Research and Development Laboratory, Fort Detrick, MD; and US Army Institute of Dental Research, Washington, DC. Primary contractors: Sterimatics Corp., New Bedford, MA and American Optical Corporation, Southbridge, MA.

D847 — Work is performed in-house by the following organizations: U.S. Army Medical Materiel Development Activity, Fort Detrick, MD; U.S. Army Medical Research Institute of Infectious Disease, Fort Detrick, MD; Walter Reed Army Institute of Research, Washington, D.C. Major Contractors include: Salk Institute, San Diego, CA; and Centers for Disease Control, Atlanta, GA.

D848 — Work is conducted in-house at US Army Biomedical Research and Development Laboratory and US Army Medical Materiel Development Activity. The major contractor is Rohm & Haas Corporation, Spring House, PA.

D849 — Work is performed in-house by US Army Medical Materiel Development Activity, Fort Detrick, MD; US Navy Medical Research and Development Command, Bethesda, MD; Walter Reed Army Institute of Research, Washington, DC; and its field activities in Thailand, Malaysia, Kenya, and Brazil; Letterman Army Institute of Research, San Francisco, CA. Primary contractor: University of Maryland School of Medicine, Baltimore, MD.

(U) Related Activities:

PE #0601102A, Defense Research Sciences, Projects BS12, BS13, BS14, BS15, and BS16.
PE #0602787A, Medical Technology, Projects A825, A871, A874, and A878.
PE #0603002A, Medical Advanced Technology, Projects D807, D810, D819, and D840.
PE #0603807A, Medical Systems Advanced Development.
There is no unnecessary duplication of efforts in Army or DoD programs. This effort is coordinated with the following agencies annually, or more frequently as required: Department of Defense, Office of the Deputy Under Secretary of Defense for Research and Advanced Technology; All Joint Technology Coordinating Groups of the Armed Services Biomedical Research Evaluation and Management Committee; Joint Services Container Steering Group; DOD Executive Agent for Land-Based Water Resources; Program Advisory Group for Bulk Petroleum Fuels Distribution; World Health Organization; Pan American Health Organization.

Program Element: **#0604807A**

PE Title: **Medical Materiel/Medical Biological Defense Equipment Engineering Development** Budget Activity: **#4**

(U) Other Appropriation Funds: ($ in Thousands) Procurement of transitioned products is provided for in Other Procurement, Army (OPA), Operation and Maintenance, Army (OMA), or passed to other procuring agencies as appropriate.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604808A**

PE Title: **Landmine Warfare/Barrier—Engineering Development** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D016 Mine Systems Engineering Development	2522	4675	8000	Cont	Cont
D021 Explosive Demolitions	4785	4056	2430	- 0 -	
D415 Mine Neutralization/Detection	8652	922	6942	Cont	Cont
PE TOTAL	15959	9653	17372		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element (PE) provides for engineering development of mine, countermine and demolitions systems. It provides a group of mutually supporting mine detection and neutralization devices to counter a variety of threat mines and obstacles, and for development of explosive demolitions systems to rapidly create anti-armor ditches, point obstacles such as road craters and bridge demolition, and defeat natural and man-made obstacles. This PE also provides for the increased tactical effectiveness and responsiveness of landmines by supporting the development of a Family of Scatterable Mines (FASCAM), which can be dispensed rapidly from helicopters, ground dispensers, artillery systems and tactical aircraft. Minefields are one of the most effective, efficient, and adaptable obstacles to armor mobility. Scatterable mines placed by highly responsive multiple delivery means provide a significant enhancement to the deterrence of Warsaw Pact armor attacks.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D016 — Mine Systems Engineering Development: Provides for engineering development of Family of Scatterable Mines (FASCAM) and new smart mines

(U) FY 1989 Accomplishments:

- **(U)** Type classified VOLCANO ground system
- **(U)** Initiated development of inert VOLCANO trainer
- **(U)** Initiated VOLCANO fabrication for tracked carrier (M548)

(U) FY 1990 Planned Program:

- **(U)** Type classify VOLCANO Air System
- **(U)** Complete testing of VOLCANO and Type Classify for M548
- **(U)** Initiate development of improved multisensor fuzing for fielded mine warfare systems

(U) FY 1991 Planned Program:

- **(U)** Continue development and test of improved multisensor fuzing for fielded systems
- **(U)** Initiate preplanned product improvements in FASCAM minefield communication and control

(U) Project D021 — Explosive Demolitions: Provides for engineering development of Tactical Explosive System (TEXS)

Program Element: **#0604808A**

PE Title: **Landmine Warfare/Barrier—Engineering Development** Budget Activity: **#4**

(U) FY 1989 Accomplishments:

- **(U)** Continued non-developmental item (NDI) evaluation of nitromethane candidate

(U) FY 1990 Planned Program:

- **(U)** Complete NDI evaluation of nitromethane candidate
- **(U)** Initiate TEXS development program

(U) FY 1991 Planned Program:

- **(U)** Complete TEXS development program and type classify system

(U) Project D415 — Mine Neutralization/Detection: Provides for engineering development of U.S. countermine systems.

(U) FY 1989 Accomplishments:

- **(U)** Initiated testing of Vehicle Magnetic Signature Duplicator (VEMASID) prototypes

(U) FY 1990 Planned Program:

- **(U)** Continue fabrication, testing, and full-scale design of VEMASID system

(U) FY 1991 Planned Program:

- **(U)** Type classify VEMASID
- **(U)** Initiate preplanned product improvement of VEMASID

(U) Work Performed By: The Project Manager for Mines, Countermine and Demolitions, Picatinny Arsenal, NJ is assigned the responsibility for landmine, countermine and explosive demolition development. The major supporting laboratories are the Armament Research, Development and Engineering Center, Dover, NJ; the Tank Automotive Research and Development Center, Warren, MI; and the Belvoir Research Development and Engineering Center, Ft. Belvoir, VA. The major countermine contractors employed at this time are Honeywell Inc, Hopkins, MN; General Dynamics, Carterlaire, MN; BMY Corporation, York, PA; Gould Electronics, Glen Burnie, MD; Texas Instruments, Austin, TX; and FMC Corporation, Fullerton, CA. Major mine contractors are Motorola Inc, Scottsdale, AZ; and Honeywell Inc, Hopkins, MN. The major demolitions contractors are Ireco Inc, Salt Lake City, UT: Atlas Powder Company, Dallas, TX and ANGUS Chemical Company, Monroe, LA.

(U) Related Activities: Component work and exploratory development for this program are conducted in PE #0602786A (Logistics Technology), #0602784A (Military Engineering Technology), #0603606A (Landmine Warfare and Barrier Advanced Technology), and #0603619A (Landmine Warfare and Barrier-Advanced Development). Engineering development efforts, which result from this program, are accomplished in PE #0604619A (Landmine Warfare Development). Mine and countermine efforts are closely coordinated to incorporate counter-countermeasures as applicable. The Project Manager for Mines, Countermine and Demolitions monitors related programs to ensure no unncessary duplication of effort with the Army or DOD. Development information on mines is coordinated and exchanged among the Services by the Tri-Service Joint Technical Coordinating Group for Unpowered Weapons. The Department of Defense's Land Warfare monitors the scatterable mine program to avoid service duplication.

Program Element: **#0604808A**

PE Title: **Landmine Warfare/Barrier—Engineering Development** Budget Activity: **#4**

(U) Other Appropriation Funds: ($ in Thousands)

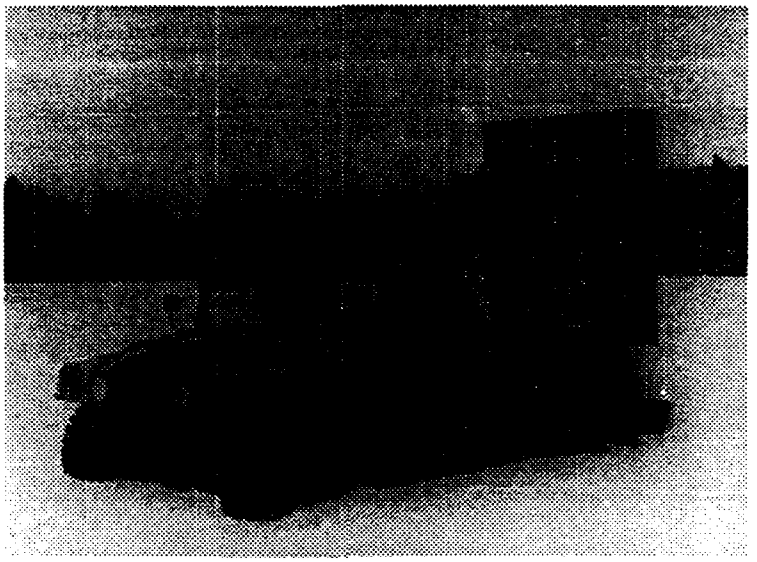
	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Ammunition Procurement, Army E72194, E72195	57013	80950	80127

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604810A**
PE Title: **Fiber Optic Guided Missile-Engineering Development**
Project Title: **FOG-M Engineering Development**

Project Number: **DC26**
Budget Activity: **#4**



POPULAR NAME: **FOG-M**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones					TBD
Engineering Milestones		Begin FSD 12/88. Continue TRR program			
T&E Milestones		Conduct initial Operational Evaluation 11/88-10/89, FDTE (IOE) 4/89-5/89, Start Extended User Employment (EUE) Evaluation 8/89	Start Test-Contractor Assessment (EDT-C 11/90)	Compl EDT-C 6/91. Start System Qual Testing 7/91	TBD
Contract Milestones		Award FSD Contract 12/88			TBD
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		75916	62600	17286	213102 (57300)
Support Contract		2719	16100	23322	141875 (20000)
In-House Support		6214	26459	11966	126974 (48200)
GFE/ Other		11578	16900	46488	95137 (15000)
Total		96427	122059	99062	577088 (140500)

Program Element: **#0604810A** Project Number: **DC26**

PE Title: **Fiber Optic Guided Missile-Engineering Development** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Fiber Optic Guided-Missile (FOG-M) system is the Non-Line of Sight (NLOS) system element of the Forward Area Air Defense System (FAADs). The FOG-M system consists of a multiple missile launcher and fire control ground station mounted on either a light or heavy vehicle. The NLOS system will permit a safely concealed and protected gunner to engage both fixed and moving targets to extended ranges, even when the targets are in defilade or concealed positions. The FOG-M can be launched from hidden positions. The gunner locates targets by viewing on a video screen what the missile imaging seeker (either television or Imaging Infrared (IIR)) sees as the missile cruises at low altitudes below cloud ceilings. The image is transmitted from the missile through a fiber optic datalink to a gunner located on the ground. Simultaneously, guidance commands are transmitted to the missile on the same optical fiber from the ground computer located in the gunner station. As part of the FAAD system, NLOS will provide air defense protection to the maneuver force against masked, stand-off rotary-wing aircraft. In addition, the NLOS system will provide fully adequate anti-armor capability against threat armor well beyond the maximum range of tank main guns or direct fire anti-tank missiles. It will have a night/adverse weather capability and utilize an on-board passive sensor which will allow the fire unit to acquire targets autonomously.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Full scale development (FSD) of NLOS FOG-M Block 1 System has been initiated with the December 1988 award of a 43-month FSD contract
- (U) Technical risk reduction (TRR) executed by MICOM Research, Development and Engineering Center (RDEC) continued into early FY90
- (U) Pre-qualification missile flights for the initial operational evaluation (IOE) were conducted from January through June 1989
- (U) IOE captive flight tests at RSA and WSMR were completed in April 1989. IOE missile flight tests completed at WSMR against both aerial and ground targets (July through September 1989)
- (U) An initial force development test & experimentation (FDT&E) was executed April and May 1989, at Ft. Bliss, TX, utilizing IOE configuration hardware to involve the user early in the development of tactics, training, and doctrine for the NLOS FOG-M Block 1 System.
- (U) Extended user employment (EUE) was begun in August 1989 at Ft. Bliss, TX, utilizing IOE configuration hardware to support the continued development of tactics, training, and doctrine for the NLOS FOG-M Block 1 System

(U) FY 1990 Planned Program:

- (U) Continue FSD development of the NLOS FOG-M Block 1 System
- (U) Conduct EUE at Ft. Bliss, TX
- (U) TRR at MICOM RDEC

(U) FY 1991 Planned Program:

- (U) Continue FSD development of the NLOS FOG-M Block 1 System
- (U) Engineering development test—contractor/government operational assessment November 1990-July 1991
- (U) Initiate system qualification testing of the NLOS FOG-M Block 1 System in July 1991, to be completed in July 1992

(U) Program Plan to Completion:

- (U) Continue FSD of the NLOS FOG-M Block 1 System
- (U) Complete an FDT&E with FSD prototype hardware

Program Element: **#0604810A** Project Number: **DC26**

PE Title: **Fiber Optic Guided Missile-Engineering Development** Budget Activity: **#4**

- **(U)** Conduct the initial operational test and evaluation (IOT&E)

D. (U) WORK PERFORMED BY: In-house efforts accomplished by US Army Missile Command, Redstone Arsenal, AL; US Army Research, Development and Engineering Center, Redstone Arsenal, AL; US Army Air Defense Board Ft. Bliss, TX, White Sands Missile Range, NM; US Army Test and Evaluation Command, Aberdeen Proving Ground, MD. FSD contractor team selected was Boeing Military Airplane Co., Huntsville, AL and Hughes Aircraft Company, Canoga Park, CA. FSD contract was awarded Dec 1988.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None.
2. **(U) SCHEDULE CHANGES:** DAB III A deleted due to deferral of production funding FY90. TRR effort reduced; EUE program ends early.
3. **(U) COST CHANGES:** $73.7M (FY92-94) transferred from procurement account (HO3100) to purchase hardware and provide test support to conduct live fire/operational testing of the system in compliance with Title 10 law.

F. (U) PROGRAM DOCUMENTATION:

Milestone I (FAAD-WG Report to Sec Defense)	01/86
Acquisition Decision Memo	12/86
Required Operational Capabilities (ROC)	10/87
RFP Release (Full Scale Development)	11/87
Baseline Cost Estimate	06/88
Acquisition Strategy Report	07/88
Decision Coordinating Paper (DCP)	07/88
Business plan to Congress	07/88
Test and Evaluation Master Plan (TEMP)	06/88
Integrated Logistics Support Plan (ILSP)	09/88

G. (U) RELATED ACTIVITIES: There is no unnecessary duplication of effort with other Army or other service/agency programs. Related Activities include:

- PE #0603757A (Project No. D465 — Non-Line of Sight)
- PE #0604741A (Air Defense Command, Control and Intelligence-Engineering Development)
- PE #0603757A (Project No. D683-LOS AD System Forward-Heavy)
- PE #0603313A (Missile and Rocket Advanced Technology)

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: The government of France is drafting a data exchange agreement for consideration by NLOS PMO. The government of Italy is interested in data exchange.

J. (U) TEST AND EVALUATION DATA: Not Applicable.

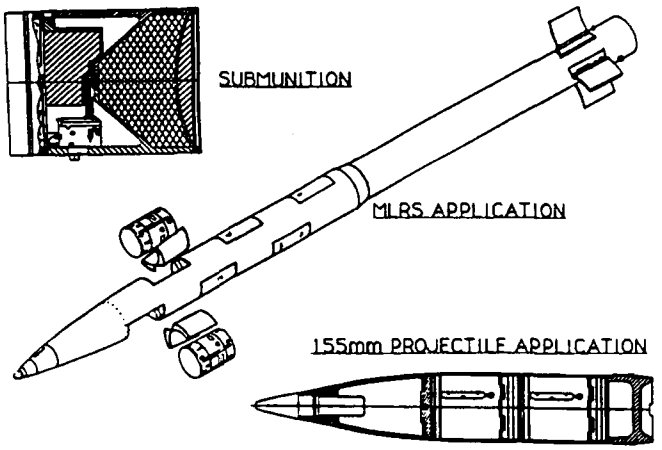
FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604814A** Project Number: **D644**

PE Title: **Sense and Destroy Armor (SADARM) — Engineering Development** Budget Activity: **#4**

Project Title: **Generic SADARM Engineering Development**

SADARM PROGRAM



POPULAR NAME: **SADARM**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones					ASARCIII 2Q/92 DABIII 3Q/92
Engineering Milestones		MLRS Critical Design Rev 7/89	Critical Des Rev Submit 4/90		FUE 155mm 4Q/93; FUE MLRS 3Q/94
T&E Milestones		Congress Directed Demo 3Q89 Projectile Flt Test MLRS 5/89	MLRS Disp Flts 3Q90-2Q91 155mm Tech Tst Flts 3Q90–4Q91	MLRS Tech Test Flts 4Q91–2Q92 155mm IOTE 4Q91–2Q92	IOTE MLRS 1Q93–3Q93
Contract Milestones					FSP Submunition 155mm 3Q/92 LRIP MLRS 3Q92
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		99600	90890	73658	445200 (57400)
Support Contract		18927	18200	6649	62800 (1621)
In-House Support		11490	17472	12700	105100 (13300)
GFE/ Other		13900	16200	12500	63800 (9300)
Total		143917	142762	105507	676900 81621

Program Element: **#0604814A** Project Number: **D644**

PE Title: **Sense and Destroy Armor (SADARM) — Engineering Development** Budget Activity: **#4**

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Sense and Destroy Armor (SADARM) munitions will provide an enhanced counterbattery capability for Multiple Launch Rocket System (MLRS) and 155mm Howitzer delivery systems with both systems capable of attacking targets well beyond the Forward Line of Troops (FLOT) in a fire-and-forget mode. This development responds to the primary fire support deficiency of insufficient lethality identified by the Fire Support Mission Area Analysis. SADARM will be capable of use in inclement weather, degraded battlefield conditions and nuclear, biological and chemical (NBC) environments, both day and night. SADARM munitions are designed for use against self-propelled howitzers and armored threat vehicles acquired while providing counterfire, close support, suppression of enemy air defense (SEAD) and interdiction fires. Upon ejection from the 155mm projectile or the MLRS rocket, the submunition deploys and descends toward the ground at a constant velocity and spin rate. The submunition contains a sensing mechanism which is a dual mode combination of millimeter wave sensor and an infrared sensor array. If a target is present within the scan area, the sensor detects its presence and fires an explosively formed penetrator into the target.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- **(U)** Conducted 155mm projectile component design and testing
- **(U)** Successfully completed projectile flight tests of modified advanced development projectiles (8-inch) with instrumented and tactical submunitions
- **(U)** Started procurement of long lead hardware for technical tests (TT) and initial operational test and evaluation (IOTE).
- **(U)** Began Multiple Launch Rocket System (MLRS) dispenser tests with instrumentation packages

(U) FY 1990 Planned Program:

- **(U)** Begin expenditures for MLRS technical tests and IOTE hardware
- **(U)** Begin 155mm Projectile technical tests
- **(U)** Conduct 155mm force development test and evaluation (FDTE)
- **(U)** Continue MLRS dispenser tests with instrumented and tactical submunitions

(U) FY 1991 Planned Program:

- **(U)** Complete MLRS dispenser tests with instrumented and tactical submunitions
- **(U)** Complete MLRS component design and testing
- **(U)** Complete 155mm Projectile TT
- **(U)** Begin 155mm Projectile IOTE
- **(U)** Begin Multiple Launch Rocket System (MLRS) TT flights

(U) Program Plan to Completion:

- **(U)** Complete 155mm Projectile IOTE
- **(U)** 155mm type classification (TC) standard full-scale production — 2Q92
- **(U)** Conduct MLRS SADARM FDTE 2Q92
- **(U)** Complete MLRS TT and TC low rate initial production (LRIP) — 2Q92
- **(U)** Army System Acquisition Review Council (ASARC) III — 2Q92
- **(U)** Milestone III Defense Acquisition Board — 3Q92
- **(U)** MLRS IOTE — 1Q93-3Q93
- **(U)** MLRS Milestone Decision Review — 4Q93
- **(U)** MLRS TC-standard full-scale production — 4Q93

Program Element: #0604814A
PE Title: **Sense and Destroy Armor (SADARM) — Engineering Development**

Project Number: D644
Budget Activity: #4

- (U) First unit equipped — 155mm — 4Q93
- (U) First unit equipped — MLRS — 3Q94

D. (U) WORK PERFORMED BY: Major Contractors are Honeywell Inc.; Minneapolis, MN; Aerojet Electro Systems, Azusa, CA; LTV Corp.; Dallas, TX. Inhouse efforts accomplished by: Program Executive Officer, Armaments, Picatinny Arsenal, NJ; Product Manager, Sense And Destroy Armor (SADARM), Picatinny Arsenal, NJ; Program Manager, Multiple Launch Rocket System (MLRS), Redstone Arsenal, AL.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None
2. **(U) SCHEDULE CHANGES:** None
3. **(U) COST CHANGES:** None

F. (U) PROGRAM DOCUMENTATION:

Required Operational Capability (ROC)	3/86
Decision Coordinating Paper (DCP)	12/87
Acquisition Plan/Acquisition Strategy	7/87
System Threat Assessment Report (STAR)	1/87
Operational and Organizational (O&O) Plan	1/87
Integrated Logistics Support Plan (ILSP)	1/87
Test and Evaluation Master Plan (TEMP)	6/88

G. (U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Army or other Service/Agencies.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable

J. (U) TEST AND EVALUATION DATA: Firings of modified advanced development hardware (8-inch Howitzer), as required by FY86 Joint Appropriations Conference report language, were completed during July 1989. Proof-of-principle was successfully demonstrated in a complete firing, dispense, acquisition, and target engagement sequence.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604816A** Project Number: **#DC27**

PE Title: **LONGBOW (Formerly Airborne Adverse Weather Weapon System (AAWWS))-ED** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: LONGBOW Engineering Development

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
LONGBOW	- 0 -	73404	159057	159780	392241

NOTE: This program was initiated in FY 1985 under PE 0102812A at a funding level of $122,500K thru FY 1987. LONGBOW proof-of-principle was continued under PE #0603776A in FY 1988 to FY 1990 and transitions to engineering development in this PE in FY 1990.

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: There is a critical need for a weapon system that is capable of being employed day or night in adverse weather and obscurants, and provides the AH-64 with a fire-and-forget capability. The missile must be effective in engaging and destroying advanced threat armor on the AirLand Battlefield of the late 1990's and into the 2000's. To be effective and survive on this future battlefield, the attack helicopter team must be able to rapidly engage multiple targets with minimum exposure time, and deploy a weapon that is inherently resistant to threat countermeasure techniques. The LONGBOW consists of an integrated fire control radar (FCR) and a radio frequency (RF) autonomous seeker in a HELLFIRE missile. LONGBOW will provide the AH-64 and Light Helicopter (LHX) a true fire-and-forget capability, greatly increasing weapon system effectiveness and aircraft survivability.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project DC27 — LONGBOW:

(U) FY 1989 Accomplishments:

- **(U)** See PE #0603776A RDT&E Descriptive Summary for advanced development efforts
- **(U)** Conducted Milestone IB Army Systems Acquisition Review Council (ASARC)

(U) FY 1990 Planned Program:

- **(U)** Conclude all-up-rounds (AUR) flights of the proof-of-principal (POP) hardware to validate the LONGBOW design
- **(U)** Conduct Milestone II to obtain Department of the Army approval to start LONGBOW engineering development production prove-out program (full-scale engineering development)
- **(U)** Award separate full-scale engineering development contracts for the fire control radar and the HELLFIRE missile RF seeker

(U) FY 1991 Planned Program:

- **(U)** Continue LONGBOW engineering development under the production prove-out program
- **(U)** Conduct hardware and software critical design reviews for both the fire control radar and the RF HELLFIRE seeker.

D. (U) WORK PERFORMED BY: The LONGBOW POP and full-scale development (FSD) programs are being accomplished by a joint venture team comprised of two companies, Martin Marieta Corporation, Orlando, Florida and Westinghouse Electronics Corporation, Baltimore, Maryland. The award of the production contract will be competitive.

Program Element: **#0604816A** Project Number: **#DC27**

PE Title: **LONGBOW (Formerly Airborne Adverse Weather Weapon System (AAWWS))-ED** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** None
2. **(U) SCHEDULE CHANGES:** None
3. **(U) COST CHANGES:** None

F. (U) PROGRAM DOCUMENTATION:

Organization and Operational (O&O) Plan	8/85
System Concept Paper dated	10/85
TRADOC Letter of Agreement (LOA)	1/86

G. (U) RELATED ACTIVITIES: LONGBOW will be integrated with the APACHE (AH-64) helicopter and is a pre-planned product improvement for the Light Helicopter (LHX) Mission Equipment Package (MEP). AH-64 integration development is being accomplished under PE 0203744A, Aircraft Modifications. There is no unnecessary duplication of effort within the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

J. (U) MILESTONE SCHEDULE:

Milestones	Milestones Dates
Army Systems Acquisition Review Council (ASARC) Milestone IB	7/89
Complete early user test and evaluation of POP	12/89
ASARC Milestone II Program Review	5/90
Complete proof-of-principal program	6/90
Complete LONGBOW engineering development	12/93
Begin initial operational test and evaluation	1/94
ASARC III	5/94

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604818A**

PE Title: **Army Tactical Command and Control Hardware and Software**

Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D323 • Army C^2 Common Hardware/Software (CHS)	7981	4863	6115	Cont	Cont
DC34 Army Tactical C^2 Systems (ATCCS) Engineering	- 0 -	14772	12149	Cont	Cont
DC36 C^3I Interoperability Test Suite	- 0 -	5203	4565	- 0 -	
PE TOTAL	7981	24838	22829		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The umbrella program to exploit automation technology for the conduct of combat operations is the Army Tactical Command and Control System (ATCCS) program. The ATCCS program provides automation in the five battlefield functional areas with the following specific systems: (1) the Maneuver Control System (MCS); (2) the Advanced Field Artillery Tactical Data System (AFATDS); (3) the All Source Analysis System (ASAS) for Intell/EW; (4) the Forward Area Air Defense Command, Control and Intelligence System (FAADC2I); and (5) the Combat Service Support Control System (CSSCS). To provide an overall technically sound, cost effective, and operationally responsive approach, the design and development of ATCCS must be accomplished on a total systems basis. The ATCCS Systems Engineering Program provides the required systems engineering to assure integrated Army tactical command and control, and the utilization of common hardware and software throughout the five ATCCS nodal systems. Prior to FY 1990 ATCCS Common Hardware and Software (CHS) development was accomplished in PE #0604779A. The C^3I interoperability test bed provides each system developer the capability to test its system's compatibility and interoperability with other systems without requiring the interfacing systems to be relocated. Each ATCCS system's life-cycle software engineering center throughout the country is connected via commercial leased lines to each of the other centers to test the interfaces prior to field testing. Within this program element in FY 1989, threat materiel was acquired and exploited to support development. In FY 1990 and FY 1991 threat materiel acquisition/exploition has been programed in PE #0605709A/DC28.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D323 — ATCCS Common Hardware/Software: Develop and product improve common hardware and software for the five Command and Control (C^2) nodal systems of ATCCS. (Funded under PE #0604779A for FY88 and FY89.)

(U) FY 1989 Accomplishments:

- **(U)** Performed production acceptance testing for Common Hardware/Software (CHS)
- **(U)** Procured Tactical Computer Sets for ATCCS nodals
- **(U)** Fielded initial quantities of Common Hardware/Software (CHS)
- **(U)** Integrated CHS into the Standard Integrated Command Post Shelter (SICPS)

(U) FY 1990 Planned Program:

- **(U)** Assure commonality of Tactical C^3I systems
- **(U)** Continue procuring tactical computer sets for ATCCS nodals
- **(U)** Continue fielding of CHS
- **(U)** Continue Integration of CHS

Program Element: #0604818A

PE Title: **Army Tactical Command and Control Hardware and Software** Budget Activity: #4

(U) FY 1991 Planned Program:

- (U) Assure commonality of Tactical C^3I Systems
- (U) Continue fielding of CHS
- (U) Initiate actions leading to award of second generation of CHS
- (U) Develop standard nodal system Operational Facilities configuration using CHS

(U) Project DC36 — The C3I Interoperability Test Suite: Components of which are the Army Interoperability Network (AIN) and the support through use of the AIN of interoperability testing. AIN is a centrally controlled, nationally distributed network of test instrumentation and communications that is being implemented in blocks to conform to the block development approach of ATCCS. AIN interconnects the Communications-Electronics Command (CECOM) Life Cycle Software Engineering (LCSE) Centers and provides its users with access to not only Army but also Joint tactical automation systems and their supporting communications systems. AIN allows distributed developmental testing of interfaces as the first phase of the complex process of assuring: (1) Nodal Interoperability (between Battlefield Automated Systems and Operational Facilities within a Battlefield Functional Area (BFA)); (2) Army Interoperability (among BFA Control Systems and between BFA subordinate systems of different BFAs); and (3) Joint and Combined Interoperability.

(U) FY 1990 Planned Program:

- (U) Implement AIN Block 0 initial testing capability
- (U) Design AIN Block 1 hardware and software
- (U) Establish AIN Block 1 functional system architecture
- (U) Establish AIN Block 1 subsyste n designs
- (U) Complete Block 1 System Requirements/System Design Review
- (U) Prepare test documentation for AIN test and evaluation
- (U) Finalize Army interoperability test policy and related planning documents

(U) FY 1991 Planned Program:

- (U) Complete Block 1 Preliminary Design Review (PDR)
- (U) Initiate purchase of hardware, implement, and install Army Interoperability Test Center (AITC), tactical communications interfaces, and Ft. Leavenworth remote site
- (U) Integrate and test AIN block 1 in preparation for Maneuver Control System S.11 and Initial Force Level Control System interoperability testing
- (U) Participate in Army test requirements and test planning
- (U) Coordinate with ATCCS Functional Area project managers to develop schedules for developmental certification test

(U) **Work Performed By:** Contractors: UNISYS, Eatontown, NJ; Tech Dyne Systems, Alexandria, VA; System Development Corporation, Alexandria, VA; and MITRE Corp, McLean, VA. In house organizations: US Army Communications Electronics Command (CECOM), Ft Monmouth, NJ; US Army Test and Evaluation Command (TECOM), Ft Huachuca, AZ; Miltope Corp., Melville, NY; R&D Associates, Marina Del Ray, CA; Teledyne Brown Engineering Huntsville, AL; Nordan, Tulsa, OK; Comcon Delran, NJ; Communications Electronics Board (CEB) Fort Gordon, GA.

(U) **Related Activities:** Program Element #0203740A (Maneuver Control System)
Program Element #0203726A (Advanced Field Artillery Tactical Data System)
Program Element #0603805A (Combat Service Support Control System Evaluation & Analysis)
Program Element #0604741A (Air Defense (C^2I Engineering Development)
Program Element #0604321A (Joint Tactical Fusion Program)
Program Element #0604321A (All Source Analysis System)

Program Element: **#0604818A**

PE Title: **Army Tactical Command and Control Hardware and Software**

Budget Activity: **#4**

Program Element #0603767A (Combat Service Support Control System)
Program Element #0604779N (Joint Interoperability of Tactical C^2 Systems)
Program Element #0205604N (Tactical Information System)
Program Element #0604779A (Joint/NATO C^2 Interoperability)
Program Element #0203740A (Maneuver Control System)

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604818A** Project Number: **# DC34**

PE Title: **Army Tactical Command and Control Hardware and Software** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Title: Army Tactical C2 Systems (ATCCS) Engineering

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
Army Tactical C2 Systems Engineering	- 0 -	14772	12149	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Air Land Battle doctrine requires military leaders to make sound and timely command and control decisions to direct the activities of assigned and supporting units. The umbrella program to exploit automation technology in support of this mission is the Army Tactical Command and Control Systems (ATCCS) Program. The horizontal integration effort, although going on independently in each Battlefield Functional Area, was not disciplined enough to address all connections within the entire spectra of communications and control. Therefore, to ensure this horizontal integration effort is complete, a significant engineering and integration effort is required. This project will provide the technical and programatic disciplines required for systems engineering and integration, acquisition management, testing, Ada software development, interoperability, fielding, and sustainment to assure an interoperable, as well as affordable ATCCS.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) Program Executive Office, Command and Control Systems provided FY 1989 funds to initiate integration effort
- (U) Awarded Systems Engineering and Integration (SE&I) contract 18 August 1989
- (U) Began development of ATCCS System Development Master Plan and target system specifications
- (U) Performed configuration management of ATCCS
- (U) Initiated special studies/analyses (communication loading, technology insertion, logistics, training and security)

(U) FY 1990 Planned Program:

- (U) Established separate RDTE Project for this effort to improve management visibility and to consolidate funding
- (U) Establish common and force level control software analysis and security requirements
- (U) Complete command post analyses & configuration drawings
- (U) Draft communications loading analysis
- (U) Uniform training analysis/plan established
- (U) Complete ATCCS development master plan
- (U) Analyze shortfalls/ATCCS target system
- (U) Draft target system specification
- (U) Continue configuration updates and management of ATCCS development
- (U) Provide program management support to Program Executive Office (PEO)

Program Element: **#0604818A** Project Number: **# DC34**

PE Title: **Army Tactical Command and Control Hardware and Software** Budget Activity: **#4**

(U) FY 1991 Planned Program:

- **(U)** Complete communication loading analysis
- **(U)** Finalize ATCCS shortfall analysis and technology insertion plans
- **(U)** Complete ATCCS specification
- **(U)** Provide configuration audit of ATCCS interoperability per user requirements
- **(U)** Update ATCCS system development master plan
- **(U)** Continue configuration updates & management of overall ATCCS development
- **(U)** Continue program management support to PEO

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

D. (U) WORK PERFORMED BY: In house organization: Program Executive Officer for Command and Control Systems, Fort Monmouth, NJ. Contractor: General Electric Aerospace Military and Data Systems Operations Division.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY: Not Applicable

F. (U) PROGRAM DOCUMENTATION:

ATCCS TEMP (REV 1)	6/89
ATCCS Acquisition Plan (AP)	8/88

G. (U) RELATED ACTIVITIES:

- Program Element #0203726A (Advanced Field Artillery Tactical Data System)
- Program Element #0203740A (Maneuver Control System)
- Program Element #0604321A (All Source Analysis System)
- Program Element #0604741A (Air Defense C^2I Engineering Development)
- Program Element #0603805A (Combat Service Support Control System Evaluation and Analysis)
- Program Element #0604779A (Joint/NATO Command and Control Systems Interoperability)
- PEO CCS Mission is to assure that no unnecessary duplication exists. A central feature of all ATCCS programs is to ensure interoperability with all other battlefield functional areas. There is no duplication between Program Element #0604779A (Joint/NATO Command and Control Systems Interoperability) and this Program Element. Program Element #0604779A is concerned with Joint/NATO standards and protocols whereas this Program Element is focused on the overall ATCCS architecture and intra/unique ATCCS interoperability and management issues.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE:

- Common hardware and software Contract Aug 88
- ATTCS System Engineering and Integration Contract Awarded Aug 89
- ATCCS Target System Baseline Definition Complete by Jun 90
- ATCCS Target System Specification Complete by Mar 91

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604819A**
PE Title: **Line-of-Sight Anti-Tank**
Project Title: **Line-of-Sight Anti-Tank**

Project Number: **#DE07**
Budget Activity: **#4**

NO PICTURE AVAILABLE

POPULAR NAME: **AAWS-H or LOSAT**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones					II Major decision review 12/91
Engineering Milestones					System Critical Design Review 5/92
T&E Milestones					Initial Operational Test 1Q95
Contract Milestones				Award FSD Contract 3/91	Contract Award 1Q94
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract		- 0 -	- 0 -	52091	422980 (353690)
Support Contract		- 0 -	- 0 -	1012	4688 (3490)
In-House Support		- 0 -	- 0 -	9982	53129 (41029)
GFE/ Other		- 0 -	- 0 -	9787	56901 (44834)
Total		- 0 -	- 0 -	72872	537698 (443043)

Transitions from Advanced Development — See PE #0603612A/D096

Program Element: #0604819A
PE Title: Line-of-Sight Anti-Tank
Project Number: #DE07
Budget Activity: #4

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The current and projected armor threat and operational concept envisioned for fighting the anti-armor battle requires an effective, extended range, vehicular mounted, heavy anti-tank capability for the infantry. The Line-of-Sight Anti-Tank (LOSAT) will be capable of operating out to maximum range of direct fire and will perform under day/night adverse weather conditions, and in the presence of obscurants. The LOSAT program will develop a replacement system(s) for the Improved Tube-Launched, Optically-Tracked, Wire-Guided Missile (TOW) Vehicle (ITV), the dedicated Infantry Heavy Anti-Tank System. LOSAT will be counter-measures hardened to perform effectively in a dirty battlefield environment. LOSAT will incorporate a growth potential to defeat the evolving Soviet armor threat. This effort transitioned from PE #0603612A/D096 in FY 1991.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1990 Planned Program:
- (U) Best technical approach source selection for full-scale development candidate

(U) FY 1991 Planned Program:
- (U) Award full-scale development (FSO) contract
- (U) Complete Kinetic Energy Missile advanced technology transition demonstration test
- (U) Conduct FSD program for option or mix of options:
  - Priority 1: Kinetic Energy Missile (KEM)
  - Priority 2: TOW/Advanced Missile System-Heavy (AMS-H) Improved Fire Control System (to complement LOSAT)
  - Priority 3: AMS-H (if KEM is unsuccessful)
- (U) Conduct early user test
- (U) Component test

(U) Program Plan to Completion:
- (U) Complete operational testing
- (U) Begin low rate initial production
- (U) Complete system qualification

D. (U) WORK PERFORMED BY: In-house efforts performed by US Army Missile Command (MICOM) Redstone Arsenal, AL. Contractors selected for entry full-scale development phase will be determined in 2Q FY91.

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY: In advanced development in FY 1990 — See PE #0603612A/D096.

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** Not applicable.

F. (U) PROGRAM DOCUMENTATION:

Letter of Agreement	11/85
Advanced Anti-Tank Weapon System-Heavy Program Decision Memorandum	8/86
Special In-Process Review	12/87
AAWS-H HQDA Program Review	8/88
Organizational & Operational Plan	1/89

Program Element: **#0604819A** Project Number: **#DE07**
PE Title: **Line-of-Sight Anti-Tank** Budget Activity: **#4**

G. (U) RELATED ACTIVITIES:

- Program Element #063612A, Project Number D308 (Advanced Antitank Weapon System-Medium)
- Program Element #063612A, Project #D096 (Line-of-Sight Anti-tank Weapon System)
- Program Element #0603757A (Forward Area Air Defense System)
- Program Element #0602303A (Rocket & Missile Technology)
- Program Element #0603313A (Hypervelocity Missile)
- Program Element #0604310A (Ground Launched HELLFIRE)
- Program Element #0603321A (Missile Counter-Countermeasure Technology)
- Program Element #0602120A (Electronic Survivability and Fuzing Technology)
- Program Element #0602624A (Weapons and Munitions Technology)
- Program Element #0602618A (Ballistics Technology)
- Program Element #0602709A (Night Vision and Electo-Optics Technology)
- Program Element #0603710A (Night Vision, Combat Vehicles)
- Program Element #0203802A (TOW Product Improvement Program-TOW 2B Project: #D336)

There is no unnecessary duplication of effort within the Army or other Services/Agencies within the Department of Defense. This is assured by continuous coordination with other Services and Agencies and oversight of the Program by the OSD-level Conventional Systems Committee.

H. (U) OTHER APPROPRIATION FUNDS: (S in Thousands) Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

J. (U) TEST AND EVALUATION DATA: Specific tests and related schedules are not yet available.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0604821A** Project Number: **#DE12**

PE Title: **Follow-On To LANCE (FOTL) — Engineering Development** Budget Activity: **#4**

Project Title: **Follow-On To LANCE Program**

NO PICTURE AVAILABLE

POPULAR NAME: **FOLLOW-ON TO LANCE**

A. (U) SCHEDULE/BUDGET INFORMATION: ($ In Thousands)

SCHEDULE		FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			MOD MS I RVN MS II Decision		Milestone III; TC STD 4Q93
Engineering Milestones		DOE cost study 3/89		Critical Design Review	
T&E Milestones				Initiate Component/ Subsystem Tests TBD	DT/OT, Force Dev Test and Eval (FDTE), System Engr Tests
Contract Milestones		Release Draft RFP-for FSED Contract 2/90	SSEB Release RFP	Award FSD contract	Award Prod Contract
BUDGET ($000)		**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract			10649	76729	212522 (125144)
Support Contract			3033	9194	37430 (22041)
In-House Support			6041	9348	52789 (31085)
GFE/ Other			12597	16957	71882 (4327)
Total		7351*	32320	112228	374623 (182597)

*For continuity, display data represents Advanced Development funding in PE #0603777A Follow-On To Lance.

Program Element: **#0604821A** Project Number: **#DE12**
PE Title: **Follow-On To LANCE (FOTL) — Engineering Development** Budget Activity: **#4**

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments: Not Applicable

(U) FY 1990 Planned Program:
- **(U)** Release competitive RFP for full-scale engineering development (FSED)
- **(U)** Develop and staff Milestone II documentation
- **(U)** Milestone I/II Decision
- **(U)** Award FSED Contract
- **(U)** Initiate hardware/software development
- **(U)** Producibility engineering and planning (PEP) activities
- **(U)** Integrated logistics support

(U) FY 1991 Planned Program:
- **(U)** Initiate prototype build
- **(U)** Continue FSED
- **(U)** Preliminary design review
- **(U)** Initiate component/subsystem tests
- **(U)** Continue producibility and logistics analysis
- **(U)** Complete hardware/software design
- **(U)** Critical design review

(U) Program Plan to Completion:
- **(U)** Complete FSED
- **(U)** Conduct development test/operational tests (DT/OT)
- **(U)** Conduct force development test and evaluation
- **(U)** Complete system environmental tests
- **(U)** Milestone III - type classify standard
- **(U)** Award production contract

D. (U) WORK PERFORMED BY: The program is managed by Project Manager Follow-On to Lance (FOTL) with PM Nuclear Munitions coordinating the nuclear warhead development with the US Army Armament, Munitions and Chemical Command and the Department of Energy.

Program Element: **#0604821A** Project Number: **#DE12**
PE Title: **Follow-On To LANCE (FOTL) — Engineering Development** Budget Activity: **#4**

E. (U) COMPARISON WITH FY 1990/1991 AMENDED RDTE DESCRIPTIVE SUMMARY:

1. **(U) TECHNICAL CHANGES:** Not applicable.
2. **(U) SCHEDULE CHANGES:** Not applicable.
3. **(U) COST CHANGES:** Not applicable.

F. (U) PROGRAM DOCUMENTATION:

O&O Plan Approved	5/87
Mission Need Statement (MNS)	11/87
Acquisition Decision Memorandum for MSO Signed	[illegible]88
Military Characteristics-NUC WHD	12/
ROC Planned Completion	1/90

G. (U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Army or within other Services/Agencies of the Department of Defense. This is assured by continuous oversight of the program by the OSD Strategic Systems Committee. A related effort under PE #0602303A (Missile Technology) provides support needed to develop necessary documentation and to conduct analysis in preparation for a modified Milestone I. The FY 1989 effort was performed under PE #0603777A, Follow-On to Lance — System Advanced Development.

H. (U) OTHER APPROPRIATION FUNDS: ($ in Thousands) Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: No agreements implemented. Coordination with NATO partners is planned.

J. (U) TEST AND EVALUATION DATA: TBD

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605301A**
PE Title: **Army Kwajalein Atoll** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D614 Army Kwajalein Atoll	157485	162856	180033	Cont	Cont
PE TOTAL	157485	162856	180033		

B. (U) BRIEF DESCRIPTION OF ELEMENT: United States Army Kwajalein Atoll (USAKA) is an activity of the DOD Major Range and Test Facility Base. It supports Strategic Defense functional and integrated technology validation, Navy Sea Launched Ballistic Missile (SLBM) testing, Air Force Intercontinental Ballistic Missile (ICBM) development and operational testing, and data collection of objects in space. USAKA is the only range in the free world where ICBMs can be fired in a tactical configuration with sophisticated technical data collection during the terminal portion of the trajectory. Locating experiments on USAKA has a synergistic effect since both the strategic offensive and defensive program benefit. USAKA's unique capabilities are collection of signature data on objects outside the earth's atmosphere, recording of missile re-entry phenomena, collection of terminal trajectory and impact data, recovery of re-entry vehicles and nearly immediate transmission of data to respective mission sponsors. The Kiernan Re-entry Measurements Site (KREMS) continues to be a vital national asset as a test-bed facility with state-of-the-art capabilities on the leading edge of metric, signature and imaging radar technology. Provides salaries and related personnel benefits for authorized civilian personnel and associated administrative support. USAKA is contractor operated and heavily dependent on associated support contractors. Program funds range instrumentation acquisition, repair and maintenance, and base operations, in addition to the programs that directly support test operations.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D614 — U.S. Army Kwajalein Atoll. The Air Force, Navy and Strategic Defense Initiative (SDI) Organization have programs planned which have significant test and data gathering requirements at the USAKA. Air Force programs require firing at full range with complete data collection during terminal trajectory. Strategic Defense Initiative programs require range sensors to collect technical data in support of programs being conducted at USAKA. These test data cannot be obtained except through the use of technical facilities available on and in the vicinity of USAKA. Data collection on objects in space remains significant because the Defense Advanced Research Project Agency (DARPA) Long-Range Tracking and Instrumentation Radar is one of only three sensors world wide that has deep-space tracking capability.

(U) FY 1989 Accomplishments:

- **(U)** Continued to support strategic, operational and development testing for all services; Air Force programs such as Peacekeeper, Titan, Minuteman II and III, Small ICBM, Navy Trident; Army's Airborne Optical Adjunct (AOA); and NASA's space shuttle programs. Continued construction support for SDI programs to include the Army's Exoatmospheric Re-entry Vehicle Interceptor Subsystem (ERIS) and High Endoatmospheric Defense Interceptor (HEDI), and Air Force's Space Based Interceptor (SBI) program
- **(U)** Continued improvement and modernization of range facilities for more cost-effective testing and supported the continuous update of range equipment and facilities to include communications, safety, and most importantly, radars

Program Element: **#0605301A**
PE Title: **Army Kwajalein Atoll** Budget Activity: **#6**

(U) FY 1990 Planned Program:

- **(U)** Continue to support strategic, operational and development testing for all services; Air Force programs such as Peacekeeper, Titan, Minuteman II and III, Small Intercontinental Ballistic Missile (ICBM) and Maneuvering Systems Technology (MAST); Navy's Trident; and the Army's ERIS and AOA programs. Complete construction of ERIS, HEDI and SBI facilities
- **(U)** Award competitive build-to-lease contract to provide for unaccompanied personnel housing and family quarters for contractor personnel.
- **(U)** Initiate a long term aviation support contract which includes a lease for the provision of intra-atoll air transportation at Kwajalein Atoll, Republic of the Marshall Islands
- **(U)** Continue minimal improvement and modernization of range technical facilities to ensure continued supportability
- **(U)** Limited and/or negative real growth in recent years has created a significant backlog of maintenance and repair (BMAR). Cost cutting initiatives to fund additional projects are limited because the majority of funding in this program is required for fixed costs such as civilian pay and support contracts (USAKA is contractor operated). BMAR will accordingly grow from $42.9M in FY 1989 to $53.2M in FY 1990.

(U) FY 1991 Planned Program:

- **(U)** Continue to support strategic operational and developmental testing for all services; Air Force programs such as Peacekeeper, Titan, Minuteman II and III, and Small ICBM; Navy's Trident; the Army's ERIS and AOA programs; and NASA's space shuttle programs
- **(U)** Continue improvement and modernization of range facilities for more cost-effective testing and to support the continuous update of range equipment and facilities to include communications, safety, and most importantly, radars
- **(U)** Increase in FY 1991 is required to:
  - Commence implementation of USAKA Environmental Impact Statement mitigation actions to bring the installation into compliance with appropriate environmental standards
  - Implement Physical security fix-it and Counter-Intelligence plan to bring the range to the minimum standard required to safeguard classified data
  - Constrain Backlog of Maintenance and Repair (BMAR) to a more manageable level

(U) Work Performed By: USAKA is a subordinate command of the US Army Strategic Defense Command (USASDC). Contractors are: Pan Am World Services, Cape Canaveral, FL; Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, MA; GE Corporation, Moorestown, NJ; GTE Government Systems Corporation, Needham Heights, MA; Control Data Corporation, Minneapolis, MN; Am Pro Protective Agency, Inc., Columbia, SC; and Aeromet Inc., Tulsa, OK.

(U) Related Activities: U.S. Army Kwajalein Atoll is essential to accomplishment of the Strategic Defense Initiative and support for operational and development testing of deployed strategic systems such as Minuteman and Peacekeeper. There is no unnecessary duplication of effort within the Army or the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
Military Construction, Army Funds (current guidance)	15490	9500	- 0 -
Military Construction, Defense Funds	16000	- 0 -	- 0 -

Program Element: **#0605301A**
PE Title: **Army Kwajalein Atoll** Budget Activity: **#6**

(U) International Cooperative Agreements: The use of land at USAKA is provided for in the Compact of Free Association between the U.S. Government and the Government of the Republic of the Marshall Islands (RMI). Specific issues are covered in the Status of Forces Agreement (SOFA) and the Military Use and Operating Rights Agreement (MUORA). USAKA provides no direct research, development, test and evaluation support to foreign governments. Services provided to the test action are of a community service nature and are reimbursable by the host nation. Funding associated with the SOFA and MUORA are provided directly to the RMI government by U.S. Department of the Interior.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605601A**

PE Title: **Army Test Ranges and Facilities** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D066 Aviation Engineering Flight Activity	10267	11302	9255	Cont	Cont
D067 Air Worthiness Qualification Support	4056	3221	3895	Cont	Cont
D452 Cold Regions Test Center	6676	7635	5462	Cont	Cont
D618 Aviation Development Test Activity	6796	8140	8608	Cont	Cont
D630 TECOM Test Design and Evaluation	3073	3119	3230	Cont	Cont
DE90 Yuma Proving Ground	16120	21102	23637	Cont	Cont
DE91 Combat Systems Test Activity	30938	37740	40326	Cont	Cont
DE92 Dugway Proving Ground	12902	12213	16779	Cont	Cont
DE93 White Sands Missile Range	63144	67649	71357	Cont	Cont
DE94 Army Electronic Proving Ground	11498	12203	14934	Cont	Cont
DE97 DOD High Energy Laser System Test Facility	24656	30579	32408	Cont	Cont
PE TOTAL	190126	214903	229891		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program sustains a capability for conducting developmental, production acceptance and product improvement testing of materiel, weapons, and weapon systems at five designated DOD major ranges and test facility bases, a cold regions test center, a high energy laser test facility, and three aviation testing activities. This program also provides a capability to perform test design and assessment functions. Each facility/activity has an established capability uniquely required to assure technical adequacy and quality of materiel under development or procurement. Increase of funds is primarily for test range modernization, additional functional missions, increased laser test activity, and a conversion of military aircraft maintenance personnel to contract personnel.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D066 — Aviation Engineering Flight Activity: This program improves the capability of Army aviation through the conduct of engineering flight testing of aircraft and aircraft systems. This includes evaluation of aircraft incorporating advanced concepts with potential military applications; evaluation of foreign science and technologies through flight test of foreign air vehicles; technology flight evaluations of non-military aircraft and aircraft systems and technologies for potential Army applications; and tests to determine airworthiness of prototypes, initial production Army aircraft, and proposed engineering change proposals or modifications to existing aircraft systems.

Program Element: #0605601A
PE Title: **Army Test Ranges and Facilities** Budget Activity: #6

(U) FY 1989 Accomplishments:

- (U) 28 major test programs performed
- (U) UH-60 External Stores Air Worthiness and Flight Certification (A&FC)
- (U) AH-64 Air-to-Air-Stinger Preliminary Air Worthiness Evaluation (PAE)
- (U) OH-58D A&FC
- (U) UH-1 Composite Main Rotor Blade A&FC
- (U) RC-12K PAE/A&FC
- (U) AH-64 AAWWS (LONGBOW APACHE PAE)

(U) FY 1990 Planned Program:

- (U) Air Worthiness Qualification testing for the improved UH60, AH64, Army Helicopter Improvement Program (AHIP) and other Army aviation systems
- (U) Technology evaluation of domestic and foreign aircraft
- (U) Upgrade specially designed data acquisition packages
- (U) Facilities improvement program
- (U) The increase in FY 1990 reflects a zero sum realignment in the Research, Development, Test and Evaluation (RDTE), Army Appropriation which funds the improved helicopter icing spray system integration and testing and aerial electronics support.

(U) FY 1991 Planned Program:

- (U) Continue Air Worthiness Qualification testing for the improved UH60, AH64 and the AHIP and other Army aviation systems
- (U) Continue technology evaluation of domestic and foreign aircraft
- (U) Continue upgrade specially designed data acquisition packages
- (U) Continue facilities improvement program

(U) Project D067 — Air Worthiness Qualification Support: This support effort insures aircraft are safe to fly within the complete mission envelope.

(U) FY 1989 Accomplishments:

- (U) Provided or continued technical support for:
  - UH-60L helicopter qualifications & testing
  - Light Helicopter Experimental (LHX) Program
  - Helicopter Structural Integrity Program (HSIP)
  - Composite Rotor System testing on UH-60A
  - Air to Air Stinger (ATAS) on the AH-1 helicopter
  - Special Operations Aircraft (MH-60K, MH-47E)
  - Fast Rope Infiltration/Exfiltration System (FRIES)
- (U) Continued monitoring V-22 technology for application to Army aircraft
- (U) Continued technical support for Improved Helicopter Icing Spray System (IHISS)
- (U) Managed/executed the aeronautical design standards program
- (U) Automated Army special access programs and test incident reports/corrective action reports
- (U) Testing of 800 gallon internal fuel tanks on the CH-47D helicopter
- (U) Continued developing equipment design and airworthiness qualification requirements with respect to air-to-air combat
- (U) Initiated development of Threat Simulator
- (U) Qualification of new tail rotor swashplate design on the AH-64

Program Element: **#0605601A**
PE Title: **Army Test Ranges and Facilities** Budget Activity: **#6**

- **(U)** Development/qualification of AH64 LONGBOW Weapons System
- **(U)** Qualification/installation of Airborne Target Handover System (ATHS) and 701C engine on the AH-64
- **(U)** Development/qualification of the Flight Data Recorder on the CH-47, AH-64, UH-60, MH-60K, MH-47E, and OV-1E helicopters
- **(U)** Participated in Critical Design Review for MH-60K helicopter
- **(U)** Continued support for testing of Air-to-Air Stinger (ATAS) on the AH-64
- **(U)** Managed/executed technical and airworthiness qualification mission for all Army aircraft
- **(U)** Developed test management capability for Program Executive Officer/Program Managers (PEO/PMs), maintained Test and Evaluation (T&E) Database and interface with Army-wide Test and Evaluation Database (ATEDB), continued support for Test and Evaluation Master Plans (TEMPs), Test Integration Working Groups (TIWGs), and staff supervision for Aviation Engineering Flight Activity (AEFA)
- **(U)** Continued support contract for T&E documentation

(U) FY 1990 Planned Program:

- **(U)** Continue to manage/execute technical and airworthiness qualification mission for all Army aircraft
- **(U)** Continue to manage/execute the aeronautical design standards program
- **(U)** Continue to develop test management capability for PEO/PMs, maintain T&E Database and interface with ATEDB, continue support for TEMPs, TIWGs, and staff supervision for AEFA
- **(U)** Continue technical support of FRIES, AH-64 basic helicopter, ATAS on the AH-1 helicopter, Special Operations Aircraft (SOA) (MH-60K/MH-47E), IHISS, HSIP, AAWWS Longbow, ATHS, Flight Data Recorder, Threat Simulator, MSIP, air-to-air combat, and V-22
- **(U)** Continue support contract for T&E documentation

(U) FY 1991 Planned Program:

- **(U)** Continue to manage/execute technical and airworthiness qualification mission for all Army aircraft
- **(U)** Continue to manage/execute the aeronautical design standards program
- **(U)** Continue to develop test management capability for PEO/PMs, maintain T&E Database and interface with ATEDB, continue support for TEMPs, TIWGs, and staff supervision for AEFA
- **(U)** Create Technical Records Management System (TRMS)
- **(U)** Finalization of HSIP
- **(U)** Continue technical support of UH-60L, AH-64 basic helicopter, FRIES, air-to-air combat, Threat Simulator, AAWWS Longbow, ATHS, MSIP, Flight Data Recorder
- **(U)** Continue support contract for T&E documentation

(U) Project D452 — Cold Regions Test Center: This program includes development and postproduction testing to determine the effects of cold weather environment on the man/materiel interface. Until June, 1989, this project also included the Tropic Test Center (TTC) in the Republic of Panama. TTC's mission has been assigned to Dugway Proving Ground and funds were transferred to Project E92.

(U) FY 1989 Accomplishments:

- **(U)** Systems tested included:
  - Field Burner Unit

Program Element: **#0605601A**
PE Title: **Army Test Ranges and Facilities** Budget Activity: **#6**

- Nuclear Biological Chemical (NBC) Reconnaissance System
- M1A1 Tank Block II Improvement Program
- High-Mobility, Multipurpose Wheeled Vehicle (HMMWV)
- Cold Weather Aircrew Clothing System
- Pursuit Deterrent Munition
- Single Channel Ground and Airborne Radio System (SINCGARS) Tropic and Arctic Phases

(U) FY 1990 Planned Program:

- **(U)** Continue to operate and maintain a test capability at the Cold Regions Test Center
- **(U)** Systems to be tested include:
  - M1A1 Block II Improvement Program
  - Self-contained Toxicological Environment
  - Family of Medium Tactical Vehicles (FMTV)
  - Modular Pack Mine System (MOPMS)

(U) FY 1991 Planned Program:

- **(U)** Continue to operate and maintain a test capability at Cold Regions Test Center
- **(U)** Systems to be tested include:
  - Palletized Loading System (PLS)
  - Penetration Augmented Munition (PAM)
  - Integrated Aircrew Helmet System HGU-56
- **(U)** FY 1991 reflects a decrease to support the transfer of operational control of tropic environment testing to Dugway Proving Ground

(U) Project D618 — Aviation Development Test Activity (AVNDTA): Conducts system development and production acceptance testing of Army aircraft. AVNDTA also gathers data to aid in establishing component service life, repair parts consumption, required inspection cycles, and needed improvements.

(U) FY 1989 Accomplishments:

- **(U)** Operated and maintained AVNDTA
- **(U)** Tests included:
  - "Lead the Fleet" (LTF) AH-1 Cobra
  - Progressive phased maintenance programs
  - Light Helicopter Family experiments
  - Particle separators for various airframes
  - AH-64A Apache
  - CH-47 Chinook

(U) FY 1990 Planned Program:

- **(U)** Continue to operate and maintain AVNDTA
- **(U)** Systems to be tested or continued include:
  - LTF testing of AH-1 Cobra
  - LTF testing of UH-60A Helicopter
  - CH-47D Helicopter
  - Aircrew Microclimatic Cooling System
  - On Board Oxygen Generating System

Program Element: **#0605601A**
PE Title: **Army Test Ranges and Facilities** Budget Activity: **#6**

- **(U)** The increase in FY 1990 and 1991 reflects a zero sum realignment in RDTE,A to fund aviation maintenance personnel replacement contract.

(U) FY 1991 Planned Program:

- **(U)** Continue to operate and maintain AVNDTA
- **(U)** Systems to be tested or continued include:
  - LTF testing of AH-1 Cobra
  - LTF testing of UH-60A Helicopter
  - CH-47D Helicopter
  - Aircrew Microclimatic Cooling System
  - Integrated Aircrew Helmet System HGU-56

(U) Project D630 — TECOM Test Design and Evaluation: Provides for continuous assessment of approximately 400 non-major systems. Includes independent design of development and initial production tests and for subsequent independent analysis and assessments of the results to include recommendations for type classification and materiel release of all non-major systems.

(U) FY 1989 Accomplishments:

- **(U)** Continued test design and continuous assessment program to incorporate systems such as
  - C17 Aircraft (airdrop)
  - Heavy Equipment Transporter Semitrailer
  - 3-60KW Tactical Quiet Generators

(U) FY 1990 Planned Program:

- **(U)** Continue test design and assessment program to incorporate new systems and continuous assessment of all non-major systems:
  - Technical assessments for non-major acquisition programs
  - Interface with materiel acqusition process

(U) FY 1991 Planned Program:

- **(U)** Continue test design and assessment program to incorporate new systems and continuous assessment of all non-major systems:
  - Technical assessments for non-major acquisition programs
  - Interface with materiel acquisition process

(U) Project DE90 — Yuma Proving Ground: Operates and maintains testing capability at Yuma Proving Ground (YPG), AZ, and provides institutional funds for conducting technical tests. YPG's mission is to plan, conduct, analyze, and report the results of development and other tests of aircraft armament, long-range artillery, air delivery and mobility systems. YPG also conducts natural desert environmental tests. Major facilities include an artillery firing range, an air-to-ground and ground-to-ground fully instrumented aircraft armament range, an instrumented air delivery test area, and mobility test areas.

(U) FY 1989 Accomplishments:

- **(U)** Continued to operate and maintain a test capability at YPG
- **(U)** Maintained testing capability to meet scheduled test workload for development and production tests of weapons, weapon systems and materiel
- **(U)** Test workload accomplished for FY 1989 included:
  - Low-Altitude, High-Speed Airdrop System
  - 155mm Self-Propelled Howitzer Improvement Program

Program Element: **#0605601A**
PE Title: **Army Test Ranges and Facilities** Budget Activity: **#6**

- Light Helicopter Family
- Armor Enhancement Initiative
- Global Positioning System

(U) FY 1990 Planned Program:

- **(U)** Continue to operate and maintain a test capability at YPG
- **(U)** Systems to be tested include:
  - XM 872 105mm Rocket-Assisted Kinetic Energy (RAKE) cart
  - XM 785 155mm Nuclear Projectile
  - 120mm Mortar Illum Cart
  - C17 Transport
  - Howitzer Improvement Program
- **(U)** The increase in FY 1990 and 1991 reflects a zero sum realignment within RDTE,A to upgrade ranges and equipment (other than instrumentation) and to fund the aviation maintenance personnel replacement contract

(U) FY 1991 Planned Program:

- **(U)** Continue to operate and maintain a test capacility at YPG
- **(U)** Systems to be tested include:
  - Heavy Force Modernization (HFM)
  - XM 872 105mm RAKE cart (continuation)
  - Family of Medium Tactical Vehicles
  - Sense and Destroy Armor Projectile (SADARM)
  - NAVSTAR Global Positioning System (GPS) User Equipment

(U) Project DE91 — Combat Systems Test Activity: This project finances the costs of maintaining a testing capability at the U.S. Army Combat Systems Test Activity (CSTA), Aberdeen Proving Ground, MD, except those costs that can be directly identified to a user of the facility. CSTA is responsible for conducting technical tests of weapons and weapon systems; munitions and components; survey and target acquisition equipment; combat, special and general-purpose vehicle and ancillary automotive equipment; combat engineer equipment; and troop support equipment. CSTA also has a capability for a radiation environment simulating the neutron output of a nuclear weapon using a fast-burst nuclear reactor, and conducts nuclear radiation evaluations.

(U) FY 1989 Accomplishments:

- **(U)** Operated and maintained a test capability at CSTA
- **(U)** Maintained testing capability commensurate with scheduled test workload for development and production tests of weapons, weapons systems, and materiel
- **(U)** Workload accomplished included continued support of:
  - U.S. Navy ship armor program
  - Development testing of the 120mm Gun Mount/M1E1
  - Combat Vehicle Track and Suspension
  - Improved Ribbon Bridge
  - the 155mm Howitzer Improvement
  - Vulnerability and live fire testing of U.S. and foreign combat systems

(U) FY 1990 Planned Program:

- **(U)** Continue to operate and maintain a test capability at CSTA
- **(U)** Systems to be tested include:

Program Element: #0605601A
PE Title: **Army Test Ranges and Facilities** Budget Activity: #6

- Heavy Force Modernization (HFM)
- M1A1 Abrams Tank System
- Family of Medium Tactical Vehicles (FMTV)
- 120mm Gun Mount to M1A1
- Bradley Fighting Vehicle System (BFVS) modifications

- (U) The increase in FY 1990 and 1991 reflects a zero sum realignment within this program to upgrade test support equipment (other than instrumentation) and to fund increase in authorized civilian work years.

(U) FY 1991 Planned Program:

- (U) Continue to operate and maintain a test capability at CSTA
- (U) Systems to be tested include:
  - Heavy Force Modernization (HFM)
  - Palletized Loading System
  - Magnetic Protective Enhancement System
  - 120mm Gun Mount to M1A1 modifications
  - M1A1/M1E1 Abrams Tank Systems

(U) Project DE92 — Dugway Proving Ground: This project finances the cost of operating and maintaining a test capability at U.S. Army Dugway Proving Ground (DPG), UT, and (effective June, 1989) at Tropic Test Center, Republic of Panama, for conducting technical tests. Project provides for maintaining a capability for development, production, and product improvement test of chemical weapons; chemical/biological defense systems and smoke munitions systems; battlefield obscurant/smoke testing; and chemical warfare/chemical biological defense (CW/CBD) support for DOD agencies. This project also funds the Dugway Proving Ground Modernization project which was established to modernize the Army Major Range and Test Facility Base at DPG. Tropic Test Center is used on a safari basis.

(U) FY 1989 Accomplishments:

- (U) Operated and maintained a capability for development, production, and product improvements tests of chemical weapons, chemical/biological defense systems, smoke munitions, battlefield obscurants/smoke testing. Assumed Tropic Test Center's mission upon its deactivation in June, 1989
- (U) Tests accomplished include:
  - Simplified Collective Protection Equipment
  - Nuclear Biological Chemical (NBC) Reconnaissance Vehicle
  - Remote Sensing Chemical Agent Alarm
  - Enhanced Smoke
  - Heavy Mortar Screening Cartridge
- (U) Ecological surveys were continued to support increased testing
- (U) Contractual services performed included test grid and laboratory repair, expanded training, ADP hardware and software maintenance, and software development

(U) FY 1990 Planned Program:

- (U) Continue to operate and maintain a test capability at DPG and operate Tropic Test Center on a safari basis
- (U) Systems to be tested or continued include:
  - Aerial Reconnaissance System
  - Simplified Collective Protection System

Program Element: **#0605601A**
PE Title: **Army Test Ranges and Facilities** Budget Activity: **#6**

- Self-contained Toxicological Environment
- Improved Lightweight Decontamination System
- Joint Chemical/Biological (CB) Contact Point & Test Project

(U) FY 1991 Planned Program:

- **(U)** Continue to operate and maintain a test capability at DPG
- **(U)** Systems to be tested or continued include:
  - Aerial Reconnaissance System
  - Simplified Collective Protection System
  - Joint CB Contact Point & Test Project
  - 40mm High Velocity Smoke Grenade
- **(U)** The increase in FY 1991 reflects the transfer of operational control of natural tropic environment testing from Tropic Test Center to Dugway Proving Ground

(U) Project DE93 — White Sands Missile Range: Operates and maintains a testing capability at White Sands Missile Range (WSMR), NM, and provides institutional funds for conducting technical tests. WSMR capability consists of civilian, military & contractor cadre and instrumentation adaptive to range user requirements for testing military strategies and tactical systems throughout the system/equipment life cycles. Although WSMR is primarily a missile range for testing ballistic and guided missiles, air defense systems, artillery guided missiles, etc., other capabilities exist for performing a variety of tests including artillery command and control systems, aircraft armament, conventional artillery and ground vehicles. Being the largest overland range in the U.S., launch complexes are integrated into a modern real-time data collection and data reduction processing system. Capabilities include optical and calibration laboratories, inertial guidance test facilities and full spectrum nuclear effects facilities. Other mission functions include the conduct of R&D of range instrumentation and technical/scientific support to tenants and other DOD activities.

(U) FY 1989 Accomplishments:

- **(U)** This program financed a testing capability commensurate with scheduled test workload
- **(U)** Tests accomplished included:
  - Development tests in support of the Strategic Defense Initiatives
  - Nuclear hardening and effects test of DOD equipment
  - Acceptance and surveillance testing of PATRIOT, HAWK, and PERSHING Missile systems
  - Continued testing of the Forward Area Air Defense System (FAADS)
  - Development testing of the Multiple Launch Rocket System's (MLRS) Sense and Destroy Armor and Terminally Guided Warheads
  - Development testing of Army Tactical Missile
  - Testing in support of Navy and Air Force missile and electronic programs

(U) FY 1990 Planned Program:

- **(U)** Continue to operate and maintain a test capability at WSMR
- **(U)** Systems to be tested or continued include:
  - Nuclear Hardening of DOD equipment
  - Army Tactical Missile
  - FAADS
  - Acceptance and Improvement to PATRIOT
  - Acceptance and Improvement of MLRS
- **(U)** Increase in FY 1990 and FY 1991 is for the aviation maintenance personnel replacement contract

Program Element: **#0605601A**

PE Title: **Army Test Ranges and Facilities** Budget Activity: **#6**

(U) FY 1991 Planned Program:

- **(U)** Continue to operate and maintain a test capability at WSMR.
- **(U)** Systems to be tested or continued include:
  - Nuclear Hardening of DOD equipment
  - Army Tactical Missile
  - Smart Munitions and Missile Warheads
  - FAADS
  - Testing in support of Strategic Defense Initiative

(U) Project DE94 — Army Electronic Proving Ground: Operates and maintains a testing capability at the U.S. Army Electronic Proving Ground (EPG), Fort Huachuca, AZ, and provides institutional funds for conducting technical tests. EPG is a Field Operating Activity of U.S. Army Test and Evaluation Command and a tenant of the U.S. Army Information Systems Command, Fort Huachuca, AZ. EPG is unique within DOD because of the naturally quiet, electromagnetic environment and expansive real estate, low annual rainfall, and special facilities to accomplish its mission of planning, conducting, evaluating, and reporting on the results of development/development-type tests for communications, command and control, optical/electro-optical signal intelligence, and electronic warfare equipment and systems. EPG operates an electro-magnetic environmental test facility, an electronic countermeasures vulnerability test facility, a systems test facility, a systems interoperability and computer software testing facility, an electronic realistic battlefield environmental facility, and an electro-optical systems test facility.

(U) FY 1989 Accomplishments:

- **(U)** Continued to operate and maintain testing capability commensurate with scheduled test workload
- **(U)** Tests accomplished or continued include:
  - Global Positioning System
  - Vehicle Magnetic Signature Duplicator
  - Mobile Subscriber Equipment
  - Modular Tactical Communications Systems

(U) FY 1990 Planned Program:

- **(U)** Continue to operate and maintain a test capability at EPG
- **(U)** Systems to be tested or continued include:
  - Position Locating and Reporting System
  - Mobile Subscriber Equipment
  - Automatic Meteorological System
  - Light Helicopter, Experimental (LHX)
  - Facility Intrusion Detection System
- **(U)** Increase in FY 1990 and FY 1991 is for the aviation maintenance personnel replacement contract

(U) FY 1991 Planned Program:

- **(U)** Continue to operate and maintain a test capability at EPG
- **(U)** Systems to be tested or continued include:
  - Multi-Service Communication System
  - EXJAM
  - Air Defense Electronic Warfare System
  - Position Locating and Reporting System

Program Element: **#0605601A**
PE Title: **Army Test Ranges and Facilities** Budget Activity: **#6**

- Mobile Subscriber Equipment

(U) Project DE97 — DOD High Energy Laser System Test Facility (HELSTF): Operates and maintains the broad-based high-energy laser test capability at White Sands Missile Range, NM, to support Tri-Service damage, vulnerability and lethality laser tests. Initial emphasis is being placed on systems level and target-hardening test programs of the Strategic Defense Initiative Office and Service damage and vulnerability test efforts. This progam provides funds for acquisition, installation, and checkout of instrumentation and facility support equipment not specifically identified with a particular laser system or project. Additional test capabilities are being installed. These include the Large Vacuum Chamber with additional damage and vulnerability test requirements funded by the Strategic Defense Initiative Office which will be turned over to the facility for operation and maintenance when complete. Direct operations and maintenance costs identified to facility users will be funded by users. Additional funds were programed for FY 1990 and 1991 to continue laser lethality, vulnerability and damage testing by the Mid-Infrared Advanced Chemical Laser (MIRACL) and the Sealite Beam Director (SLBD).

(U) FY 1989 Accomplishments:

- **(U)** Continued to operate and maintain test capability at HELSTF
- **(U)** Actions accomplished include:
  - The Large Vacuum Chamber was made fully operational
  - Continued acquisition of the Surrogate High Energy Vulnerabiliy and Tactics Test Suite
  - Planned and designed acquisition of the Directed Energy Weapons Evaluation Test Suite
- **(U)** Continued support to the Air Force and Navy test programs including:
  - Air Force defensive shield tests
  - Air Force tests against solid hardened boosters
  - Navy Strategic Defense initiative sponsored tests
  - Navy High Power Phase characterization tests

(U) FY 1990 Planned Program:

- **(U)** Continue to operate and maintain a test capability at the HELSTF at WSMR using the Mid-Infrared Advanced Chemical Laser (MIRACL)/Sealite Beam Director (SLBD) and Air Force Excimer Raman-Shifted Laser Device (EMRLD) laser capabilities
- **(U)** Systems to be tested or continued include:
  - Air Force defensive shield tests
  - Laser challenges to obscurants
  - Laser tests against hardened boosters
  - Testing in support of Strategic Defense Initiative

(U) FY 1991 Planned Program:

- **(U)** Continue to operate and maintain a test capability at the HELSTF at WSMR using the MIRACL/SLBD and EMRLD laser capabilities
- **(U)** Systems to be tested or continued include:
  - Testing in support of Strategic Defense Initiative
  - Laser challenges to obscurants
  - Acceptance tests of other directed energy weapons

(U) Work Performed By: In-house testing is performed by civilian and military personnel assigned to respective facilities augmented by temporarily assigned military personnel from Forces Command and the National Guard. Support functions are performed by: Pan Am Aero, Inc., Balboa, Republic of Panama; Polack & Associates, S.A., Balboa, Republic of Panama; Sikorsky Support

Program Element: **#0605601A**
PE Title: **Army Test Ranges and Facilities** Budget Activity: **#6**

Services, Inc., Stratford, CT; COBRO, Wheaton, MD. Other contractors include: Dynamic Science, Phoenix, AZ; Dyna Corp, Albuquerque, NM; Mandex, Vienna, VA; Kentron International, Dallas, TX; Old Dominion, Hampton, VA; AAI Corp, Baltimore, MD; Consultants & Designers, Baltimore, MD; Dynamic Sciences, Inc., Frederick, MD; Frederick Manufacturing, Frederick, MD; Vanguard Technologies, Aberdeen, MD; Andrulus Corp, Bethesda, MD; LEMSCO, Houston, TX; Bell Technical Corp, Sierra Vista, AZ; COMARCO, Sierra Vista, AZ; Dyna Corp, McLean, VA; LEMSCO, Houston, TX; Dynaspan, Alamagordo, NM; PSL, Las Cruces, NM; TRW, Redondo Beach, CA; Lockheed Engineering, Management and Services Company, Houston, TX.

(U) Related Activities: The five US Army Test and Evaluation Command (TECOM) activities plus Kwajalein Missile Range comprise the Army's contribution to the DOD Major Range and Test Facility Base. This base also includes designated Air Force and Navy Test facilities, all of which operate under a DOD uniform reimbursement policy; users of these facilities pay directly identifiable testing costs, and the host activity finances all other costs associated with maintaining a testing capability at a given installation. The Office of the Deputy Director of Defense Research and Engineering (Test and Evaluation) reviews management of all DOD test facilities to avoid unnecessary duplication of capablities, to insure that highest priority capabilities are established expeditiously and suitably maintained, and to insure integration of testing by the Services. The Jefferson Proving Ground, Madison, IN, production acceptance testing mission is initially financed by the Operations and Maintenance, Army appropriation with subsequent reimbursement from the Procurement, Army appropriation. In addition to the foregoing, this program, with its general emphasis on testing is related to the activities of other Army test facilities, commodity commands, and other military Service facilities, as well as the US Army Operation Test and Evaluation Agency. Extensive coordination is conducted with other Services to ensure no unnecessary duplication of effort.

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
PROCUREMENT: (Not Applicable)			
MILITARY CONSTRUCTION:			
DPG	12800	2400	450
EPG	1200	0	0
YPG	0	11400	0
CSTA	0	0	10400

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605602A**

PE Title: **Army Technical Test Instrumentation and Targets**

Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D238	Aerial Targets	5764	11467	14372	Cont	Cont
D453	TECOM Test Instrumentation	40298	38255	60845	Cont	Cont
D459	Ground Targets	1430	781	657	Cont	Cont
D628	AMC/TECOM Test Technology	10448	10039	12610	Cont	Cont
PE TOTAL		57940	60542	88484		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program funds procurement of instrumentation and test equipment for Army technical test activities and Army technological efforts to support the testing of advanced, high-technology systems and weapons developments. It also involves long-range plans, investigations, and development and acquisition of test technology responsive to critical test issues associated with systems developments to validate the technical performance of Army systems. Included are: Advanced Test Technology Concepts Development to identify long-range requirements and coordinate Army Material Command (AMC)-wide efforts in test technology; Test Methodology Improvements to establish standardized and international test procedures and methods; Instrumentation Development of prototype instrumentation not readily available off-the-shelf; Test and Evaluation Command (TECOM) Test Instrumentation for Improvement and Modernization of Ranges and Test Facilities: Aerial threat targets to challenge ground-to-air weapons and Ground Targets to challenge ground and air-to-ground weapons. Major increase in funds for testing critical areas (air defense, aviation, C3I, etc) was directed by the Army Chief of Staff, as urged by GAO, HAC S&I and Congressional advice for improved testing of modern equipment.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D238 — Aerial Targets: This project provides funds for development, prototype fabrication, test, and evaluation of threat representative aerial targets. The project encompasses a family of targets, control systems, and augmentation devices needed to realistically test U.S. Army Air Defense Weapons, air-to-air systems and to train personnel. Developments include full scale and subscale helicopter targets, large scale replicas of Soviet fighter aircraft, improved subscale fixed wing targets, control systems for nap-of-the-earth and formation flying capability, low altitude supersonic targets, anti-radiation missile surrogates, tactical missile targets, threat augmentation systems, and improved counter-measure devices. Targets are developed for both technical and operational tests/field exercises, and training.

(U) FY 1989 Accomplishments:

- **(U)** Developed Large Scale Rotary Wing Target (HAVOC)

(U) FY 1990 Planned Program:

- **(U)** Continue to develop Large Scale Rotary Wing Target (HAVOC)
- **(U)** Develop Large Scale Rotary Wing Target (HOKUM)
- **(U)** Develop subscale targets used in production lot testing of air defense weapon systems
- **(U)** Develop Advanced Helicopter Controls

Program Element: **#0605602A**

PE Title: **Army Technical Test Instrumentation and Targets** · Budget Activity: **#6**

- **(U)** Develop subscale Helicopter Target
- **(U)** Support TECOM Management of Targets and Threat Simulators (MATTS) office

(U) FY 1991 Planned Program:

- **(U)** Continue to develop Large Scale Rotary Wing Target (HOKUM)
- **(U)** Continue to develop augmentation devices
- **(U)** Continue to develop Large Scale Rotary Wing Target (HAVOC)
- **(U)** Develop Advanced Helicopter Controls
- **(U)** Develop Subscale Helicopter Target
- **(U)** Support TECOM Management of Targets and Threat Simulators (MATTS) office

(U) Project D453 — TECOM Test Instrumentation: This project provides the scientific and technical capability to perform developmental testing of materiel, weapons, and weapon systems at five U.S. Army Test and Evaluation Command (TECOM) activities that have been designated as elements of the DOD Major Ranges and Test Facility Base, in addition to two environmental centers and the Aviation Development Test Activity. Each activity has an established capability requirement to assure the technical adequacy and quality of materiel under development such as missiles, tactical vehicles, fire support, Command, Control, and Communications and Intelligence (C^3I), and general equipment. Funding provides for instrumentation, test equipment, and improvement and modernization of ranges such as modern tracking and surveillance radars, automated data acquisition and processing networks, secure telemetry systems, environmental test chambers, secure voice and data communications networks, specialized test beds, and secure electronic communications test facilities. This project is required to respond to the diversity of systems being developed and to keep pace with the rapid advances in weapons systems technology in order that they be adequately tested. The increase in FY 1991 will be applied to the more critical instrumentation requirements of Instrumentation Command Control and Interoperability, electromagnetic effects on new technology weapons systems and live fire vulnerability.

(U) FY 1989 Accomplishments:

- **(U)** Upgraded Telemetry Ground Stations
- **(U)** Constructed Compact Antenna Range
- **(U)** Developed state-of-the-art video tracking systems with remote operation for use in hazardous areas
- **(U)** Instituted replacement of obsolete communications and control consoles for instrumented ranges
- **(U)** Initiated acquisition of Aberdeen Proving Ground, MD, facility for determination of long-range depleted uranium (DU) penetration performance in armor targets/full-up vehicles

(U) FY 1990 Planned Program:

- **(U)** Procure Robotic Mannequin for Dugway Proving Ground, UT
- **(U)** Continue Compact Antenna Range Acquisition for the Electronic Proving Ground (EPG), AZ
- **(U)** Complete Basic Stress Loading Facility for EPG for C^3I interoperability tests
- **(U)** Acquire Airspace Surveillance Radars & Display Control Systems for White Sands Missile Range, NM
- **(U)** Continue development of and acquire Drone Control System for helicopter control at low altitudes

Program Element: #0605602A

PE Title: **Army Technical Test Instrumentation and Targets** Budget Activity: #6

(U) FY 1991 Planned Program:

- (U) Continue Drone Control System Capability Improvement
- (U) Acquire Fiber-Optic Network for range signal security
- (U) Acquire Frequency Surveillance System
- (U) The increase in FY 1991 funds is to acquire improved capabilities for inter/intra range communications, telemetry, data transmission, instrumentation, targets, and test control necessary to test the broad spectrum of new technology and advanced capability weapons systems scheduled for test over the next six years. Typically, instruments are not project specific but will allow for the testing of the new technologies and improved performance of multiple weapons systems, e.g., current tracking systems lack the dynamic response necessary to track new high velocity missiles and projectiles

(U) Project D459 — Ground Targets: This program funds Army efforts to support testing of advanced weapon systems by developing surrogate armor vehicle targets which are required to adequately stress weapons systems. This tasking includes long range planning to determine future target needs and trends, development of coordinated requirement documents which provide a technical description of the required target characteristics, overview management of the target research development test and evaluation process, and the certification process to ensure that substitute targets adequately replicate the threat.

(U) FY 1989 Accomplishments:

- (U) Continued smart munitions target support
- (U) Initiated contractor support for surrogate targets
- (U) Developed threat target signature replication capability
- (U) Supported Army Tactical Missile System (ATACMS) and Wide Area Mine (WAM) target requirements

(U) FY 1990 Planned Program:

- (U) Provide target accreditation support to Smart Munitions Programs
- (U) Develop surrogate-target accreditation procedures
- (U) Consolidate all Army target requirements (ATR)
- (U) Support laboratory threat target signature measurements
- (U) Develop Future Soviet Tank (FST) Target
- (U) Continue development of threat ground vehicle targets

(U) FY 1991 Planned Program:

- (U) Develop long-range target development plan, 1995-2005
- (U) Support target remote control system development
- (U) Continue target accreditation support for Smart Munitions
- (U) Support development of target signature improvements

(U) Project D628 — AMC/TECOM Test Technology: Advanced technology in modern weapons systems requires new test technology to assess the worth of those systems to the Army. Technology improvement efforts include Methodology, Test Procedure Standardization, Advanced Test Technology Concepts, Instrumentation Development, AMC Management of Targets and Threat Simulators, and Test Facilities 5-Year Master Plan and Register. These efforts look ahead at test requirements, develop plans, and take action to assure the necessary test concepts and resources will be available when needed.

Program Element: **#0605602A**

PE Title: **Army Technical Test Instrumentation and Targets** Budget Activity: **#6**

(U) FY 1989 Accomplishments:

- **(U)** Continued to determine/validate/identify Army requirements for the Army Space Systems Test Bed (ASSTB) in cooperation with OSD National Space Test Range programs
- **(U)** Continued to determine critical test data requirements and develop (if necessary) comprehensive test suite for testing Directed Energy Weapons (DEW)
- **(U)** Developed methodology for survivability of combat vehicles
- **(U)** Developed methodology for Electromagnetic Environment Test Facility
- **(U)** Developed air defense C^3I model and simulation
- **(U)** Initiated incorporation of Global Positioning System into ground based instrumentation
- **(U)** Continued to document requirements for high priority targets
- **(U)** Developed and refined 59 test procedures for development systems in all test areas
- **(U)** Continued to manage test programs for Battlefield Deception and Aerial Targets
- **(U)** Developed preliminary design of a national inter-range communication system to meet requirements of a National Space Test Range
- **(U)** Initiated efforts to determine test technology requirements for advanced sensors and low observables
- **(U)** Identified baseline test requirements and shortfalls for Electronics and Electromagnetic Effects (E3) testing of Aviation Systems
- **(U)** Validated the need for a Technology Base Program to Develop Test Technology
- **(U)** Incorporated baseline testing requirements for Unmanned Ground Vehicles (UGV) into OSD UGV Master Plan

(U) FY 1990 Planned Program:

- **(U)** Perform technical efforts and analysis of requirements/deficiencies for testing Army space, Directed Energy Weapons (DEW) laser systems
- **(U)** Develop corresponding test and evaluation concepts with respect to advanced technology thrusts (space, lasers, armor enhancement, etc.)
- **(U)** Develop methodology for weapon system live fire vulnerability/survivability, antennas, and smokes and obscurants
- **(U)** Develop Air Defense Command, Control, Communications and Intelligence (C^3I) performance models related to test design procedures and evaluation
- **(U)** Continue target accreditation
- **(U)** Design and develop overall Army electronic warfare test capability developments
- **(U)** Continue hi-resolution millimeter wave radar development
- **(U)** Develop radar jammer target simulator
- **(U)** Initiate investigations to develop test technology for emerging/development systems in all mission areas
- **(U)** Expand sensor and low observable effort to include other signature studies in acoustics, magnetic, etc.
- **(U)** Identify baseline test requirements and shortfalls for testing electromagnetic/electrothermal guns
- **(U)** Complete concept studies for High Powered Microwave (HPM) susceptability test capabilities
- **(U)** Continue active participation in tri-service efforts to establish a National Space Test Range
- **(U)** Develop design specifications for tri-service inter-range communications system to support National Space Test Range Effort

Program Element: #0605602A

PE Title: **Army Technical Test Instrumentation and Targets** Budget Activity: #6

(U) FY 1991 Planned Program:

- (U) Continue technical efforts and analysis of requirements/deficiencies for testing Army space, low observable systems and other high technology military systems; develop corresponding test technology concepts
- (U) Continue methodology development for live fire and smoke/obscurant testing
- (U) Develop methodology for testing systems employing Artificial Intelligence (AI), development of targets and threat simulators and expert systems
- (U) Develop universal target control systems
- (U) Develop improved dynamic strain measurement techniques for high explosive environments
- (U) Continue active participation in tri-service efforts to establish a National Space Test Range
- (U) Develop design specification for tri-service inter-range communications system to support National Space Test Range Effort

(U) Work Performed By: Major contractors are: RCA Corp, Morristown, NJ; Westinghouse, Baltimore, MD; JET Propulsion Lab, Palo Alto, CA; Sperry Corporation, Reston, VA; Physical Sciences Lab, New Mexico State Univ, Las Cruces, NM; Lockheed, Los Angeles, CA; TVI Corporation, Beltsville, MD; KAMAN Science, Colorado Springs, CO; Science and Technology Corp, Hampton, VA; Battell Pacific Northwest Laboratory, Richland, WA; Interspec, Philadelphia, PA; Contraves Goerz, Pittsburgh, PA; Frederick Manufacturing, Frederick, MD; Lemsco, White Sands, NM; Honeywell, Inc., Defense Avionics Systems Division, Albuquerque, NM; Orlando Helicopter Airways, Inc., Orlando, FL; Kaman Aerospace Corporation, Bloomfield, CT; Micro Systems, Inc., Fort Walton Beach, FL; Beach Aircraft, Wichita, KS; and Native American Services, Huntsville, AL. Study contracts are now in place with SRS Technologies, Huntsville, AL; Illinois Institute of Technology Research Center, Chicago, IL; and Physical Science Lab, New Mexico State University, Las Cruces, NM; Georgia Tech Research Institute, Atlanta, GA; AAI Corp, Reisterstown, MD; Colea Inc., Huntsville, AL. In-house developing organizations include: U.S. Army Test and Evaluation Command, APG, MD; U.S. Army Missile Command, Redstone Arsenal, AL; U.S. Army Combat Systems Test Activity, APG, MD; U.S. Army Yuma Proving Ground, AZ; U.S. Army Dugway Proving Ground, UT; U.S. Army White Sands Missile Range (WSMR), NM; U.S. Army Vulnerability Assessment Lab, WSMR, NM; Army Electronic Proving Ground, Ft. Huachuca, AZ; U.S. Army Tropic Test Center, Republic of Panama; U.S. Army Cold Regions Test Center, Ft. Greeley, AK; U.S. Army Aviation Development Test Activity, Ft. Rucker, AL;

(U) Related Activities: Tri-services requirements are coordinated and duplication of effort is precluded through the Joint Technical Coordination Group for Aerial Targets and Target Needs. The Army is chairman of the Subscale Subsonic Target and Helicopter Targets Subcommittee.
This program is related to PE #0605601A — Army Test Ranges and Facilities; #0605603A — Army User Test Instrumentation & Threat Simulators; #0604211F — Advanced Aerial Targets; #0604755F — Improved Capability for Development Test & Evaluation; #0604208N — Range Instrumentation Systems Development; #0604258N — Navy Targets System Development; #0605862N — RDTE Instrumentation and Materiel Support; #0604735F — Range Improvement; #0604094D — Central Test and Evaluation Investment Program.

Program Element: **#0605602A**

PE Title: **Army Technical Test Instrumentation and Targets**

Budget Activity: **#6**

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
PROCUREMENT:			
Missile Procurement, Army			
Air Defense Targets (C93000)	16756	23317	10151

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605603A**

PE Title: **Army User Test Instrumentation and Threat Simulators** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D976	Army Development & Acquisition of Threat Simulators (ADATS)				
	24211	26072	30023	Cont	Cont
D986	TRADOC Support Equipment				
	13727	17578	8082	Cont	Cont
M992	National Training Center Support				
	1620	2644	3119	Cont	Cont
PE TOTAL	39558	46294	41224		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element finances development of instrumentation for Training and Doctrine Command (TRADOC) Test Boards and for the Army Training Centers; and provides funds to develop threat simulators. These threat simulators, which look and act like enemy equipment, provide realistic tactical environments during operational user testing of new weapon systems and support Army training activities. The program is developed in coordination with the Operational Test and Evaluation Capability Improvement Program (OT&E CIP) to preclude duplication.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D976 — ADATS: Finances Army development of threat simulators for TRADOC. Simulators represent Soviet systems (missile and electronic systems, command and control, communications, helicopters and combat vehicles) that are used to portray a realistic threat environment during operational testing of U.S. systems. They will also support joint operational tests and Army training.

(U) FY 1989 Accomplishments:

- **(U)** Significant testing of the following U.S. development programs were supported:
  - Special Electronic Mission Aircraft (SEMA)
  - Pedestal Mounted STINGER (PMS)
  - Line-of-Sight Forward Heavy (LOS F-H)
  - Army Tactical Missile System (ATACMS)
  - Command, Control and Communications Countermeasures Joint Tactical Fusion
  - HAWK Phase III
  - Howitzer Improvement Program (HIP)
- **(U)** Systems fielded:
  - XMHD (Helicopter, simulator) one system
  - XMU375S (C3 System) two systems
  - XMG1S (C3 System) two systems
  - (XM11) (SAM) one system

(U) FY 1990 Planned Program:

- **(U)** Significant testing of the following U.S. development programs will be supported:
  - Army Tactical Missile System (ATACMS)
  - Forward Area Air Defense Command, Control and Intelligence (FAAD C2I)

Program Element: **#0605603A**

PE Title: **Army User Test Instrumentation and Threat Simulators** Budget Activity: **#6**

- Close Unmanned Aerial Vehicle-Fixed (UAV)
- Joint Surveillance Target Attack Radar System (JSTARS)
- Advanced Field Artillery Tactical Data System (AFATDS)
- Howitzer Improved Program (HIP)
- Joint Advanced Special Purpose Jammer (ASPJ)

• **(U)** Systems to be fielded:

- XMHDS (Helicopter) two systems
- XM43S (AA Gun) one system
- XMP12 (C3 System) one system
- XM14S (SAM) 10 systems (Mod)
- XM11 (SAM) one system
- XM13 (SAM) two systems
- XMHKS (Jammer) one system

(U) FY 1991 Planned Program:

• **(U)** Significant testing of the following U.S. development programs will be supported:

- Special Electronics Missions Aircraft (SEMA)
- Sense and Destroy Armor Projectile (SADARM)
- Advanced Field Artillery Tactical Data System (AFATDS)
- Mini Eye Safe Sensor
- Single Channel Ground/Air Radar Systems (SINCGARS)
- FIREFINDER II (AN/TPQ 36/37)

• **(U)** Systems to be fielded:

- XMHVS (Helicopter) one system
- XMHOKS (Helicopter) one system
- XMHJS (Jammer) one system
- XM13S (SAM) one system
- XM43S (AA Gun) three systems
- XMP12S (C3 System) three systems

(U) Project D986 — TRADOC Support Equipment: Finances the development of instrumentation for Operational Testing (OT) and Force Development Testing and Experimentation (FDTE) at TRADOC Test and Experimentation Command (TEXCOM), TEXCOM Combined Arms Test Center (TCATC), TEXCOM Experimentation Center (TEC) and the eight test boards. TCATC conducts large-scale FDTE and OT; TEC conducts precise or heavily instrumented field experiments and OT; the boards conduct OT, materiel concepts evaluations, and small-scale FDTE. This project provides for the development and acquisition of essential instrumentation to simulate a realistic combat environment and to measure performance of hardware and personnel under those conditions for effectiveness and suitability determination of new materiel. Instrumentation systems provide operational test scenario command and control, force-on-force weapon engagements with real time casualty assessments, and collection of objective and subobjective test data. The increase in FY 1990 will be applied to the more critical modern and cost-effective instrumentation requirements: the Mobile Army Instrumentation System (MAIS); modified Multiple Object Tracking Radar, AN/MPS-39 (MOTR), and the C3I Interoperability Test Instrumentation System.

Program Element: #0605603A

PE Title: **Army User Test Instrumentation and Threat Simulators** Budget Activity: #6

(U) FY 1989 Accomplishments:

- (U) Initiated development of: C3 Test System, Advanced Combat Rifle Test Range, Three Dimensional Threat Surrogates Visual Models (VISMOD), and Modernization of Instrumentation to improve air defense testing and electronic countermeasures.
- (U) Continued MAIS program into development to provide a movable test capability for support of Initial Operational Test and Evaluation (IOTE) at various test sites
- (U) Developed instrumentation for improved IOTE of air defense systems, not only for safe range operations, but for measuring hit/misses during nap of the earth (NOE) operations and other more realistic combat testing

(U) FY 1990 Planned Program:

- (U) Continue MAIS, VISMOD and C3I programs into full scale development and initiate Electronic Countermeasures (ECM) instruments for IOTE
- (U) Continue development of Pairing Through Obscuration test instrumentation (new direct fire simulated lasers) and MIDI/MOTR Radar
- (U) Acquire Automated Intelligence/Electronic Warfare instrumentation player systems for Operational Testing of C3I systems/Non-Line-of-Sight Air defense
- (U) Field Electronic Warfare System (EWS) and Automated Video Data Reduction (AVDR) System in support of C2 system

(U) FY 1991 Planned Program:

- (U) Continue MAIS deployment of 200 to 500 players and production of Automated Intelligence/EW systems
- (U) Continue development of MIDI/MOTR radar
- (U) Develop Automated Intelligence/EW Equipment for ECM tests
- (U) Initiate development of C3I Software for Blue systems and new VISMOD surrogate threat systems
- (U) Acquire 20 C3I units for tests of Mobile Subscriber Equipment (MSE), Maneuver Control System (MCS) and Enhanced Position Location Reporting System (EPLRS)

(U) Project M992 — National Training Center Support: This project provides for development or upgrade of the instrumentation at the Army's Combat Training Centers which includes the National Training Center (NTC), Fort Irwin, CA, Joint Readiness Training Center (JRTC), Ft Chaffee, AR, and Combat Maneuvers Training Center (CMTC), Hohenfels, Germany. The instrumentation system will enable participating units, commanders, and staffs to measure their performance in a simulated combat environment and thereby increase their training for combat readiness. The increase between FY 1989 and FY 1990 reflects a consolidation of resources at TRADOC in support of the NTC Instrumentation System and the NTC Operation Group.

(U) FY 1989 Accomplishments:

- (U) Continuation of projects started in FY 1988 and earlier
  - Developed a capability to collect data for use by the Army's combat developers in formulating new system needs, training, tactics/doctrine concepts.

(U) FY 1990 Planned Program:

- (U) Continue to develop capability.
  - Initiate modernization of the Multiple Integrated Laser Engagement System (MILES) to improve Real Time Casualty Assessment and Force-On-Force engagements.

Program Element: **#0605603A**

PE Title: **Army User Test Instrumentation and Threat Simulators** Budget Activity: **#6**

(U) FY 1991 Planned Program:

- **(U)** Continuation of development capability.
  - Development of interfacing instrumentation requirements to accommodate future utilization of Global Positioning System (GPS) at training centers.

(U) Work Performed By: In-house work is performed by elements of the Army Research Institute at TRADOC at Fort Monroe and Fort Eustis, VA; Ballistics Research Laboratory, Aberdeen Proving Ground, MD; the Armament R&D Center, Picatinny Arsenal, NJ; and the Army Intelligence Agency (Missile and Space Intelligence Center). Contractors include: BDM, McLean, VA; International Laser System, Orlando, FL; General Electric, Syracuse, NY; Bell Technical Operations, Inc., Sierra Vista, AZ; EC Corp, Oakridge, TN; LORAL Data Communication Corp, Anaheim, CA; ULTRA Defense and Space System, Inc, Sierra Vista, AZ; Chrysler Pentastor, Huntsville, AL; University of Texas, Austin, TX; Georgia Tech, Atlanta, GA; Engineering and Commercial Research, Inc, McLean, VA; XM11S, General Dynamics, Ft Worth, TX; XM15S, Boeing, Seattle, WA; and Electronic Warfare Associates, Vienna, VA.

(U) Related Activities: The program is coordinated with the DOD Operational Test and Evaluation Capability Improvement Program (OT&E CIP), PE #0604340D, to preclude duplication. There is no duplication within the Department of Defense (DOD). A joint service committee oversees threat simulator development for the DOD. A lead service is appointed to develop a simulator that has multiple service requirements. Headquarters, Department of the Army provides oversight. Coordination with other Army agencies and services is accomplished through scheduled meetings, resource reviews and planning seminars.

(U) Other Appropriation Funds: ($ in Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate
PROCUREMENT:			
OPA	14748	18077	8690

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605604A**

PE Title: **Technology and Vulnerability Assessment** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D181 Antiradiation Missile Counter/Countermeasures	3590	- 0 -	- 0 -	- 0 -	56141
D190 System Vulnerability Assessment Technology	6716	6761	7085	Cont	Cont
D234 Ground Combat System Vulnerability	3034	5451	5690	Cont	Cont
D235 Missile Counter/Countermeasures Technology	571	1016	1042	Cont	Cont
D267 Air Defense and Space System Vulnerability	4170	6870	7226	Cont	Cont
D462 Technical Vulnerability Reduction	3381	2946	3064	Cont	Cont
D626 C3 Systems Vulnerability/Susceptibility	4258	5884	6145	Cont	Cont
DC10 Technology Assessment	- 0 -	4421	5724	Cont	Cont
PE TOTAL	25720	33349	35976		

B. (U) BRIEF DESCRIPTION OF ELEMENT: Funds were transferred from PE #0603270A--Electronic Warfare Technology and PE #0604270A—Electronic Warfare Development in response to Congressional direction and in recognition of the need to have improved management by consolidating vulnerability activities. Funding for administration and management support for vulnerability assessment has also been transferred to this program from PE #0602120A. The effectiveness of weapon, communication, aviation, and electronic systems can be severely degraded or neutralized by enemy radio electronic combat (REC) techniques unless adequate electronic counter-countermeasures (ECCM) are incorporated during system design. The objectives of this program element are to: (1) develop the necessary technology, facilities, and expertise to assess the performance of Army systems against the current and future REC threats; (2) conduct theoretical analyses, simulations, and field experiments to provide a vulnerability data base, (3) perform actual vulnerability assessments to quantify system effectiveness in a REC environment; and (4) provide supporting technology for ECCM hardening efforts. Additionally, this effort provides the technology support for antiradiation missile countermeasures, signature measurements, sensor/signal processing, and survivability. Activities in progress include the assessment of the effects of lasers, high power microwave, EO/RF jammers, and decoys on STINGER, PATRIOT, TOW-2B, HAWK, FAADS, JSTARS, Firefinder, EPLRS, MSE, Regency Net, MLRS-TGW, LONGBOW, SADARM, AAWS-M, ATACMS, HELLFIRE, AAWS-H, BFV, M1A2, HFM and the classified programs. Other activities include the electromagnetic interference investigations on BLACKHAWK and APACHE, electronic warfare exploitation of foreign missile systems, and developing an improved vulnerability assessment methodology. The technology and resource bases developed within the projects in this program element provide the technology and facilities necessary to conduct vulnerability assessments of Army systems. Funding for the actual conduct of the assessments is supported by the system developer.

Program Element: **#0605604A**
PE Title: **Technology and Vulnerability Assessment** Budget Activity: **#6**

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D181 — Antiradiation Missile Counter/Countermeasures (ARM-CM): This project investigates methods to counter the antiradiation missile (ARM); investigates the vulnerability of US critical asset PATRIOT and HAWK systems to the anti-radiation threat; investigates the threat exploitation of friendly system electromagnetic radiations; seeks measures to reduce/modify friendly signatures so they cannot be exploited. Army will reprogram funds below threshold for FY 1990.

(U) FY 1989 Accomplishments:

- (U) Completed updating Generic Simulation Interface (GSIM) and coding Advanced Generic ARM Seeker (AFGAS) model
- (U) Completed and tested AFGAS
- (U) Completed design of balloon platform

(U) FY 1990 Planned Program:

- (U) Track emerging ARM threats
- (U) Maintain FGAS, existing ARM-CM field test assets
- (U) Begin validation of AFGAS model
- (U) Complete AFGAS C-band seeker for PATRIOT tests
- (U) Begin construction of AFGAS S-band seeker
- (U) Construct AFGAS balloon platform
- (U) Support R&D testing of the Marine Corps Hawk Decoys
- (U) Test the NATO DART radar ARM-CM
- (U) Support first article test (FAT) of the Marine Corps TPS-32 radar
- (U) Evaluate alternative ARM-CM techniques

(U) FY 1991 Planned Program:

- (U) Program Not Funded

(U) Project D190 — System Vulnerability Assessment Technology: This project supports development of the Army initiative to reduce systems' susceptibility to electromagnetic (EM) environmental effects; e.g., critical Army aviation special EM interference (SEMI) investigations of Blackhawk for flight safety concerns. This project also includes the Army's electronic warfare (EW) signature measurement program and the assessment of laser countermeasure (CM) effects on Army optical/electro-optical (O/EO) systems. This project provides supporting technology and data for the Army's EW vulnerability assessment (EWVA) program. Inherent in this program is the use of extensive assessment facilities and threat emulators to quantify susceptibilities early in system development cycles, and to preclude costly retrofits. This project supports investigations of new technologies for assessment techniques and makes recommendations for hardening alternatives if system susceptibilities or vulnerabilities are discovered. Also funds salaries, travel, equipment/facilities, and general management/administrative support.

(U) FY 1989 Accomplishments:

- (U) Completed SEMI investigations of UH-60A (BLACKHAWK) and AH-64 (APACHE) helicopters, and STINGER, HELLFIRE (Block V), and Remote Controlled Anti-Armor Mine (RAAM)
- (U) Developed two potential materials for sensor protection against laser threats
- (U) Completed Electro-Optical Countermeasure (EOCM) assessments of M1A1 and M60 tank optics under the Optical Improvement Program (OIP).

Program Element: #0605604A
PE Title: **Technology and Vulnerability Assessment** Budget Activity: #6

- (U) Made EW signature measurements in support of APACHE Target Acquisition and Designation Sight/Pilot Night Vision Sensor (TADS/PNVS) and STINGER Reprogrammable Microprocessor (RMP) investigations.

(U) FY 1990 Planned Program:

- (U) Conduct laser CM investigations of the OH58-D mast-mounted sight
- (U) Perform CM experiments in support of Forward Area Air Defense System (FAADS) development program
- (U) Provide vulnerability data on the Advanced Anti Tank Weapon System-Medium (AAWS-M) system
- (U) Conduct SEMI/high power microwave (HPM) assessments of Army missile and aviation systems
- (U) Perform infrared (IR), ultraviolet (UV), and radio frequency (RF) signature measurements to support FAADS, STINGER, other Army development programs, and foreign material exploitation programs
- (U) Support the Army electromagnetic (EM) effects action program
- (U) Explore and develop EW technology to support current and future vulnerability assessments of weapons/Command, Control, Communications and Intelligence (C3I) systems

(U) FY 1991 Planned Program:

- (U) Provide laser vulnerability data to support EW CCM hardening of land combat systems and the FAADS development program
- (U) Conduct SEMI investigations of three Army weapon/communication-electronic systems and platforms
- (U) Begin HPM evaluation of shielding techniques for computers and communications systems, and missile hardening techniques for millimeter wave (MMW) weapon systems
- (U) Continue support of Army EM environmental effects program
- (U) Continue EO, IR, UV, and RF signature measurements to support Army development activities and foreign materiel exploitation
- (U) Continue exploring and developing EW technology to support current and future vulnerability assessments of weapon/C3I systems

(U) Project D234 — Ground Combat System Vulnerability: Project investigates the vulnerability of Army smart weapons to EW. Weapons being developed under the mission areas of close combat, fire support, aviation, fuzes, and mines/countermines are assessed for susceptibilities/vulnerabilities. Recommend CCMs and evaluate effectiveness of implemented hardening. Assessments support weapon requirements, test evaluation master plans, cost/operational effectiveness analyses, and major decision milestones. Also funds salaries, travel, equipment/facilities, and general management/administrative support.

(U) FY 1989 Accomplishments:

- (U) Completed EW field investigations on the TOW-2B missile fuze sensors and provided vulnerability assessment to Source Selection Evaluation Board for down selection decision
- (U) Conducted captive flight EW experiments and measurements in support of Sense and Destroy Armor (SADARM) and Multiple Launch Rocket System-Terminally Guided Warhead (MLRS-TGW) In-Process Review (IPR)
- (U) Completed preliminary EW lab/field investigations and simulation analyses on FAADS-Line of Sight-Forward-Heavy(LOS-F-H) fuze
- (U) Provided three letter reports assessing the performance of three candidate weapon systems for the AAWS-M Milestone II decision

Program Element: #0605604A
PE Title: **Technology and Vulnerability Assessment** Budget Activity: #6

(U) FY 1990 Planned Program:

- (U) Perform preliminary EW Lab/field investigations of TOW-2B sensor and AAWS-M advanced hardware and Line of sight Antitank (LOSAT) dirty battlefield experiments
- (U) Provide detailed EWVAs of the Smart Target Activated Fire and Forget (STAFF) and LONGBOW systems to support milestone II decisions
- (U) Conduct simulations and field EW investigations on the MLRS binary chemical warhead fuze, multi-option artillery fuze (MOAF), and FAADS-LOS-F-H fuze
- (U) Support SADARM captive flight production qualification test with EW investigations and vulnerability analyses
- (U) Initiate seismic and acoustic measurements and susceptibility analyses on smart mines/countermines

(U) FY 1991 Planned Program:

- (U) Continue EWVAs of Army smart weapons systems
- (U) Complete vulnerability assessments of TOW-2B, SADARM, MLRS-TGW, and support full scale development of AAWS-M and LOSAT
- (U) Conduct EW simulations/studies of Autonomous Precision Guided Munitions (APGM)
- (U) Continue seismic/acoustic EW investigations of smart mines/countermines
- (U) Conduct computer simulations to evaluate Follow-on-to-Lance (FOTL) performance in EW environments
- (U) Continue EWVA of AAWS-M, STAFF, AAWS-H, Kinetic Energy Missile (KEM), and LONGBOW
- (U) Start vulnerability assessments on alternate TOW-2B

(U) Project D235 — Missile Counter/Countermeasures Technology: Project supports development of counter-countermeasures (CCM) to harden missile systems against laser and RF directed energy threats. Supports modeling to investigate vulnerabilities of systems to threat air defense systems. Supports investigations of missile signatures and exploitability. Investigates technology to harden optical windows against RF. Also funds salaries, travel, equipment/facilities and general management/administrative support.

(U) FY 1989 Accomplishments:

- (U) Developed technology to produce dual mode optical windows and missile domes to protect dual mode IR/millimeter wave missile sensors
- (U) Measured RF environment generated by the Fiber Optic Guided-Munition (FOG-M) missile system
- (U) Participated in planning, execution, and analysis of Ladder Rack tests
- (U) Measured High Powered Microwave (HPM) effects on nonlinear materials and on RF shielding effectiveness of dual bandpass period structures

(U) FY 1990 Planned Program:

- (U) Expand capability to model battlefield effects on FOG-M and other missiles
- (U) Continue signature reduction techniques development to update modeling efforts and develop and evaluate robust generic missile system CCM technology

(U) FY 1991 Planned Program:

- (U) Use improved model to evaluate battlefield effects on FOG-M and other missile systems
- (U) Continue to develop non-linear materials to protect O/EO sensors from frequency agile directed energy weapons (DEW) threat

Program Element: #0605604A
PE Title: **Technology and Vulnerability Assessment** Budget Activity: #6

- (U) Continue signature measurement and reduction program, conduct field tests to determine effectiveness of techniques, and develop generic missile system CCM technology

(U) Project D267 — Air Defense and Space Systems Vulnerability: Supports vulnerability assessments of air defense (AD) and space weapons systems. Evaluations support milestone and production decisions on new family of AD for Army divisions as well as theater missile air defenses. Supports vulnerability assessments of product improvements and new capability modifications to PATRIOT and HAWK. Also funds salaries, travel, equipment/facilities and general management/ administrative support.

(U) FY 1989 Accomplishments:

- (U) Supported STINGER requirement for Electro-Optical Countermeasures (EOCM) data base
- (U) Performed ECCM assessment of PATRIOT during Preplanned Product Improvement (P3I) and operational system tests
- (U) Conducted EW susceptibility analysis of elements of Strategic Defense Systems (SDS)
- (U) Continued support of FAADS LOS-F-H with EW scenarios, and added to the EWVA data bases.

(U) FY 1990 Planned Program:

- (U) Continue EWVA and ECCM assessments of PATRIOT, PATRIOT variants, and Theater Missile Defense (TMD)
- (U) Continue EW performance analysis of elements and architecture for the Phase I Strategic Defense System (SDS) concept and provide EWVA results and recommendations to IPR
- (U) Conduct EWVAs of STINGER, Chaparral, directed energy weapon (DEW) self-protection, and FAADS FOG-M, HAWK, PATRIOT and FAADS LOS-F-H
- (U) Develop advanced EOCM hardware for EWVA environment generation for EO missile system test programs
- (U) Provide independent CM vulnerability assessment for FAADS LOS-F-H production decision
- (U) Develop threat EW replication techniques and devices for EWVA field support exercises and AD missile test program
- (U) Develop critical subsystems for concept investigation of next generation standoff jammer threat emulator

(U) FY 1991 Planned Program:

- (U) Provide EW environment generation and measurements for PATRIOT, PATRIOT variants, and TMD
- (U) Continue development of Electronic Countermeasures (ECM) systems, instrumentation, and laboratory upgrades
- (U) Conduct reactive threat CM susceptibility investigations of electro-optical missile systems and HAWK ECCM improvements
- (U) Develop quick reaction capability (QRC) CCM descriptions for the FAADS LOS-F-H and HAWK systems

(U) Project D462 — Technical Vulnerability Reduction: This project funds the Army Survivability Management Office to be the Army Materiel Command's survivability specialist, a spokesman for survivability policy, and manager of survivability enhancement programs involving multiple organizations or systems. An objective of project activities is to determine the best means for coping with countermeasures and lethal weapons effects. The relative severity of all threats is gauged,

Program Element: #0605604A
PE Title: **Technology and Vulnerability Assessment** Budget Activity: #6

and experimental information from every organization performing vulnerability assessment is integrated to form a comprehensive prescription for a robust system. Results are used to predict quantitative requirements for system performance under combat conditions, to help Project Managers translate requirements into system technical features, to develop technology investment plans with substantial survivability payoff, and to ensure that survivability performance issues are developed for testing.

(U) FY 1989 Accomplishments:

- (U) Performed a net assessment of tactical communications survivability and identified potential hardening ideas
- (U) Developed criteria for a countermeasure set that could defeat overmatching threats to the survival of ground combat vehicles
- (U) Published a parametric survivability analysis of future fighting vehicles
- (U) Created a new analytic technique for portraying the muted infrared signatures of anti-armor weapon targets

(U) FY 1990 Planned Program:

- (U) Assess the degree of protection afforded combat vehicle crews and the prospects for improving their survival during combat operations
- (U) Perform a survivability benefit comparison of armed helicopter maneuverability/agility with other means of attenuating attrition
- (U) Publish a source book of ground combat vehicle survivability principles and design concepts for use by requirements and system developers
- (U) Gauge the relative severity of weapon effects that could threaten Unmanned Aerial Vehicle (UAV) survival and identify practical means of risk reduction

(U) FY 1991 Planned Program:

- (U) Continue leading the Army Optical Improvement Program to install laser protection in frontline weapon sights
- (U) Complete assembly of a compact work station to serve Army needs for a comprehensive countermeasure analysis capability and a central bank of hardening data
- (U) Investigate means for avoiding attacks on howitzers stemming from the predictability of intercepted shell trajectories
- (U) Conduct a study of battle cab/cockpit material choices and design attributes that would be highly resistant to chemical agent effects

(U) Project D626 — Command, Control, and Communications (C3) Systems Vulnerability/Susceptibility: Supports vulnerability assessments of Army communications and electronic equipment against friendly and threat electromagnetic radiation (EMR). Provides field threat environment support for EWVA. Assesses foreign threat weapons' ECM vulnerabilities to Blue EW systems; provides threat weapon design data to jammer developers and technical capability information to the intelligence community. Supports Army initiative in EM effects vulnerability reduction of C3 systems. Also funds salaries, travel, equipment/facilities and general management/administrative support.

(U) FY 1989 Accomplishments:

- (U) Completed ECM vulnerability assessments of five foreign surface-to-air missiles, and one foreign anti-tank guided missile
- (U) Assessed effectiveness of two important U.S. jammers against foreign surface-to-air missile simulation model
- (U) Used unique new foreign antitank guided missile simulator in EWVA

Program Element: **#0605604A**

PE Title: **Technology and Vulnerability Assessment** Budget Activity: **#6**

- **(U)** Completed initial susceptibility analysis of Mobile Subscriber Equipment (MSE) communications links and made major ECCM recommendations
- **(U)** Successfully demonstrated Multichannel Steerable Null Antenna Processor (MSNAP) to PM-MSE as a candidate ECCM product enhancement
- **(U)** Completed pretest analysis test designs and test plane for Joint Surveillance Target Attack Radar (JSTARS) Multimode radar
- **(U)** Initiated EW vulnerability investigation of FAADS Ground Based Sensor (GBS).

(U) FY 1990 Planned Program:

- **(U)** Chair a DOD foreign missile analysis effort
- **(U)** Coordinate participation in international cooperative program with Canadian and United Kingdom (UK) Ministries of Defense
- **(U)** Complete vulnerability assessments of six foreign surface-to-air missiles, two foreign anti-tank guided missiles, and one foreign air-to-surface missile
- **(U)** Continue EWVAs for MSE product improvement program
- **(U)** Continue support of current and future target acquisition radars to include JSTARS, Firefinder, space defense emerging smart weapon system and ground surveillance concepts
- **(U)** Continue EWVA of Army Tactical Command and Control System (ATCCS)

(U) FY 1991 Planned Program:

- **(U)** Begin developing DOD's first realtime, hardware-in-the-loop simulation of a new foreign surface-to-air missile
- **(U)** Complete EWVAs of four foreign surface-to-air missiles, one foreign anti-tank guided missile, and one foreign air-to-surface missile
- **(U)** Begin participation in International Cooperative program with Canadian and UK Ministries of Defense
- **(U)** Significantly upgrade existing software ECM simulation modules
- **(U)** Continue EWVAs in support of FAADS GBS and aerial sensors
- **(U)** Complete EW susceptibility/vulnerability test on JSTARS blocks I & II system configuration
- **(U)** Complete EWVA of Strategic Defense Initiative (SDI) ground-based radar concepts, and of High Frequency Steerable Null Antenna Processor (HFSNAP), Short Term Anti Jamming Technic (STAJ), and Regency Net (RN)
- **(U)** Continue EWVA support to PM-MSE, special forces communications, space and satellite C31 systems
- **(U)** Provide EW Support to Army Ultra High Frequency (UHF) ECCM techniques program for MSE
- **(U)** Complete enhancements to netted communications systems deployment aid anti-jamming model and begin efforts for full model validation for use in Initial Operational Test and Evaluation (IOT&E) planning/training.
- **(U)** Continue EW support to the All Source Analysis System, FAADS Command Control and intercept, Advanced Field Artillery Tactical Data System (AFATDS), Maneuver Control System (MCS), and Combat Service Support Control System (CSSCS) nodal systems of Army Tactical Command and Control System (ATCCS)

(U) Project DC10 — Technology Assessment: Project provides management, policy, and guidance for the preparation, conduct and validation of vulnerability/lethality assessments and oversight coordination in Signatures, Sensors and Signal Processing. Funds Vulnerability/Lethality Assessment Management Office (VLAMO) and the Signatures, Sensors and Signal Processing Technology Organization (S3TO). Serves as the Army proponent for a total materiel life cycle vulnerability/

Program Element: #0605604A

PE Title: **Technology and Vulnerability Assessment** Budget Activity: #6

lethality assessment program. Conducts independent evaluation of all assessment results. Coordinates use of signatures, vulnerability assessments in modeling efforts in conjunction with the Army Materiel Systems Analysis Activity (AMSAA). S3TO develops and maintains cognizance of signature data and sensor/signal processing technological efforts throughout the DOD community. Maintains a supporting capability, including development and use of war games, models, simulations, signature and environmental measurements, equipment prototype field tests and analysis tools necessary to support technology assessment. Identifies and recommends appropriate balance to minimize redundancy and maximize technological return. Coordinates Army acoustic Reconnaissance, Surveillance and Target Acquisition (RSTA) Technology with special emphasis on signal processing.

(U) FY 1989 Accomplishments:

- **(U)** Establish checklist for foreign target signature validation
- **(U)** Plan Multi-Mission Area Sensor (MMAS) demonstration
- **(U)** Present S3 Tech Base investment strategy, utilizing results of sensor and signal processing survey, to Army managers
- **(U)** Publish Directory of Army signature databases and distribute to other services
- **(U)** Established focal point and initiated independent review of laboratory vulnerability/lethality assessment activities
- **(U)** Coordinated laboratory activities and initiated development of criteria in support of initiative in electromagnetic environment effects

(U) FY 1990 Planned Program:

- **(U)** Prepare a multi-year program plan which will insure the availability of vulnerability/lethality assessment data necessary for future decisions
- **(U)** Provide policy and guidance for preparation, conduct, and validation of vulnerability/lethality assessments throughout the materiel life cycle
- **(U)** Continue initiatives in developing/refining criteria for electromagnetic environmental effects
- **(U)** Initiate acoustic oversight committee activities to focus Army RSTA technology program

(U) FY 1991 Planned Program:

- **(U)** Develop full-spectrum signature model and distribute to industry and other services
- **(U)** Review applicability of MMAS common sensor concept at division-level for RSTA missions
- **(U)** Start "Centers of leadership" for signature, technologies and modeling
- **(U)** Support DoD Tri-Service Automatic Target Recognition (ATR) steering committee plan development
- **(U)** Coordinate and prioritize resources to implement multi-year program plan which will ensure the availability of vulnerability/lethality data required for future decisions
- **(U)** Continue to provide policy and guidance for the preparation, conduct, and validation of vulnerability/lethality assessments throughout the materiel life cycle
- **(U)** Continue initiatives in electromagnetic environmental effects hardening criteria

(U) Work Performed By: In-house work to be performed by Harry Diamond Laboratories, Adelphi, MD; Vulnerability Assessment Laboratory, White Sands, NM; Electronics Technology and Devices Laboratory, Fort Monmouth, NJ; Survivability Management Office, Adelphi, MD; Foreign Intelligence Office, Adelphi, MD; the U.S. Army Missile Command, Countermeasures/Counter-Countermeasures Center, Huntsville, AL; Vulnerability and Lethality Management Office, Aberdeen, MD; and the Signatures, Sensors, and Signal Processing Technology Organization, Adelphi, MD. Supporting efforts are provided by Naval Weapons Center, China Lake, CA; Letterman Research

Program Element: #0605604A

PE Title: **Technology and Vulnerability Assessment** Budget Activity: #6

Institute, San Francisco, CA; Pacific Missile Test Center, Point Mugu, CA; Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH; and Rome Air Development Center, Griffiss Air Force Base, NY. Major contractors are: Tracor Flight Systems, Inc., Santa Anna, CA; ST Research, Newington, VA; Malibu Research, Santa Monica, CA; Computer Sciences Corp, Huntsville, AL; TRW, McLean, VA; TRW Electromagnetic Systems Laboratories, Sunnyvale, CA; LTV Vought, Dallas, TX; International Systems, McLean, VA; Physical Science Laboratory, Las Cruces, NM; Raytheon Service Company, El Paso, TX; General Dynamics, Fort Worth, TX; Texas Medical Instruments, San Antonio, TX; Syndetix, Las Cruces, NM; Resource Engineering and Planning, El Paso, TX; Battelle Northwest Laboratory, Hanford, WA; Engineering Systems and Planning Huntsville, AL; System Planning Corp., Arlington, VA; BDM Corp., McLean, VA; Analytics Inc., Willow Grove, PA; Defense Research Technologies, Inc., Rockville, MD; Gleason Research Associates, Inc., Columbia, MD; J.S. Lee Associates, Inc., Arlington, VA; Georgia Tech Research Institute, Atlanta, GA; Digital Radio Corp., Redondo Beach, CA; Hughes Aircraft Corp., Fullerton, CA; E-Systems, Greenville, TX; GTE Sylvania, Mountain View, CA; MACOM-PHI, Torrance, CA; Microwave Semi-Conductor, Somerset, NJ; Lockheed Electronics Co., Plainfield, NJ; American Electronic Laboratories, Lansdale, PA; SCS Telcom, Port Washington, NY; Martin Marietta Corp., Orlando, FL; ESL, Inc., Sunnyvale, CA; RCA Corp., Camden, NJ; ITT Corp, Nutley, NJ; Digital Radio Corp., Inglewood, CA; Delfin Corp., San Jose, CA; Sanders Associates, Nashua, NH; Quest Research Corp, McLean, VA; and IITRI, Chicago, IL.

(U) Related Activities:

Program Element: #0602782A (Command, Control Communications Technology)
Program Element: #0603789F (Command, Control and Communications and Technology Development)
Program Element: #0604573N (Shipboard Electronic Warfare Improvements)
Program Element: #0604270A (Electronic Warfare Development)
Program Element: #0603745A (Tactical Electronic Support Measure (ESM) Systems)
Program Element: #0602131M (Marine Corps Landing Force Technology)
Tri-Service Signature Working Group; Tri-Service ATR Working Group;
Tri-Service Joint Working Group on Electronic Warfare; Joint-Service Technical Coordinating Groups; Tri-Service Technical Coordinating Groups. Tri-Service Joint Working Group on Antiradiation Missile Countermeasures (ARM-CM) Activities coordinated with other Government services and agencies. There is no unnecessary duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605702A**

PE Title: **Meteorological Support to RDT&E Activities** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D127 Meteorological Support to RDT&E Activities	18372	23138	24395	Cont	Cont
PE TOTAL	18372	23138	24395		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Army requires detailed atmospheric data from the surface to near space altitudes as part of its testing program. This program develops, provides, and maintains the full range of meteorological support required by Army RDT&E centers and test facilities at 14 permanent test sites (CONUS/OCONUS), and for special support at temporary test sites. Provides atmospheric information critical in tests of high priority Army weapons and materiel in order to determine modifications required for atmospheric effects. The program also provides for selective modernization of meteorological equipment that provides more and better data with reduction in operating and maintenance costs.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D127 — Meteorological Support to RDT&E Activities.

(U) FY 1989 Accomplishments:

- **(U)** Provided support to project managers and testing programs at 14 permanent RDT&E sites in support of 465 Army RDT&E efforts
- **(U)** Expanded capabilities of automated ground measurement systems by adding new instruments and increasing sampling frequency.
- **(U)** Provided centralized access to environmental data base by test officers and project managers

(U) FY 1990 Planned Program:

- **(U)** Provide the Army RDT&E community with tailored support to quantify atmospheric effects at 14 permanent locations and, as required, worldwide
- **(U)** Provide smoke and atmospheric characterization measurements, Multiple Launch Rocket System (MLRS) and Army Tactical Missile System (ATACMS) wind profiles, and noise assessment evaluations for selected test/training sites
- **(U)** Provide specialized environmental support for directed energy weapons programs and the ground based free electron laser project, when operable
- **(U)** Modernize operational support equipment for meteorological teams to meet customer requirements
- **(U)** Install additional frequency agile transmissometers, forecasters workstations, and radio theodolites at selected meteorological team sites
- **(U)** The increase in FY 1990 and 1991 reflects a zero sum transfer of administration and management costs of RDTE,A laboratories from PE 0602784A — Military Engineering Technology. The realignment covers salaries, travel, equipment, and general support of civilian management personnel and their administrative support staffs.

(U) FY 1991 Planned Program:

- **(U)** Measure and integrate conventional and remotely sensed meteorological data to support RDT&E of all major Army systems and materials in test-required climatic conditions

Program Element: **#0605702A**

PE Title: **Meteorological Support to RDT&E Activities** Budget Activity: **#6**

- (U) Support directed energy systems tests and demonstrations
- (U) Install horizontal path profiler, path-integrated rain sensors, and other meteorological test instruments, and very long range visibility sensors at selected meteorological team sites to support RDT&E customers
- (U) Provide smoke dynamics, transmittance and atmospheric measurements

(U) Work Performed By: In-house effort will be accomplished by US Army Laboratory Command, Atmospheric Sciences Laboratory, White Sands Missile Range, NM. Major contractors are New Mexico State University Physical Sciences Laboratory, Las Cruces, NM; Lockheed Corporation, White Sands Missile Range, NM; and Science and Technology Corp, Hampton, VA.

(U) Related Activities: PE #0601102A — Defense Research Sciences and #0602784A — Military Engineering Technology. There is no unnecessary duplication of effort within the Department of Defense

(U) Other Appropriation Funds: ($ in Thousands) Not applicable

(U) International Cooperative Agreements: The Atmospheric Science Laboratory supports NATO and World Meteorological Organization testing.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605706A**
PE Title: **Materiel Systems Analysis** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D026	Test Design and Evaluation	7430	7081	7345	Cont	Cont
M541	Materiel Systems Analysis	17003	16028	16090	Cont	Cont
PE TOTAL		24433	23029	23435		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element (PE) supports the in-house and contractor support requirements associated with the US Army Materiel Systems Analysis Activity (AMSAA) located at Aberdeen Proving Ground, MD. AMSAA provides the independent technical capability in the Army Materiel Command (AMC) for the conduct of materiel systems analyses. AMSAA evaluates the performance of existing and proposed materiel systems throughout their life cycle to support major Army commands and higher headquarters in the conduct of Cost and Operation Effectiveness Analyses (COEAs) and conducts materiel systems analyses for DOD and other services' agencies, AMC major subordinate commands, R&D Centers, Program Managers (PM) and Program Executive Officers (PEO). AMSAA also supports the Army Model Improvement Program (AMIP) in development of a hierarchy of models and data bases for use in Army studies and analysis. AMSAA has a major role in live fire test design, analysis and evaluation, and coordinates with other members of the Joint Technical Coordination Group for Munitions Effectiveness (JTCG/ME) and the AMIP to insure that there is no unnecessary duplication of efforts in either program. This program element also funds independent design of technical, developmental and production tests; and for subsequent independent evaluations in support of the Army Acquisition Executive (AAE) or other decision bodies. These evaluations contribute to the acquisition decision process for all major Army acquisitions. AMSAA makes an evaluation of all factors pertinent to the materiel acquisition decision process, including technical risks and trade-off analyses, development and operational test results, produceability, and logistics factors. AMSAA is the technical evaluator of development and production testing of systems under PEO Management. AMSAA has a lead role in the execution of the Army and joint live fire test missions.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D026 — Test Design and Evaluation: This project provides for developmental, production and product improvement test design and evaluation after the conduct of the testing. Such test design and evaluation are performed independent of the PEO/PM materiel development commands and the testing agencies. It is a project separate from the AMSAA institutional, fixed and recurring account, because of its significance and the desire for management visibility. It funds the salaries of civilian employees assigned to the test design and evaluation mission and associated contractor support and other in-house operations such as data processing and reports publication.

(U) FY 1989 Accomplishments:

- (U) Independent evaluations of technical tests were provided to the Army Acquisition Executive (AAE) or appropriate Army decision makers for: Howitzer Improvement Program (HIP), Forward Area Air Defense System (FAADS) Non-Line of Sight (NLOS), Advanced Anti-Tank Weapon System-Medium (AAWS-M), Positioning Locating Reporting System/Joint Tactical Information Distribution System (PLRS/JTIDS) HYBRID, Joint Anti-Tactical Missiles (JATM) (PATRIOT), VAMPIRE
- (U) Test planning/designs were developed for technical tests planned for FY 1990-91

Program Element: **#0605706A**

PE Title: **Materiel Systems Analysis** Budget Activity: **#6**

(U) FY 1990 Planned Program:

- (U) Evaluation in support of AAE decisions for: Advanced Anti-Tank Weapon System-Heavy (AAWS-H), FAADS Line-of-Sight-Forward-Heavy, AAWS-M, Joint Surveillance and Target Attack Radar System (JSTARS), Advanced Combat Rifle, HIP, and Remotely Piloted Vehicles Forward Looking Infrared (RPV FLIR)
- (U) Test and evaluation planning will support evaluations projected in FY 1991

(U) FY 1991 Planned Program:

- (U) Evaluation in support of AAE decisions for: Advanced Field Artillery Tactical Data System (AFATDS), PLRS-JTIDS HYBRID, JTIDS, and M-119 Extended Range Light Weight Howitzer (105 mm)
- (U) Test and evaluation planning efforts will support evaluations projected for FY 1992 and beyond

(U) Project M541 — Materiel Systems Analysis: This project funds AMSAA's primary mission of independent systems analysis and effectiveness evaluations for major materiel systems. AMSAA evaluates existing or proposed material systems to develop estimates of their performance which are incorporated into major studies and analyses conducted by Department of the Army (DA), AMC, and Training and Doctrine Command (TRADOC) study activities. AMSAA conducts materiel systems analyses in support of PEOs, PMs, and R&D Centers to provide a basis for technical requirements in developing acquisition strategies, concept definitions, Required Operational Capabilities (ROC), and Request for Proposals (RFP). This project also includes the efforts to develop analytical methodologies to characterize the performance of new technologies associated with smart munitions, sensors, and command & control systems. AMSAA is the AMC lead activity for systems analysis; Reliability, Availability and Maintainability (RAM) Methodology; Battlefield Systems Integration; and the Army Model Improvement Program.

(U) FY 1989 Accomplishments:

- (U) Continued to support Army studies with Red and Blue system performance estimates to include the following studies: FAADS Mix Analysis, Wide Area Mines Study, IAAWS Phase II, SMART Weapons Study, Counter Target Acquisition Study (CTAS), Intelligence/Electronic Warfare (IEW) Mission Area Analysis, Directed Energy Warfare Utility Analysis, and the Light Hellicopter Experimental (LHX) COEA Follow-on.
- (U) Supported recurring Army Theater Level Studies including performance estimates for: OMNIBUS FY91, AFPDA, Measuring Improved Capabilities of Armed Forces (MICAF)/Measuring Relative Capability of Armed Forces (MERCAF) FY 1989, and MRFS FY 1989.
- (U) Continued to provide materiel analyses in support of PMs/PEOs/R&D centers including: LHX Mission Profiles, HELLFIRE Lethality Improvements, Armor/Anti-Armor Technology Programs, Air-to-Air Combat Analysis Modeling, Deep Fires Effectiveness Analyses, and Electrical-Optical (EO) Detection System Methodology.

(U) FY 1990 Planned Program:

- (U) Continue to support Army studies with Red and Blue system performance estimates to include TRADOC cost and Operational Effectiveness Analyses and Force Structure Studies including: Line of Sight Anti-Tank (LOSAT), LHX, Deep Fires, M1A2, Heavy Force Modernization, Enhanced Position Location Reporting System (EPLRS), NLOS, Combined Arms, STINGRAY, Sense and Destroy Armor Projectile (SADARM), DAZER, Multiple Launch Rocket System-Terminally Guided Warhead (MLRS-TGW), Global Positioning System (GPS), Unmanned Aerial Vehicle (UAV), Follow-on to Lance (FOTL), Airborne Adverse Weather Weapon System (AAWWS), Palletized Loading System (PLS)-TWV, Family of Tactical Vehicles-TWV, Block III Tank, Block III Infantry Fighting Vehicle (IFV).
- (U) Continue to provide materiel analyses in support of PMs/PEOs/R&D Centers

Program Element: **#0605706A**

PE Title: **Materiel Systems Analysis** Budget Activity: **#6**

- **(U)** Continue to support recurring Army Theater Level Studies including performance estimates for: TAA #1 (Base Case), OMNIBUS FY 1991 (Excursions), MICAF FY 1990, and Joint Program Assessment Memorandum (JPAM).

(U) FY 1991 Planned Program:

- **(U)** Continue to support Army studies with Red and Blue systems performance estimates to include TRADOC Cost and Operational Effectiveness Analyses and Force Structure Studies at FY 1990 level.
- **(U)** Continue to support recurring Army Theater Level Studies to include performance estimates for: TAA #2 (FIA & DA), OMNIBUS FY 1993, AFPDA, MICAF FY 1991 and MRFS FY 1991.

(U) Work Performed By: In-house work is performed by U.S. Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD. Contractors include Ketron, Inc., Wayne, PA; Armament Systems, Inc., Anaheim, CA; and CAS, Inc., Huntsville, AL.

(U) Related Activities:

- **(U)** AMSAA is the executive agent for the Joint Technical Coordination Group for Munitions Effectiveness (JTCG/ME), which has the responsibility for managing the technical and fiscal aspects of the JTCG/ME program
- **(U)** Program Element #0605805A (Munitions Standardization, Effectiveness and Safety)

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605709A (TIARA)**
PE Title: **Exploitation of Foreign Items** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D650 Exploitation of Foreign Items	4263	4155	4289	Cont	Cont
DC28 Acquisition/Exploitation of Threat Items	- 0 -	12743	18385	Cont	Cont
PE TOTAL	4263	16898	22674		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is a continuing program to acquire and evaluate foreign material. The purpose of this program is to support the force and materiel developers, scientific and technical intelligence needs, operations and training. Program objective is to support the development of U.S. systems by examining foreign materiel to identify and analyze innovations and technology, to develop countermeasures, and to support operational commanders with items for training the force. Primary objectives are to conserve funds, to save research and development manhours, to enhance and improve U.S. designs by providing information and intelligence on systems that contain advanced technology which represent a threat to U.S. systems, and to train U.S. forces. This enables the Army to profit from advances in foreign technology, develop countermeasures and train in opposing forces tactics and weapons systems.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D650 — Exploitation of Foreign Items: Acquisition and exploitation of leading-edge technology, generally from North Atlantic Treaty Organization (NATO) or cooperative countries, in order to prevent technological surprise and shorten the research and development (R&D) cycle, thereby saving time and funds.

(U) FY 1989 Accomplishments:

- **(U)** During FY89 HQ Army Materiel Command funded 69 of 104 potential acquisition and exploitation projects. The value and impact of these acquisitions will be better known in FY90 as exploitation is completed

(U) FY 1990 Planned Program:

- **(U)** Finish exploitation of items acquired in FY 1989
- **(U)** A total of 68 projects have been received in FY90 with a total acquisition and exploitation value of approximately $16 million. After review and two prioritization panels, 39 projects have been funded for acquisition. As FY90 progresses, another 10-15 projects will receive funding

(U) FY 1991 Planned Program:

- **(U)** Complete exploitation of items acquired in FY 1990
- **(U)** Acquire and initiate exploitation of additional foreign technologies and items identified during FY 1991

Program Element: **#0605709A (TIARA)**

PE Title: **Exploitation of Foreign Items** Budget Activity: **#6**

(U) Project DC28 — Acquisition/Exploitation of Threat Items: Acquisition and exploitation of foreign equipment from threat or non-cooperative countries to gain technology, determine threats to US systems and to support training and operational requirements. Priorities are determined by the Army's five year plan approved by the Army leadership.

(U) FY 1990 Planned Program:

- **(U)** Acquire and initiate exploitation of threat systems identified in the Army Foreign Materiel Program (FMP) Five Year Plan

(U) FY 1991 Planned Program:

- **(U)** Acquire and initiate exploitation of threat systems identified in the FMP Five Year Plan
- **(U)** Continue exploitation of threat systems acquired in FY 1990

(U) Work Performed By: The Army Deputy Chief of Staff for Intelligence has overall management responsibility. The Commander, Army Intelligence Agency is responsible for executing the exploitation program with coordination and support from Army Materiel Command. Other Government activities are tasked in a support role depending upon exploitation and evaluation needs. Where the Army acts as the Executive Agent, the Army is responsible for implementing the exploitation and evaluation to ensure that the objectives and requirements of all Services and agencies are satisfied.

(U) Related Activities: Exploitation and evaluation is coordinated with the Defense Intelligence Agency, other Services, and other interested agencies. Program Element #0301359A, Project 381, under the direction of Director of Central Intelligence, is used for acquisition and exploitation of items of lesser costs and of national intelligence value. Cost relationship is maintained with other government agencies to avoid duplication of effort in the Army and DOD.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605710A**

PE Title: **Joint Chemical/Biological Point of Contact, Test and Assessment** Budget Activity: **#4**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D049 Joint Chemical-Biological Contact Point and Test	2025	2559	2726	Cont	Cont
D204 Field Smoke Assessment	3444	3380	3602	Cont	Cont
PE TOTAL	5469	5939	6328		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program supports the direct costs of US Army Dugway Proving Ground, Utah to conduct chemical-biological (CB) tests used in developing operational procedures and doctrine, to employ currently fielded equipment in a CB environment, to maintain the repository of CB information (CB technical data source books), and to respond to unified and specified commands and all services for CB information. The program also supports the conduct of field tests to observe and measure effects on performance of battlefield obscurants on electro-optical/smart weapon systems. Data gathered by such tests is analyzed, catalogued, and disseminated in support of continued development on these systems.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991:

(U) Project D049 — Joint CB Contact Point and Test: Conducts CB tests and maintains repository of CB information for multiple users.

(U) FY 1989 Accomplishments:

- **(U)** Completed four field tests: effects of water temperatures and soap; Mission Oriented Protective Posture (MOPP) exchange procedures; collective protection procedures; overpressure on helicopter operations
- **(U)** Completed five laboratory tests: decontaminants on aircraft; decontaminants on vehicle materials; chemical agents on aircraft and vehicle materials; penetration of food packaging; filter durability
- **(U)** Completed eleven technical analyses and pre-test studies; including avoidance; threat concept; threat assessment; assembly area; leaking munitions; submicron particles; vehicle purge; field laundering; aircraft summary.
- **(U)** Produced one CB Technical Data Source Book: summary of tests

(U) FY 1990 Planned Program:

- **(U)** Continue to conduct required field/lab tests and technical studies.

(U) FY 1991 Planned Program:

- **(U)** Continue to conduct required field/lab tests and technical studies.

(U) Project D204 — Field Smoke Assessment: Conducts field tests to observe and measure the effects of battlefield obscurants on electro-optical/smart weapon systems.

(U) FY 1989 Accomplishments:

- **(U)** Conducted Smoke Week 11, Feb 89, Canada and Smoke Symposium 13, Apr 89, Laurel, MD
- **(U)** Initiated work on 3rd generation obscuration producing capability

Program Element: #0605710A

PE Title: **Joint Chemical/Biological Point of Contact, Test and Assessment** Budget Activity: #4

(U) FY 1990 Planned Program:

- **(U)** Support major weapon systems evaluations
- **(U)** Conduct Smoke Week 12 and Smoke Symposium 14

(U) FY 1991 Planned Program:

- **(U)** Field test of third generation obscuration producing capability
- **(U)** Support major weapon systems evaluations
- **(U)** Conduct Smoke Week 13 and Smoke Symposium 15

(U) Work Performed By: In-house efforts will be accomplished by U.S. Army Chemical Research Development and Engineering Center, Aberdeen Proving Ground, MD; U.S. Army Atmospheric Sciences Laboratory, White Sands Missile Range, NM; U.S. Army Dugway Proving Ground, UT; and Naval Weapon Support Center, Crane, IN. Major contractor is Science and Technology Corporation, Hampton VA.

(U) Related Activities: Not applicable.

(U) Other Appropriation Funds: ($ in Thousands) Not applicable.

(U) International Cooperative Agreements: Not applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605712A**
PE Title: **Support of Operational Testing** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D001	OTEA IOTE	15165	25031	28014	Cont	Cont
D985	Concepts Evaluation of Materiel	1697	2493	2380	Cont	Cont
DV02	Test Boards	27911	26148	19568	Cont	Cont
DV03	TRADOC IOTE	5695	9541	13316	Cont	Cont
PE TOTAL		50468	63213	63278		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program finances the direct costs of planning and conducting Early User Test and Evaluation (EUTE), Initial Operational Test and Evaluation (IOTE), and Operational Assessments (OA) on major and nonmajor materiel systems. It also provides funds to conduct military potential testing of developmental materiel and provides for the fixed and recurring costs of operating eight test boards.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D001 — Operational Test and Evaluation Agency (OTEA) IOTE: This project finances the direct cost of planning and conducting Early User (EU), and Initial Operational Test and Evaluation (IOTE) on major and selected nonmajor materiel systems. It funds only costs directly attributable to conduct of the tests, including: data collection and reduction services; training and temporary duty of test personnel; temporary civilian labor costs, human factors support; communications support; acquisition, installation and operating costs of special equipment and/or instrumentation support equipment; costs of modifying end item or support equipment and costs of subsequent refurbishment; and costs of transporting test items. IOTE of operational effectiveness of developmental materiel is conducted under conditions as close as possible to those encountered in actual field or combat environments with troops trained to employ the materiel. Its purpose is to develop data to assist in making production decisions. OTEA actively participates in the conduct of tests and provides an independent evaluation of effectiveness and suitability of the system. The increase in FY 1990 and FY 1991 funds is needed to cover required level of operational testing. Failure to fund these tests will result in system delays, decision/milestone review delays and increased test costs.

(U) FY 1989 Accomplishments:

- **(U)** Tests completed in the following systems:
  - 155mm Howitzer Improvement Program (HIP) IOTE
  - NAVSTAR Global Positioning System OA and IOTE
  - Pedestal Mounted Stinger (PMS) IOTE
  - Forward Area Air Defense Non-Line-of-Sight Initial System (FAAD-NLOS SYS) EUTE
  - Forward Area Air Defense Line-of-Sight-Forward-Heavy (FAAD-LOS-F-H) IOTE
  - Army Tactical Missile System Missile System (ATACMS) IOTE
  - Single Channel Ground and Airborne Radio System Integrated COMSEC GND ICOM IOTE

Program Element: **#0605712A**
PE Title: **Support of Operational Testing** Budget Activity: **#6**

(U) FY 1990 Planned Program:

- **(U)** Tests are planned in the following systems:
  - FAAD NLOS EUTE
  - FAAD LOS-F-H IOTE
  - NAVSTAR GPS IOTE
  - ATACMS IOTE
  - Single Channel Objective Tactical Terminal (SCOTT), AN/TCS-124 IOTE
  - C-17 IOTE
- **(U)** Pre-test Preparation:
  - FAAD C2I — Ground Sensor IOTE
  - Advance Anti-Armor Weapons System-Heavy (AAWS-H) EUTE
  - SINCGARS ICOM IOTE
  - Army Field Artillery Tactical Data Systems (AFATDS) BLK I IOTE
  - Joint Surveillance and Targets Attack Radar System (JSTARS) IOTE
  - Joint Tactical Data Distribution System Class 2 IOTE
  - 155mm Sense and Destroy Armor (SADARM) IOTE
  - All Source Analysis System/Enemy Situation Correlation Element (ASAS/ENSCE) IOTE
  - Multiple Launch Rocket System — Terminal Guidance Warhead (MLRS TGW) IOTE

(U) FY 1991 Planned Program:

- **(U)** Tests are planned in the following systems:
  - Joint Tactical Data Distribution (JTIDS CL2M) IOTE
  - Advanced Anti-Armor Weapons System-Heavy (AAWS-H) OA
  - C-17 Aircraft IOTE
  - FAAD C2I GS EUTE
  - Joint Tactical Data Distribution System (CLS3M) (JTIDS CL3M) IOTE continuation
  - All Source Analysis System/Enemy Situation Correlation Element (ASAS/ENCE) IOTE
  - Joint Surveillance and Target Attack Radar System (JSTARS) IOTE
  - Single Channel Ground and Airborne Radio System Integrated COMSEC (SINCGARS ICOM/ABN) IOTE
  - 155mm Sense and Destroy Armor (SADARM) IOTE
  - Advanced Anti-Armor Weapons System-Medium (AAWS-M) IOTE
- **(U)** Pre-test Preparation:
  - Continue MLRS TGW IOTE
  - Continue AFATDS BLK 1 IOTE
  - FAAD C2I Aerial Sensor IOTE

(U) Project D985 — Concepts Evaluation of Materiel: This project provides limited funds for buying or leasing of commercially available equipment, other services and foreign items to permit conduct of innovative tests of limited scope and duration. This provides insights into the feasibility of a materiel concept or system for which a potential requirement can be clarified or initiated. Items selected for such testing have high potential for increasing combat effectiveness and have military potential for readily solving materiel requirement deficiency. These are quick reaction tests that also support the Army combat developer in validating up front, early system training, tactics, and organizational concepts.

Program Element: **#0605712A**
PE Title: **Support of Operational Testing** Budget Activity: **#6**

(U) FY 1989 Accomplishments:

- (U) Tests completed:
  - Infantry Self-Defense system, DAZER
  - Ballistic Eye Protection
  - Airpowered Tool Sets
  - Maneuver Battalion (BN) Scout Platoon Concept Evaluation Plan (CEP)
  - Escort Jammer Phase I
  - Maneuver Control System (MCS) ANBACIS
  - Nuclear, Biological and Chemical (NBC) Reconnaissance Squadron Operations

(U) FY 1990 Planned Program:

- (U) Tests are planned for the following systems:
  - STINGRAY
  - Escort Jammer Phase II
  - EForce Advanced Combat Rifle

(U) FY 1991 Planned Program:

- (U) Tests are planned for the following systems:
  - Smoke Dissipating System
  - P2 Decon Squad
  - P2 FASV/M109
  - Directed Energy Weapon (DEW) Variant

(U) Project DV02 — Test Boards: This project finances the fixed and recurring costs (civilian salaries, equipment, supplies, etc.) of eight subordinate elements of the Training and Doctrine Command (TRADOC) Test and Experimentation Command: Health Services Command Medical Department Activity Board, Ft Sam Houston, TX; Armor and Engineer Board, Ft Knox, KY; Air Defense Board, Ft Bliss, TX; Infantry Board, Ft Benning, GA; Field Artillery Board, Ft Sill, OK; Aviation Board, Ft Rucker, AL; Intelligence and Security Board, Ft Huachuca, AZ; Communications/Electronics Board, Ft Gordon, GA; and Airborne Special Operations Board, Ft Bragg, NC. Their primary mission is to conduct operational testing of developmental materiel and joint tests. Direct test costs are funded by Projects DV03 and D985.

(U) FY 1989 Accomplishments:

- (U) Efficiencies in test planning/execution and maximizing of test assets/resources were realized since the test boards were assigned to TEXCOM. The reorganization enhanced overall Army IOTE's and provided improved capabilities for assessing TRADOC products (tactics, doctrine, and organizational concepts) prior to Service or DOD Milestone acquisition decisions for new materiel/weapon systems. Management continued to maximize cost savings to ensure higher quality testing. Significant tests conducted and/or continued were:
  - Pedestal Mounted Stinger (AVENGER)
  - Howitzer Improvement Program
  - NAVSTAR GPS
  - ATACMS
  - Palletized Load System
  - Single Channel Ground and Airborne Radio System
  - SCOTT
  - Forward Area Air Defense Line-of-Sight-Forward-Heavy
  - M1A1 Improved Commander Weapon Station

Program Element: #0605712A
PE Title: **Support of Operational Testing** Budget Activity: #6

- Light Assault Bridge
- Air-Ground Engagement System
- Battalion Mortar System — 120 mm (towed)
- Field Feeding in Cold Environment

(U) FY 1990 Planned Program:

- (U) Significant tests planned to be conducted or continued include:
  - Regency Net
  - Interim Ground Station Module
  - Enhanced Position Location Reporting System
  - Simulation of Area Weapons Effects-Radio Frequency
  - Air Delivery of MLRS Rocket MOD
  - Army Tactical Missile System
  - XM21 Remote Sensing Chemical Agent Alarm
  - Tactical Explosive System, Phase II
  - Aircrew Member Protective Mask
  - Soviet Artillery Effects IIB

(U) FY 1991 Planned Program:

- (U) Significant tests planned include:
  - JTIDS
  - All Source Analysis System/Enemy Situation Correlation Element
  - AAWS-M
  - AAWS-H
  - C-17A Aircraft
  - FAAD C2I GS
  - Corps/Battle Simulation
  - Joint STARS
  - M916A1 Truck Tractor, Light Equip Transporter
  - Countermobility Remote Control System

(U) Project DV03 — TRADOC IOTE: This project finances direct costs of conducting Early User Test & Evaluation (EUTE), and Initial Operational Test and Evaluation (IOTE) on materiel systems to determine the operational effectiveness and suitability of developmental materiel under conditions as close as possible to those encountered in actual field use with typical troops trained to employ the materiel. The increase in FY 1990 and FY 1991 will fund the functional requirements to determine the physiological and psychological effects of the nuclear, biological and chemical environment and sustained operations on systems in combat (P2 NBC2). P2 NBC2 is a series of tests in support of Program Manager (PM) development of major systems; and doctrine development objective of quantifying operational degradation due to individual and crew operations in an NBC environment; and to identify short and long term remedial actions.

(U) FY 1989 Accomplishments:

- (U) Significant tests completed:
  - Trailblazer
  - Air-Ground Engagement System
  - Regency Net Preparation
  - Field Feeding in a Cold Environment

Program Element: #0605712A
PE Title: **Support of Operational Testing** Budget Activity: #6

- NBCRS
- FATDS tape version 9
- Family of Physical Deception Devices
- 5 ton wrecker

(U) FY 1990 Planned Program:

- **(U)** Significant tests planned include:
  - Air Delivered Expendable Jammer
  - Simplified collective protective equipment
  - Family of medium tactical vehicles
  - Palletized load system
  - Heavy equipment transporter
  - Corps theater automation data processing service center — II
  - Vehicle Magnetic Signature Duplicator
  - Mini Eyesafe Laser Infrared Observation Set
  - Regency Net

(U) FY 1991 Planned Program:

- **(U)** Significant tests planned include:
  - Corps Battle Simulation System
  - Unit Maintenance Aerial Recovery Kit
  - Improved Ribbon Bridge
  - Unmanned Aerial Vehicle — Short Range
  - M1 Block II
  - Corps Battle Simulation
  - Sky Dancer
  - High Frequency Intercept & DF System

(U) Work Performed By: IOTE is primarily conducted at Army installations under the management and supervision of the proponent TRADOC test activities or OTEA and is assisted by available local troop support. TRADOC's Combined Arms Test Center (TCATC), TEXCOM Experimentation Center (TEC) and the Test Boards are staffed by both military and civilian personnel. Contractors performing supporting work for this effort include: PRC System Services Co., McLean, VA; Advanced Technology, Reston, VA; Martin-Marietta Data Systems, Greenbelt, MD; BDM, Incorporated, McLean, VA; UTAH Position Corp, Alamogordo, NM; EC Corp, Oakridge, TN; ULTRA Defense and Space Systems, Inc., Sierra Vista, AZ; Bell Technical Operations, Inc., Sierra Vista, AZ; Management Assistance Corp. of America, El Paso, TX; and OAO, Inc. (Via GSA Office), Dallas, TX.

(U) Related Activities: The Army Staff monitors all tests for materiel development and activities to avoid duplication of effort. The Deputy Under Secretary of Defense (Test and Evaluation), and Director of Operational Test and Evaluation, Office of the Secretary of Defense (OSD), also review planned testing and development of support equipment to ensure integration of testing by the Services and to avoid duplicative testing. High-level staff management of resources for user testing is provided by the U.S. Army Test Schedule and Review Committee which is chaired by the U.S. Army Operational Test and Evaluation Agency (OTEA).

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605801A**
PE Title: **Programwide Activities** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
M881 RDTE Command/Center/General Admin Support					
	83560	84175	93249	Cont	Cont
PE TOTAL	83560	84175	93249		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program funds the management and administrative functions at thirteen Army Research, Development, Test, and Evaluation (RDTE) commands, centers and activities. This program accomplishes overall assigned research and development missions not directly related to specific research and development projects. Requested resources finance salaries and related costs for civilian personnel assigned to other than Army Management Headquarters Activities (AMHA). This program is central to efficient management of the total Army RDT&E program and provides essential support not otherwise available to Program Executive Officers and project managers. Increase starting in FY 1991 primarily funds the civilian pay raise and newly established Standardization Group-Japan.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project M881 — RDTE Command/Center/General Administrative Support

(U) FY 1989 Accomplishments:

- **(U)** Provided for continued operation of management and administrative functions at a level consistent with mission requirements and support needs at Army non-AMHA RDT&E commands, centers and activities
- **(U)** Provided continued operation of the four Standardization Groups and representative in France
- **(U)** Funded travel of Army Science Board

(U) FY 1990 Planned Program:

- **(U)** Provide for continued operation of management and administrative functions at a level consistent with mission requirements and support needs at Army non-AMHA RDT&E commands, centers and activities
- **(U)** Provide continued operation of the four Standardization Groups and representative in France
- **(U)** Funds establishment of new Standardization Group in Japan
- **(U)** Funds travel of Army Science Board

(U) FY 1991 Planned Program:

- **(U)** Provide for continued operation of management and administrative functions at a level consistent with mission requirements and support needs at Army non-AMHA RDT&E commands, centers and activities
- **(U)** Provide continued operation of the five Standardization Groups and AMC Representative in France
- **(U)** Funds travel of Army Science Board

Program Element: **#0605801A**

PE Title: **Programwide Activities** Budget Activity: **#6**

(U) Work Performed By: Subordinate Commands and other activities of the US Army Materiel Command, the US Army Medical R&D Command, and the US Army Research Institute.

(U) Related Activities: Research and Development Commands/Centers perform staff management functions related to work performed by RDTE laboratories and test facilities. There is no unnecessary duplication of effort within the Army or the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Five Standardization Groups and AMC Representative in France are listed as participating establishments/authorities on all bilateral Data Exchange Annexes pertaining to their assigned countries. An integral part of their responsibilities is the monitoring of these programs and the roll of fostering an environment in which international cooperative agreements can be established.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605802A**

PE Title: **International Cooperative Research and Development** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
M798 International Cooperative Research and Development — Army Research Institute					
	1065	1724	1905	Cont	Cont
PE TOTAL	1065	1724	1905		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The goal of this program is to expand worldwide allied standardization and interoperability through cooperative R&D projects and technology sharing. This program funds the travel costs and administrative support required to participate in international fora, such as the NATO Army Armaments Group (NAAG), and to pursue international cooperative agreements such as Memoranda of Understanding. This program also includes the United States' share of the costs of the NATO Industrial Advisory Group (NIAG); the Four Power Senior National Representatives (SNR); the American, British, Canadian, Australian (ABCA) Standardization Program; the Technical Cooperation Program; Bilateral Staff Talks; and Army Armaments Working Groups with many nations.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project M798 — International Cooperative R&D — Army Research Institute:

(U) FY 1989 Accomplishments:

- **(U)** Continued domestic and international travel linked to scientific and technological exchanges that have military application and mutual benefit for the United States and its allies
- **(U)** Continued to fund a portion of the United States' share of the NIAG budget
- **(U)** Continued program supporting regular attendance at meetings of eleven NATO panels; nineteen ABCA Working Groups; annual meetings of SNR, staff talks and numerous subpanels and working group meetings
- **(U)** Continued funding travel to support cooperative R&D initiatives

(U) FY 1990 Planned Program:

- **(U)** Increase funds the entire United States' share ($900 K) of the NIAG budget
- **(U)** Continue domestic and international travel linked to scientific and technological exchanges that have military application and mutual benefit for the United States and its allies
- **(U)** Continue program supporting regular attendance at meetings of eleven NATO panels; nineteen ABCA Working Groups; annual meetings of SNR, staff talks and numerous subpanels and working group meetings
- **(U)** Continue funding travel to support cooperative R&D initiatives

(U) FY 1991 Planned Program:

- **(U)** Continue domestic and international travel linked to scientific and technological exchanges that have military application and mutual benefit for the United States and its allies
- **(U)** Continue funding of the entire United States' share of the NIAG budget
- **(U)** Continue program supporting regular attendance at meetings of eleven NATO panels; nineteen ABCA Working Groups; annual meetings of SNR, staff talks and numerous subpanels and working group meetings
- **(U)** Continue funding travel to support the cooperative R&D initiatives

Program Element: **#0605802A**

PE Title: **International Cooperative Research and Development** Budget Activity: **#6**

(U) Work Performed By: US Army Research Institute, US Army Materiel Command, and the US Army Training and Doctrine Command are principally involved.

(U) Related Activities: Attendance at meetings of these international fora further cooperative research and development efforts. These discussions lead to programs supported by the Nunn Amendment. Meetings also lead to Memoranda of Understanding and Data Exchange Agreements with NATO, Korea, Japan and the mid-East to improve combat and logistical effectiveness of the Army during wartime. The project defrays, on behalf of all services, the US support for the NATO Industrial Advisory Group to produce prefeasibility studies in support of NATO Cooperative materiel development projects.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: See Paragraph B.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605803A**

PE Title: **Technical Information Activities** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DC16 Field Assistance in Science and Technology (FAST)	- 0 -	1035	1230	Cont	Cont
DC18 Board on Army Science Technology (BAST)	- 0 -	148	153		
M720 Technical Information Functional Activities	1330	1082	1090	Cont	Cont
M727 Technical Information Activities	2125	1387	2853	Cont	Cont
M728 Information Technology	244	152	159	Cont	Cont
M729 Youth Science Activities	1743	1902	2014	Cont	Cont
M731 Government/Industry Data Exchange Program/Advisory Group on Electronic Devices GIDEP/AGED	314	152	159	Cont	Cont
PE TOTAL	5756	5858	7658	Cont	Cont

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides for upgrading the accuracy, timeliness, availability, and accessibility of scientific, technical, and management information at all levels of Army research and development (R&D). This includes initiatives to improve information derivation, storage, access, display, validation, transmission, distribution, and interpretation. This program provides Army information to all Defense Technical Information Center (DTIC) data banks.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project DC16 — Field Assistance in Science and Technology (FAST): Composed of scientist/engineer teams recruited from Army Materiel Command (AMC) Laboratories/Centers serving major Army and Corps commanders; supported by rapid response Points of Contact at each AMC Laboratory/Center; and managed by a program director reporting to Commanding General, AMC. This network focuses AMC resources to repeatedly identify and solve field Army technical problems through technology demonstrators. This type of effort was previously funded from other RDTE,A resources. It became imperative to integrate resources and institutionalize the program to accord it stability and productivity.

(U) FY 1989 Accomplishments:

- **(U)** Developed a gun tube exerciser which permits the required exercise of Prepositioned Material Configured to Unit Sets (POMCUS) stored guns with a work expenditure estimated to be one-tenth of that required without the exerciser
- **(U)** Introduced a remote weather sensing device in Japan which provides crucial, mission-essential meteorological data to the 78th Aviation Battalion
- **(U)** Demonstrated a lithium battery tester which has the potential to save millions of dollars in battery expenditures
- **(U)** Developed range marking lights which decrease dangers in live fire exercises at major training centers

Program Element: #0605803A
PE Title: **Technical Information Activities** Budget Activity: #6

(U) FY 1990 Planned Program:

- (U) Continue to respond to Commander-in-Chief (CINC)/Major Army Commander technical quick reaction needs
- (U) Identify areas where technology can rapidly enhance operational readiness
- (U) Conduct technology demonstrations in the field

(U) FY 1991 Planned Program:

- (U) Provide research and development support for CINC/Major Army commanders
- (U) Identify research and development needs in CINC/Major Army Command area
- (U) Provide technical support to technology demonstrations

(U) Project DC18 — Board on Army Science Technology (BAST): Standing panel of the National Academy of Sciences, initially convened at the request of the Under Secretary of Army, and currently serves as the Technical/Management Advisory Panel for the Assistant Secretary of the Army, Research, Development and Acquisition. Funding is required for yearly maintenance costs and to conduct studies. This type of effort was previously funded from other RDTE,A resources. It became imperative to integrate resources and institutionalize the program to accord it stability and productivity.

(U) FY 1989 Accomplishments:

- (U) Provided support for forecast of Army science and technology needs and opportunities over next twenty years
- (U) Responded to immediate science and technology requirements

(U) FY 1990 Planned Program:

- (U) Provide expert technical and scientific advice to Army leadership
- (U) Publish monographs on the scientific areas evaluated
- (U) Provide special panel for annual In-House Laboratory Independent Research (ILIR) review

(U) FY 1991 Planned Program:

- (U) Expend technical and scientific advice to longer periods into the future with more generic emphasis.
- (U) Provide responsive scientific and technical advice in areas of Army interest
- (U) Provide special panel for annual In-House Laboratory Independent Research (ILIR) review.

(U) Project M720 — Technical Information Functional Activities. Technology transfer activities support acquisition, storage, and utilization of technical information for both military and domestic applications. Activities supported are (1) Army participation in the Defense Technical Informatic ı Center (DTIC) Work Unit Information Summary (WUIS) data base ($800 thousand per year), (2) Army support for the Federal Laboratory Consortium (FLC) ($140 thousand per year), and (3) Data collection and publication of the annual "Department of Defense In-House RDT&E Activities" report ($150 thousand per year). Technology transfer activities make technical information availabie to both the public and private sectors to reduce duplication in R&D programs and to increase competitiveness in the U.S. business community.

(U) FY 1989 Accomplishments:

- (U) Continued management and support of Army program of data input to DTIC WUIS data base

Program Element: **#0605803A**
PE Title: **Technical Information Activities** Budget Activity: **#6**

- **(U)** Completed pilot program on PC-based software. Initiated transition to PC-based system to input WUIS data for majority of Army installations. Provided training, training materials, and support for transition and utilization
- **(U)** Explored other WUIS data input alternatives
- **(U)** Continued annual data collection and publication of the "DOD In-House RDT&E Activities" report

(U) FY 1990 Planned Program:

- **(U)** Continue management and support of Army program of data input to DTIC WUIS data base
- **(U)** Continue transition to PC-based WUIS data input system for majority of Army installations. Provide training, training materials, and support for transition and utilization
- **(U)** Continue to explore other WUIS data input alternatives
- **(U)** Provide Army funding support for FLC as required by Public Law 99-502
- **(U)** Continue annual data collection and publication of the "DOD In-House RDT&E Activities" report

(U) FY 1991 Planned Program:

- **(U)** Continue management and support of Army program of data input to DTIC WUIS data base. Provide training, training materials, and support for all Army organizations that input data to the DTIC WUIS data base authorized by the Army Executive Agent
- **(U)** Provide Army funding support for FLC as required by Public Law 99-502
- **(U)** Continue annual data collection and publication of the "DOD In-House RDT&E Activities" report

(U) Project M727 — Technical Information Activities: This project supports automation for the management and execution of the Army Research and Development Appropriation. It includes the hardware, software and contractor support required to develop and implement a set of management decision aids for technical and budgetary decisions at the Army Materiel Command (AMC), Department of the Army and Office, Secretary of Defense levels.

(U) FY 1989 Accomplishments:

- **(U)** Continued the General Data Base Engineering Support Contract
  - Provided system administration on Sun Computer Technology Program Management Local Area Network (LAN)
  - Performed analyses and prepared recommendations for Government selection of prototype for PC LAN
  - Provided support in maintaining AMC technology data bases
  - Provided system administration for PC LAN
  - Provided technical advice/support for internetworking SUN/PCs/Laboratory Command (LABCOM) Network (LABNET)
  - Provided installation/maintenance of PC Network hardware and software
- **(U)** Initiated installation of a PC Network to tie all PCs together and provide access to HQ LABCOM Sun Computer LAN with on-line access to Defense Data Network (DDN)
- **(U)** Continued effort to support AMC software integration with the Army Intelligence Plan
- **(U)** Added additional memory to SUN Computer for increased efficiency
- **(U)** Designed, developed and operated database and management systems to obtain accurate information and data on worldwide scientific and technology developments to the U.S. Army technology base

Program Element: **#0605803A**
PE Title: **Technical Information Activities** Budget Activity: **#6**

(U) FY 1990 Planned Program:

- (U) Complete installation of a PC Network to tie all PC's together and provide access to HQ LABCOM Sun Computer LAN with on-line access to DDN
- (U) Continue the General Data Base Engineering Support Contract
- (U) Provide system administrator for SUN LABCOM Local Area Network
- (U) Provide analysis software support for the AMC Long Range Research Development and Acquisition Plan (LRRDAP)/Mission Area Integration Team (MAIT) process
- (U) Provide support in maintaining AMC technology data bases
- (U) Provide techonolgy analysis support to the AMC Acquisition Management System Review Committee (AMSRC)
- (U) Provide technical advice/support for internetworking of SUN/PCs/ LABNET
- (U) Continue working with LABNET group to tie HQ LABCOM computers into all LABCOM laboratories
- (U) Provide system administrator for the LABCOM PC Local Area Network
- (U) Continue studies, software development, hardware procurement and interface to other Army systems to maximize management decisions

(U) FY 1991 Planned Program:

- (U) Negotiate new General Data Base Engineering Support Contract
- (U) Provide hardware/software support to the AMC LRRDAP/MAIT process
- (U) Purchase additional peripheral equipment to upgrade SUN Computer LAN

(U) Project M728 — Information Technology. This project supports efforts in R&D to improve information access, display, interpretation, transmission, and storage. In FY 1989 this effort supplements the work in project M727 by enabling access to additional databases through a secure communications network

(U) FY 1989 Accomplishments:

- (U) Continued improvement by enabling access to additional databases through a secure communications network. Connected US Army Laboratory Command Technology Base computer to the Army Materiel Command Acquisition Information Management (AIM) Network

(U) FY 1990 Planned Program:

- (U) Modernize information access system to reflect current commercial technology in graphical interfaces
- (U) Improve graphical and input/output equipment to reflect latest commercial practice
- (U) Update software to reflect modern computing practices

(U) FY 1991 Planned Program:

- (U) Meet evolving unique requirements for RDTE management information systems at all Army levels
- (U) Increase security provisions to prevent unauthorized use and interference
- (U) Improve speed and breadth of access to reflect current computer practice

(U) Project M729 — Youth Science Activities. Youth Sciences supports science activities to encourage over 60,000 high school youths to develop interest and achieve higher levels in science, engineering, and mathematics. These activities are consolidated here to "present the Army" to a potential pool of technical talent to fill future Army needs. No other program fulfills this long-range Army goal.

Program Element: **#0605803A**

PE Title: **Technical Information Activities** Budget Activity: **#6**

(U) FY 1989 Accomplishments:

- **(U)** Continued to foster high school student interest in science, mathematics, engineering, and computers
- **(U)** Fostered joint Army/Navy Washington regional area Summer Apprenticeship Program

(U) FY 1990 Planned Program:

- **(U)** Continue to foster high school student interest in science, mathematics, engineering and computer science, nationally, through:
  - International Science and Engineering Fair
  - Junior Science and Humanities Symposiia
  - Research Engineering Apprenticeship Program
  - Computer Related Engineering Science Studies
  - International Mathematics Olympiad
- **(U)** The joint Army/Navy Washington regional area Summer Apprenticeship Program has been included into the overall effort. This provides an eight week hands-on learning experience for high school students working with bench level scientists within Army labs to learn what science is really about in hopes of encouraging more of them to enter scientific fields of study in the future. This program enhances the National Laboratory Science and Engineering Pool that in turn support Defense Industry and Laboratory needs

(U) FY 1991 Planned Program:

- **(U)** As in FY 1990, integration of US Army Training and Doctrine Command (TRADOC) and the US Army Recruiting Command in the more than 350 Science and Engineering Fairs with which the Army is involved annually
- **(U)** Increase participation of minorities in Army sponsored science and technology fairs, symposia, studies and competitions
- **(U)** Increase participation at Army laboratories/R&D Centers youth focused science and technology activities

(U) Project M731 — Government/Industry Data Exchange Program (GIDEP) and the Advisory Group on Electronic Devices (AGED). The Government/Industry Data Exchange Program (GIDEP) is a joint Government/industry effort for the exchange of existing data to enhance development, design, engineering logistics and cost of defense weapon systems equipment. Funds support GIDEP Reliability Maintainability and Failure Experience interchange data bases. Provides technical information required for Energy Design Handbooks; Hydraulic fluids, Helicopter Qualification Assurance, Safety Energy Application Missile and Rockets, Safety Energy Application for Aircraft. Vol I & II, Safety Energy Guide for Armament, and bonding adhesive information for research and design.

(U) FY 1989 Accomplishments:

- **(U)** Continued information exchange data for Non-Developmental Items (NDI) programs
- **(U)** Compiled technical information for engineering design handbooks

(U) FY 1990 Planned Program:

- **(U)** Continue information exchange data for NDI programs

(U) FY 1991 Planned Program:

- **(U)** Continue information exchange data for NDI programs

(U) Work Performed By: In-house effort accomplished by US Army Materiel Command, Alexandria, VA, US Army Laboratory Command, Adelphi, MD, and US Army Information Systems Command, Ft Huachuca, AZ. Contractors: Information Systems and Networks Corporation, Bethesda, MD;

Program Element: **#0605803A**

PE Title: **Technical Information Activities** Budget Activity: **#6**

Economic Engineering Research Corporation, Washington, DC.; Georgia Institute of Technology, Atlanta, GA and George Washington University, Washington, DC.

(U) Related Activities: The Army participates in the Defense Technical Information Center and Federal Information Managers Forums, and maintains liaison with the National Commission on Libraries and Information Services. Regular liaison with all Department of Defense and other Government technical information representatives is maintained to assure that no duplication of effort exists and that maximum transfer of information occurs. This program also cooperates with the National Library of Medicine Research Program in automatic storage and retrieval of technical information.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605805A**

PE Title: **Munitions Standardization, Effectiveness and Safety** Budget Activity: **#6**

A. (U) RESOURCES: *($ in Thousands)*

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D620 DOD Munitions Effectiveness	15544	6551	6704	Cont	Cont
DC38 CHICKEN LITTLE Follow-On	- 0 -	4908	5114	Cont	Cont
DF21 NATO Small Arms Evaluation	319	279	256	Cont	Cont
M857 Explosive Safety Standards	890	771	712	Cont	Cont
PE TOTAL	16753	12509	12786		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program supports a continuing technology base investigation. Provides a coordinated Tri-Service mechanism for the collection and free exchange of technical data on the performance and effectiveness of all non-nuclear munitions and weapon systems in a realistic operational environment.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D620 — DOD Munitions Effectiveness: Develops Joint Munitions Effectiveness Manuals per Joint Chiefs of Staff (JCS) direction which provide weapon/munitions effectiveness predictions for operational non-nuclear ordnance employed by the Services. Manages Joint Service efforts to improve the analytical methodology and data base used to determine the effectiveness of non-nuclear weapon systems. Promotes the establishment of standardized procedures for effectiveness parameters associated with munitions effectiveness. Conducts special studies to determine the effectiveness of non-nuclear munitions systems as directed by the Joint Logistics Commanders. Air-to-Surface, Surface-to-Surface, and Anti-Air weapons effectiveness, environmental effects, and target vulnerability for all types of munitions are developed. Collection, collation, storage and dissemination of combat data are part of the project. Conducts various other related ad-hoc tasks.

(U) FY 1989 Accomplishments:

- **(U)** Developed target description for Soviet FENCER and BLACKJACK aircraft
- **(U)** Developed effectiveness estimates for the Advanced Medium Range Anti-Air Missile (AMRAAM) and the Sidewinder missile improvements
- **(U)** Expanded scaled tests of modern bridges/buildings to validate computer models
- **(U)** Updated 16-inch/50 Navy gun and TOMAHAWK anti-ship missile manuals
- **(U)** Incorporated Joint Live Fire (JLF) test data for Soviet armor vehicles
- **(U)** Modeled and assessed the effectiveness of smoke/obscurant screening
- **(U)** Supported CHICKEN LITTLE data reduction and analyses and the development of smart munition performance models
- **(U)** Developed standardized warhead effectiveness data bases

Program Element: **#0605805A**

PE Title: **Munitions Standardization, Effectiveness and Safety** Budget Activity: **#6**

- (U) Developed improved models to predict modern combat vehicle vulnerability and survivability including Standard Damage Assessment Lists for Modern Tanks, Land and Amphibious Vehicles (LAV) and Self-Propelled Howitzer (SPHs)
- (U) Developed Interdiction Kill Vulnerability Models (to assess the effectiveness of deep attack smart weapons)
- (U) Developed standardized target descriptions and target vulnerability models
- (U) Gathered effectiveness data on modern top attack warheads against threat targets
- (U) Supported JLF assessment of M60A3 and Soviet light armored vehicles
- (U) Developed methodology to predict effectiveness of non-nuclear strategic capability
- (U) Developed models to predict weapon effectiveness

(U) FY 1990 Planned Program:

- (U) Perform Deep Attack Smart Munitions Performance Modeling/Methodology Upgrade
- (U) Perform vulnerability analysis of targets to Special Operations Forces weaponry
- (U) Support JLF databasing
- (U) Continue development of new vulnerability assessment methodology
- (U) Provide chemical delivery systems weaponeering
- (U) Update artillery and mortar Joint Munitions Effectiveness Manuals (JMEMs)
- (U) Support CHICKEN LITTLE data reduction and analysis
- (U) Develop submarine attack manual for the Navy
- (U) Model effects of smoke/obscurants on close air support
- (U) Develop effectiveness of Army and Marine helicopters vs. air and ground targets
- (U) Provide aircraft gunnery JMEMs for Air Force and Navy
- (U) Provide estimates for vulnerability of Soviet aircraft to air-to-air missiles
- (U) Provide target descriptions/vulnerability analyses of radars, air defense systems, bridges, buildings, power plants and armored vehicles

(U) FY 1991 Planned Program:

- (U) Continue development and initiate implementation of new vulnerability assessment methodology
- (U) Conduct vulnerability analysis of surface targets to a wide spectrum of munitions
- (U) Support CHICKEN LITTLE data reduction and analysis tasks
- (U) Add new target and weapon combinations to JMEMs
- (U) Gather empirical data on effectiveness of AGM-65 missile and MK-84 bombs

(U) Project DC38 — CHICKEN LITTLE Follow-On: Tri-Service Test and Evaluation Program for collection and evaluation of data for developmental smart munitions programs.

(U) FY 1989 Accomplishments: Not Applicable

(U) FY 1990 Planned Program:

- (U) Collect Target Signature Data from a variety of environments and store in an established data base
- (U) Measure countermeasure effects and assess vulnerabilities
- (U) Perform warhead lethality and vulnerability measurements
- (U) Measure seeker/sensor performance
- (U) Perform side by side comparison of competing technologies
- (U) Develop interdiction kill criteria

Program Element: **#0605805A**

PE Title: **Munitions Standardization, Effectiveness and Safety** Budget Activity: **#6**

- (U) Analyze system/subsystem development criteria

(U) FY 1991 Planned Program:

- (U) Continue collection of target signature and clutter data
- (U) Continue measurement and assessment of countermeasure effects and vulnerabilities
- (U) Continue measurements of warhead lethality and vulnerability
- (U) Perform tower and captive flight tests to measure seeker/sensor performance
- (U) Perform comparison of simultaneous Infra-Red (IR) Dual Mode seeker technologies
- (U) Continue development of interdiction kill criteria

(U) Project DF21 — North Atlantic Treaty Organization (NATO) Small Arms Evaluation: Assures complete interchangeability of small caliber and automatic cannon-caliber ammunition and weapons among all NATO countries with all of the associated logistic, strategic, and tactical advantages. It involves development, maintenance, and testing compliance of NATO Standardization Agreements (STANAGs) and staffing of the North American Regional Test Center (NARTC).

(U) FY 1989 Accomplishments:

- (U) Completed .50 caliber STANAG and manual of Proof and Inspection
- (U) Continued testing and certification of ammunition for NATO interoperability
- (U) Continued development and maintenance of Standardization Agreements (STANAG)
- (U) Continued operation of NARTC
- (U) Completed the NATO qualification tests for U.S. manufactured 25mm ammunition

(U) FY 1990 Planned Program:

- (U) Accomplish U.S. Ratification of .50 caliber STANAG
- (U) Initiate NATO Qualification Testing of .50 caliber ammunition
- (U) Complete NATO Qualification of 25mm ammunition
- (U) Control testing of 9mm, 5.56mm & 7.62mm ammunition

(U) FY 1991 Planned Program:

- (U) Complete NATO Qualification of .50 caliber ammunition
- (U) Control testing of 9mm, 5.56mm, 7.62mm & 25mm ammunition
- (U) Initiate and execute other standardization efforts as required

(U) Project M857 — Explosive Safety Standards: Supports explosives effects research and testing to quantify hazards and to develop techniques to mitigate these hazards in all DOD manufacturing, testing, maintenance, storage, and disposal of ammunition and explosives operations. Results are essential to the development and improvement of quantity-distance standards, hazard classification procedures, cost-effective explosion-resistant facility design procedures, and personnel hazard/protection criteria.

(U) FY 1989 Accomplishments:

- (U) Completed development/documentation for proposed tri-Service implementation of Hazard Class/Division 1.6 test protocol
- (U) Investigated effects of confinement on propellant (mass fire hazard)
- (U) Analyzed shallow (breeching) underground explosion test data
- (U) Developed automated data base for DOD Explosives Safety Seminar Proceedings

Program Element: **#0605805A**

PE Title: **Munitions Standardization, Effectiveness and Safety** Budget Activity: **#6**

(U) FY 1990 Planned Program:

- **(U)** Complete testing/analysis of Extremely Insensitive Detonating Substances (EIDS)
- **(U)** Develop prototype automated data base for DOD Explosives Safety Board accident data
- **(U)** Complete development of automated data base for DOD Explosives Safety Board minutes
- **(U)** Continue evaluation of effectiveness of barricades for reducing fragment/debris hazard
- **(U)** Conduct full-scale underground tunnel test
- **(U)** Develop/improve tri-Service approved design procedures for explosion resistant structures

(U) FY 1991 Planned Program:

- **(U)** Complete tri-Service implementation of FRAGHAZ computer program
- **(U)** Complete development of automated data base for DOD Explosives Safety Board accident files
- **(U)** Conduct full-scale underground tunnel tests
- **(U)** Develop/improve tri-Service approved design procedures for explosion-resistant structures

(U) Work Performed By: Work is accomplished by the following in-house organizations: U.S. Army Materiel Systems Analysis Activity, the Ballistic Research Laboratory, and the Chemical Research and Development Center at Aberdeen Proving Ground, MD; U.S. Army Missile Command, Redstone Arsenal, AL; U.S. Army Armament Research, Development and Engineering Center (ARDEC), Dover. NJ; Dugway Proving Grounds, UT; the Air Force Armament Laboratory, Wright-Patterson Air Force Base, OH; Oklahoma City Air Logistics Center, Tinker Air Force Base, OK; Naval Surface Weapons Center at White Oak, MD; and Dahlgren, VA; Pacific Missile Test Center, Pt. Mugu, CA; Naval Weapons Center, China Lake, CA; Navy Civil Engineering Laboratory, Port Hueneme, CA; and Army Large Caliber Weapons Systems Laboratory, Dover, NJ; Contractors are: Oklahoma State University at Eglin Air Force Base, FL and Stillwater, OK; Armament Systems, Inc., of Anaheim, CA; Denver Research Institute, Denver, CO; and Air Force Armament Division at Eglin AFB, FL.

(U) Related Activities: Projects under this program element are subjected to a close liaison and a free flow of information among the Services through regular meetings of the individual working groups which are composed of representatives from Service laboratories, Service schools, and tactical units. Unwarranted duplication is precluded by active participation in interagency working groups.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605810A**

PE Title: **RDT&E Support for Non-Developmental Items (NDI)** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D125 NDI Market Investigation	2495	1766	980	Cont	Cont
DB49 NDI Cargo Transportation Test	9769	- 0 -	- 0 -	- 0 -	- 0 -
DE65 NDI Testing	6259	5654	6596	Cont	Cont
PE TOTAL	18523	7420	7576		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Non-Developmental Items (NDI) program consists of two stages: 1) Market investigation which surveys the market place for items readily available and 2) Operational testing which involves the modification and testing of those items that satisfy or nearly satisfy all requirements but may require some minor modifications. The results of the program are submitted to a decision board for an in-process review to determine whether those modified items should go directly to procurement or whether a research and development (R&D) program should be established because the items do not meet the minimum requirements.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D125 — NDI Market Investigation: The market investigation portion is for the conduct of surveys and analyses of production items (commercial, other military or government) which are either to be a replacement item or to meet a new requirement. These tasks include a wide variety of applications including but not limited to: different sizes of engines, generators, trucks, air conditioners, materiels handling equipment, construction equipment, computers, micro processors, and watercraft to mention a few. Examples of tasks are identified below.

(U) FY 1989 Accomplishments:

- (U) Army Watercraft Program — Conducted a market investigation of the Coastal Harbor Inland service boat and Crane Barge. This market investigation resulted in the gathering of technical data for preparation of the specification and program management documentation leading to a type classification decision. Initiated technical evaluation of commercial marine hydraulic components. Initiated technical evaluation of Logistic Support Vessel alternate components
- (U) Improved Military Standard Air Conditioners — Finalized motor controller specification control drawing. Finalized air conditioner specification. Developed contracting strategy
- (U) Desert Mobility Vehicle System (DMVS) — Conducted a market investigation of commercial vehicles that will meet requirements of the Operational and Organizational (O&O) plan and will result in documentation to be used in procurement decisions. These vehicles will provide the means for strike and intelligence operations in a desert or arid environment

(U) FY 1990 Planned Program:

- (U) Commercial Equipment for Materiels Handling — Conduct market investigations on the 4K Pneumatic Tired Electric Fork Lift Truck; Compatibility of Palletized Load System with Army containers; and other materiel handling equipment procurements that may be under $2 million. The objective of these market investigations is to ensure acquisition of most

Program Element: #0605810A
PE Title: **RDT&E Support for Non-Developmental Items (NDI)** Budget Activity: #6

recently developed commercial material handling equipments that meet the Army's requirements

- (U) Commercial Air Cushion Vehicle Componentry — Conduct market investigations of Air Cushion Vehicles (ACV) control systems, lightweight engines, transmissions and propellers. Perform an analysis of commercial ACV skirt, light fan, handling systems and floating docks. The market investigations provide identification and technical evaluation of these commercial items
- (U) Composite Ballistic Tactical Vehicle — This program will investigate the use of composite material ballistic enclosures i.e., cab, for light vehicles to consider such things as repairability, crash worthiness, methods of attaching to the vehicle structure, and resistance to fragmenting munitions. This investigation will determine if composites are available that meet Army's ballistic requirements

(U) FY 1991 Planned Program:

- (U) Commercial Construction Equipment (CCE) — Conduct market investigations by questionnaire, literature search, visitations and survey of both governmental and non-governmental sources. End products will be technical reports, specification parameter, procurement guides and identification of modifications required for future procurement packages
- (U) Lightweight Hose — Conduct market investigation on lightweight hose that will be primarily used on fuel and handling equipment. This market investigation will determine the hose that most clearly meets the Army's requirements with the least amount of modification. This information will then be used by the decision board as to whether to proceed into testing, procurement, or return to an R&D project
- (U) Advanced Zinc Phosphate Poly-Electrolyte Metal Surface Treatment — Continue to investigate the use of conventional zinc phosphate paint pre-treatment instead of primer to determine how well it protects the parent metal from corrosion

(U) Project DB49 — NDI Cargo Transportation Test: Congress appropriated funds in FY 1988 and 1989 to purchase 50 Maxi-Cube bulk cargo transport systems, but did not authorize same.

(U) FY 1989 Accomplishments:

- (U) None.

(U) Project DE65 — NDI Testing: The operational testing portion conducts operational evaluation of production items identified by NDI Market Investigations. These investigations seek to satisfy new requirements or replacements for standard items in the Army inventory when that standard item is no longer available to meet the need and/or significant savings can be realized by precluding an R&D effort. The evaluation typically includes minor engineering modifications and testing of an item leading to development of performance specifications.

(U) FY 1989 Accomplishments:

- (U) Analysis of Commercial Environmental Control Units (ECUs) and Components: Market investigations identified manufacturers of Environmental Control Units (ECUs) meeting requirements. Acceptable off-the-shelf equipment was procured and limited testing being accomplished
- (U) Commercial Equipment for Materiels Handling — This is a continuing task that addresses a wide variety of items within the overall umbrella. This effort was a follow on of market investigations that were conducted. This effort involved obtaining and testing items like Graves Registration Equipment, Intra-Installation Ammo Transporter, FLEX pallets, and 10,000 pound Rough Terrain Fork Lift Truck

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PE Title: **RDT&E Support for Non-Developmental Items (NDI)** Budget Activity: **#6**

- **(U)** Pre-Painted Coil Metals — Completed update of state-of-the-art technology of coil primed metals. Installed preliminary coil primed test panels at Cape Canaveral, beach front, Marine Atmosphere Exposure Test Site. A contract will be awarded for the initiation of parts production trial runs and testing of those products
- **(U)** High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) Heavy variant — The HMMWV Heavy variant (10,000 lb GVW) is a contractor developed variant of the existing HMMWV. Testing of the new variant is determining whether the Heavy Variant is suitable for planned Army applications. The vehicle is needed to support numerous programs in the communications, intelligence, air defense, signal warfare and artillery mission areas
- **(U)** FY 1989 funding for the Heavy HMMWV program was reprogrammed to conduct technical analysis of the contractor proposal for the HMMWV Heavy Variant, to conduct selected component and engineering testing, to initiate vehicle test planning and to procure the test vehicles

(U) FY 1990 Planned Program:

- **(U)** Commercial Components for Military Vehicles — Will continue to fabricate and test parts made with composites to determine which materials give the Army better life on components exposed to the elements. Composites do not corrode and are lighter in weight than conventional materials
- **(U)** Improved Military Standard Air Conditioners — Perform testing of motor controllers in air conditioners. Review test results and rank order motor controllers with established requirements. Provide a report with recommendations to the decision board
- **(U)** Chip Resistant Chemical Agent Resistant Coating (CARC) Undercoating — This effort which is to commence in FY 1990, seeks to determine which of several candidate materials is best suited for this application, i.e. compatible with solvents used in decontamination operations. This undercoating, which will then be compatible with CARC, will not only be resistant to chipping, but will also be resistant to corrosion. It is projected to be used both in original manufacture and depot rebuild
- **(U)** HMMWV Heavy Variant — The FY 1990 program will be funded through a reprograming action to ensure the continuation of testing of the vehicles, engineering analysis of the test results, any required Integrated Logistics Support (ILS) activities related to the Heavy variant and initiation of the Technical Data Package (TDP) update

(U) FY 1991 Planned Program:

- **(U)** Analysis of Environmental Control Units — Many applications/sizes for environmental control units (ECU) do not meet the severe conditions required of military specification items. Readily available and serviceable commercial units may be applicable in many situations. The program will continue testing and studying different sizes of ECU's to determine optimum capabilities under controlled environments
- **(U)** Improved Chelators and Sequestrants — Army use of sodium hexametaphosphate as a sequestrant is ineffective. Chelators and sequestrants exist that can be used in thermally stable liquid forms which are not difficult to mix into prepared solutions at a wide range of ambient temperatures
- **(U)** Family Of Rock Processing Equipment (FORPE) — Existing FORPE has exceeded service life rendering it logistically unsupportable. Develop program documentation and performance specification for FORPE to reflect new verified requirements and to allow for future procurements.
- **(U)** Low-Profile Tubeless Radial Tires — The Army has been slow in keeping abreast with technological advances in the tire industry. The Army seeks to evaluate applicability of low-profile tires to military tactical vehicles

Program Element: **#0605810A**

PE Title: **RDT&E Support for Non-Developmental Items (NDI)** Budget Activity: **#6**

- **(U)** HMMWV Heavy Variant — The FY 1991 program includes funding to complete the testing program, any analysis required, and completion of the TDP update

(U) Work Performed By: These projects provide for performance of technical tasks and acquisition of related materiel by contract utilizing both private and Government agency contractors.

(U) Related Activities: There are no known equivalents to the Army's RDT&E funded Non-Developmental Item (NDI) program and no duplication exists.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605872A**

PE Title: **Productivity Investments** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
D851	QRIP & PECIP — OCE	1077	1151	1151	Cont	Cont
DE13	OSD PIF — OCE	- 0 -	836	154	Cont	Cont
DE89	QRIP & PECIP — AMC	7474	7986	7917	Cont	Cont
DE98	OSD PIF — AMC	32944	5561	6408	Cont	Cont
DW02	QRIP & PECIP — SDC	3094	3361	3529	Cont	Cont
ME88	RESHAPE — AMC	4274	- 0 -	- 0 -		
PE TOTAL		48863	18895	19159		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element finances Army research and development support of productivity improvements through investment in productivity-enhancing capital equipment and productivity-enhancing management initiatives in accordance with DODI 5010.36, Department of Defense (DOD) Productivity-Enhancing Capital Investment Program; DODD 3201.1, Management of DOD Research and Development Laboratories; and DODI 3201.3, DOD Research and Development Laboratories.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project D851 — Quick Return on Investment Program and Productivity Enhancing Capital Investment Programs — Office of Chief of Engineers (QRIP & PECIP — OCE).

(U) FY 1989 Accomplishments:

- (U) Example: An acquisition for FY89 was a Remotely Operated Vehicle (ROV) to support monitoring and inspection of coastal activities for a variety of military projects, including the Logistics Over the Shore (LOTS) operation and the Defense Nuclear Agency's underwater explosion studies. Use of the ROV in lieu of live divers in expensive or hazardous diving operations will save over $500 thousand over the next 10 years.

(U) FY 1990 Planned Program:

- (U) Example: A Real-Time Sea-State Forecasting System to more accurately and efficiently develop, test, demonstrate, and implement sea state forecasts. The system will be used to support the Joint Logistics Over the Shore (JLOTS) operation in which the successful integration of wind data, water levels, currents, and waves are crucial for a successful JLOTS exercise. At a cost of $136 thousand, the estimated annual savings to the Army is over $250 thousand per year.

(U) FY 1991 Planned Program:

- (U) Example: Lumina Computer Graphics and Design System supports research in the visual area for improving techniques and material supporting camouflage, concealment and deception (CCD), Scene Analysis Research (SCAN-R) and mine countermine automatic target recognition. Computer aided graphic modeling for target scene manipulation will reduce time

Program Element: **#0605872A**
PE Title: **Productivity Investments** Budget Activity: **#6**

in determining best measures for improving visual target concealment. The investment of $70 thousand should result in an average annual research and development savings of $170 thousand over 6 years.

(U) Project DE13 — Office, Secretary of Defense, Productivity Investment Funding (OSD PIF) — Office of the Corps of Engineers (OCE): This program finances Army research and development support of productivity improvement through investment in productivity-enhancing capital equipment and productivity-enhancing management initiatives at OCE. Purpose is to improve personnel productivity through expanded capital investment in productivity-enhancing equipment. Fiscal management controls have been established to insure that projects are funded as planned. Post-investment analysis is conducted to identify the benefits achieved, to include the impact on productivity of the organizations involved and the disposition of manpower savings.

(U) FY 1989 Accomplishments: Not funded.

(U) FY 1990 Planned Program:

- (U) Example: A graphics animation system to enhance the capabilities of the new Army Supercomputer Installation at the Waterways Experiment Station (WES) in Vicksburg, MS. The equipment will provide high performance distributed graphics animation for numerical model formulation and results interpretation, comprehension, and analysis. The equipment will use a portion of the new Fiber Optic Cable installed at WES to establish a very high speed proprietary network to handle the high volume communications required by graphics animation. The cost of the proposed system is $185 thousand. Savings in labor and computer time are estimated at $840K per year, with a savings to investment ratio of 18:1.

(U) FY 1991 Planned Program:

- (U) One project is planned for FY 1991 in order to provide more efficient capital machinery and reduction in man-hours at Department of Defense operating facilities. This project is a Heavy Falling Weight Deflectometer which applies a 50-kip impulse load to the pavement surface and the response is measured with seven deflection sensors. The testing operation, data collection, and data reduction is performed by computer which is part of the unit. The Heavy Falling Weight Deflectometer will be used to test airfield pavements to support research in the development of nondestructive evaluation procedures. Investment cost of approximately $150 thousand is expected to accrue savings from the reduced cost of field testing which will result in an estimated annual savings of $214 thousand for the economic life of the equipment which is estimated at ten years.

(U) Project DE89 — Quick Return on Investment Program and Productivity Enhancing Capital Investment Program — US Army Material Command (QRIP & PECIP — AMC)

(U) FY 1989 Accomplishments:

- (U) Example: Acquisition of the Pattern Design System to be located at the Natick Research Development and Engineering Center, Natick, MA which will improve the capabilities of the computerized pattern equipment. Savings are based on: (1) eliminating the need to cut, stamp, ship, retrace, and maintain patterns, (2) reducing downtime needed for the operators to solve present system configuration problems, (3) eliminating unnecessary maintenance and repair time associated with the present system which has an obsolete status. The investment of $295 thousand is expected to produce annual benefits from inhouse labor and contract costs of $203 thousand over 8 years

Program Element: **#0605872A**

PE Title: **Productivity Investments** Budget Activity: **#6**

(U) FY 1990 Planned Program:

- (U) Examples include the purchase of an Infrared Microscope, to be located at the Ballistics Research Laboratory, Aberdeen Proving Ground, MD, which will provide the capability to permit very small samples to be pressed to very high pressures which make them infrared transmitting. The investment of $37 thousand can be expected to produce annual benefits from in-house labor and contract costs of $87 thousand over 10 years.

(U) FY 1991 Planned Program:

- (U) Planned acquisition of Molecular Beam Epitaxy System to be located at the Electronics Technology and Devices Laboratory, will upgrade the present system to a 3 Inch non-bonded capacity and will be used for the growth of millimetric sources and monolithic integrated circuits (IC) devices which impact radar, smart munitions, and communication systems. The investment of $125 thousand is expected to produce annual benefits of $102 thousand over 6 years.

(U) Project DE98 — Office, Secretary of Defense, Productivity Investment Funding (OSD PIF) — Army Materiel Command (AMC): This program finances Army Research and Development support of productivity improvement through investment in productivity-enhancing capital equipment and productivity-enhancing management initiatives at AMC in accordance with DODI 5010.36, Department of Defense (DOD) Productivity-Enhancing Capital Investment Program; DODD 3201.1, Management of DOD Research and Development Laboratories; and DODI 3201.3 DOD Research and Development Laboratories. The Office of the Secretary of Defense established the program in FY 1981 for the express purpose of improving personnel productivity through expanded capital investment in productivity-enhancing equipment. Fiscal management controls have been established to insure that projects are funded as planned. Post-investment analysis is conducted to identify the benefits achieved, to include the impact on productivity of the organizations involved and the disposition of manpower savings.

(U) FY 1989 Accomplishments:

- (U) Approximately 41 projects providing more efficient capital machinery and reduction in man-hours at Department of Defense operating facilities were undertaken in FY 1989.
- (U) An example of one of these efforts is the purchase of an Automated X-Ray Diffraction System. The system incorporates search/match procedures for determining powder patterns and texture analysis while using techniques which are non-destructive to the samples. The investment of $438 thousand has a projected annual savings of $739 thousand for eight years.

(U) FY 1990 Planned Program:

- (U) Among the 15 projects planned is the use of Analytical Laboratory Robotics. This project is comprised of the purchase of two programmable laboratory robot systems which will decrease sample preparation time to a small fraction of what it is now, eliminate most of the labor costs associated with sample preparation and enable 24 hours/day operation of certain key facilities in the Ballistic Research Laboratory's Propellent Analytical Chemistry Lab, resulting in a many-fold increase in productivity. Additional savings will result from reduced (human) error, decreased materials waste, and simplified procedures made possible by the inherent safety advantages of unattended operation. Investment of $153 thousand is expected to produce annual savings of $300 thousand over 10 years.

(U) FY 1991 Planned Program:

- (U) An example of the type of projects planned is the Multi-Source Deposition System for dielectric and phosphor thin films to be used in conjunction with the existing in-house, thin film electroluminencent (TFEL) characterization facility. The Electronics Technology and Devices Laboratory is involved in the development of TFEL technology and has resulted in the

Program Element: **#0605872A**
PE Title: **Productivity Investments** Budget Activity: **#6**

design and application of TFEL panel monochrome displays into numerous Army systems. Requirements for color displays and rapid assimilation of high density information in tactical situations demands even greater involvement of ETDL in this development. Without this equipment, experimental samples will continue to be obtained through expensive contracts resulting in reduced experimental control and higher costs. Investment cost of $1 million is expected to produce annual savings of $1.1 million over 5 years.

(U) Project DW02 — Quick Return on Investment Program and Productivity-Enhancing Capital Investment Programs — U.S. Army Strategic Defense Command (QRIP & PECIP — USASDC)

(U) FY 1989 Accomplishments:

- (U) An example of one of the many efforts undertaken by USASDC in FY 1989 is the upgrade of the weather station located at the U.S. Army Kwajalein Atoll. This upgrade consists of the procurement and installation of an advanced meteorological satellite data receiving and manipulation system that will ingest data from the various orbiting satellites and perform manipulations of this data to aid in cloud detection and forecasting. The cost of the system is $750 thousand with a projected annual savings of $1.5 million for 10 years based on the prevention of unnecessary range holds and data loss due to poor forecasting during testing of airborne sensors.

(U) FY 1990 Planned Program:

- (U) One of the planned FY 1990 acquisitions is the acquisition and installation of the advanced atmospheric imaging system. This system will enhance the testing of the operational capability of weapon systems, both for planning and operations through the advanced processing, manipulation, and display of climatological characterization. The investment of $840 thousand has a projected annual savings of $1.13 million for 10 years.

(U) FY 1991 Planned Program:

- (U) An example of one of the many efforts to be undertaken in FY 1991 is the acquisition and installation of a state-of-the-art security system for the USASDC Huntsville facility. This system will utilize access cards, card readers, door alarms, cameras, video cassette recorders, etc. instead of guards physically located within the facility. An investment of $760 thousand will realize a projected annual savings of $461 thousand for 10 years.

(U) Project ME88 — Resource Self-Help/Affordability Planning Effort (RESHAPE-AMC)

(U) FY 1989 Accomplishments:

- (U) An intensive management effort which attained more productivity from the current workforce
- (U) An example of a project is the Surface Contamination Analyzer, located at Electronics Technology Laboratory, which will be used for analyzing wafer defects and contamination in the processing of semi-conductor devices and circuits. The investment of $115 thousand is expected to produce an annual savings of $128 thousand, over 8 years.

(U) **Work Performed By:** This project provides for procurement of equipment by contract and, when appropriate, for in-house personnel costs throughout the Army to provide peak demand labor hours on an economical basis.

(U) **Related Activities:** The OSD Productivity Investment Funding Program encompasses efforts in all three Services and selected Defense Agencies. There is no unnecessary duplication of effort within the Army or the Department of Defense.

(U) **Other Appropriation Funds:** ($ in Thousands) Not Applicable.

(U) **International Cooperative Agreements:** Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605894A**

PE Title: **Real Property Maintenance Activities (RPMA) — RDT&E**

Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
M0XX	RPMA — Army Materiel Command Test Ranges				
	98801	133202	145377	Cont	Cont
M1XX	RPMA — Army Materiel Command Major Subordinate Commands and Laboratories				
	61614	61549	72823	Cont	Cont
M4XX	RPMA — Corps of Engineers				
	4520	4455	4564	Cont	Cont
PE TOTAL	164935	199206	222764		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element finances activities and functions necessary for operating and maintaining US Army RDTE installations, laboratories and test ranges, i.e., operation of utilities, maintenance and repair of real property, minor construction, fire prevention, refuse collection, pest control and custodial services. The majority of available resources are required to fund fixed-cost expenses of keeping the facilities operational, e.g., electricity, water, sewage treatment, fire protection, snow removal, custodial services and refuse collection. Limited resources remain to fund the annual maintenance and repair required to preserve the life and usefulness of these critical test ranges and facilities. The deterioration resulting from this level of funding and the significant surge in the number of federal and state environmental compliance projects that must be funded, make it necessary to increase resources in this program. In FY 1989 and FY 1990, $55 million of essential maintenance and repair resources were diverted to correct environmental compliance deficiencies. In FY 1990, a reprograming request of $29 million has been submitted to fund urgent maintenance and repair projects at U.S. Army test ranges. The reprograming will replace essential maintenance and repair funds diverted to correct critical federal/state environmental deficiencies. The FY 1991 budget begins to correct this situation by adding resources for Class I environmental compliance requirements and increasing funds available for recurring maintenance and repair.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project M0XX — RPMA — Army Materiel Command (AMC) Test Ranges: Funds RPMA at the following Army test ranges which comprise a major portion of the DOD Major Range and Test Facility Base: Yuma Proving Ground, AZ; Aberdeen Proving Ground, MD; Dugway Proving Ground, UT; and White Sands Missile Range, NM.

(U) FY 1989 Accomplishments:

- **(U)** Insufficient funds were available in this project to ensure adequate maintenance and repair of the Army's test ranges and facilities
- **(U)** Resources were available for only fixed cost expenses of operating the facilities (electricity, water, sewage treatment, fire protection, custodial services, etc)
- **(U)** Resources programmed/budgeted for maintenance and repair were diverted to fund critical Occupational Safety and Health Agency (OSHA) projects (life or injury threatening), and Class I environmental projects (immediate action required under federal/state Environmental Protection Agency (EPA) consent order or enforcement action). Over $17 million was diverted to fund Class I environmental compliance projects in FY 1989

Program Element: **#0605894A**

PE Title: **Real Property Maintenance Activities (RPMA) — RDT&E** Budget Activity: **#6**

- **(U)** Essential recurring maintenance and repair (including emergency work orders for utility systems/plants) significantly underfunded, resulting in serious damage and deterioration of buildings, utility systems, and roads
- **(U)** Backlog of Maintenance and Repair (BMAR) was validated at $157 million at end of FY 1989

(U) FY 1990 Planned Program:

- **(U)** RPMA activities continue at inadequate levels. Deterioration and damage increase as essential maintenance and repair remains significantly underfunded. BMAR grows to $176 million
- **(U)** A Congressional reprograming request has been submitted to fund $29 million of vital maintenance and repair projects at Aberdeen Proving Ground, Maryland; White Sands Missile Range, New Mexico; Yuma Proving Ground, Arizona; and Dugway Proving Ground, Utah. The reprograming replaces essential maintenance and repair funds diverted to correct environmental deficiencies.

(U) FY 1991 Planned Program:

- **(U)** Begins to correct deterioration of these important ranges and test facilities by: (1) adding resources to fund Class I environmental compliance projects. (Class I projects require immediate action under federal/state EPA consent decree or enforcement order); and (2) adding resources for recurring maintenance and repair as a first step effort to curtail decay of RDTE test facilities
- **(U)** Without this corrective action, deterioration will increase to a point where mission readiness is affected

(U) Project M1XX — RPMA — Army Materiel Command Major Subordinate Commands and Laboratories: Funds RPMA at Harry Diamond Laboratories, Adelphi, MD; Picatinny Arsenal, Dover, NJ and Natick Research, Development and Engineering Center, Natick, MA.

(U) FY 1989 Accomplishments:

- **(U)** Funded RPMA activities and functions at AMC Major Subordinate Commands and Laboratories
- **(U)** The cost of complying with environmental standards increased significantly
- **(U)** Over $10 million of resources budgeted for essential maintenance and repair were diverted to fund Class I environmental compliance projects
- **(U)** BMAR was validated at $45 million at the end of FY 1989

(U) FY 1990 Planned Program:

- **(U)** Continues to fund RPMA activities and functions at AMC Major Subordinate Commands and Laboratories below funding level required to support annual recurring requirements
- **(U)** Deterioration increases as resources budgeted for essential maintenance and repair are diverted to fund environmental compliance projects
- **(U)** BMAR increases to $53 million

(U) FY 1991 Planned Program:

- **(U)** Continue to fund RPMA activities and functions at AMC Major Subordinate Commands and Laboratories
- **(U)** The Army initiative to correct RPMA deficiencies at Army ranges and test facilities provides $6.8M to fund Class I environmental compliance requirements in this project
- **(U)** Additional maintenance and repair funds are provided as a first step attempt to curtail the damage and decay existing at these facilities

Program Element: **#0605894A**

PE Title: **Real Property Maintenance Activities (RPMA) — RDT&E**

Budget Activity: **#6**

- **(U)** BMAR will increase to $61 million

(U) Project M4XX — RPMA — Corps of Engineers: Funds RPMA at Waterways Experiment Station, Vicksburg, MS; Cold Regions Research and Engineering Laboratory, Hanover, NH and Engineer Topographic Laboratories, Ft Belvoir, VA.

(U) FY 1989 Accomplishments:

- **(U)** Continued to fund RPMA activities and functions for the Corps of Engineers RDTE laboratories and test facilities
- **(U)** Deterioration continued as annual recurring requirements remain underfunded. BMAR continues to grow

(U) FY 1990 Planned Program:

- **(U)** Continue to fund RPMA activities and functions for the Corps of Engineers RDTE laboratories and test facilities
- **(U)** Deterioration continues as annual recurring requirements remain underfunded. BMAR continues to grow

(U) FY 1991 Planned Program:

- **(U)** Continue to fund RPMA activities and functions for the Corps of Engineers
- **(U)** Deterioration continues as annual recurring requirements remain underfunded. BMAR continues to grow

(U) Work Performed By: Subordinate Commands and other activities of the US Army Materiel Command and the Corps of Engineers R&D activities.

(U) Related Activities: Program Element #0605896A (Base Operations-RDT&E) finances all other functional activities related to operating and maintaining Army RDT&E installations. There is no unnecessary duplication of effort within the Army or the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605896A**

PE Title: **Base Operations — RDT&E** Budget Activity: **#6**

A. (U) RESOURCES: (S in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
M0ZZ	Base Operations — Army Materiel Command (AMC) Test Ranges				
	115082	122030	130542	Cont	Cont
M1ZZ	Base Operations — AMC Major Subordinate Commands and Laboratories				
	59705	58023	61548	Cont	Cont
M4ZZ	Base Operations — Corps of Engineers				
	8292	11447	12270	Cont	Cont
PE TOTAL	183079	191500	204360		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element (PE) finances installation support activities and functions necessary for operating and maintaining U.S. Army RDT&E installations, laboratories, and test ranges. The activities and functions include: (1) operation of consolidated post supply functions; (2) direct and general support relating to the installation or satellite support maintenance activities; (3) operation and maintenance of transportation equipment and local transportation; (4) operating laundry and dry cleaning plants and contractual services where Army-owned plants are not operated; (5) Army food service program; (6) support to military and civilian personnel; (7) operation and administration of unaccompanied personnel housing; (8) command element activities required for commanding all Army units assigned or attached to the installation; (9) automation activities; (10) development, staffing, equipping, administering, operating, supervising, and promoting recreation facilities and activities; (11) police and security services at Army installations; (12) resource management operations; (13) coordination and supervision of the planning, operations, training, and mobilization aspects of the garrison; (14) contracting operations; (15) security and counterintelligence operations; and (16) records management and publications. Provides salaries and related personnel benefits for authorized civilian personnel and associated administrative support.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project M0ZZ — Base Operations — Army Materiel Command (AMC) Test Ranges: Funds base operations at the following Army test ranges: Yuma Proving Ground, AZ; Aberdeen Proving Ground, MD; Dugway Proving Ground, UT; and White Sands Missile Range, NM.

(U) FY 1989 Accomplishments:

- **(U)** This project continued to fund the activities and functions discussed in Paragraph B for the Army Test Ranges

(U) FY 1990 Planned Program:

- **(U)** This project continues to fund the activities and functions discussed in Paragraph B for the Army Test Ranges
- **(U)** Funds conversion of dining facility cooks from military to civilian; funds the initial phase of the Congressional directed rental of non-tactical vehicles; funds the FY 1990 civilian pay raise

(U) FY 1991 Planned Program:

- **(U)** This project continues to fund the activities and functions discussed in Paragraph B for the Army Test Ranges

Program Element: **#0605896A**

PE Title: **Base Operations — RDT&E** Budget Activity: **#6**

- **(U)** The increase between FY 1990 and FY 1991 funds the final phase of non-tactical vehicle rental; funds civilian benefits associated with the conversion of non-appropriated fund positions to appropriated fund positions; funds the FY 1991 civilian pay raise and annualization of the FY 1990 civilian pay raise

(U) Project M1ZZ — Base Operations — Army Materiel Command (AMC) Major Subordinate Commands and Laboratories: Funds base operations at Harry Diamond Laboratories, Adelphi, MD; Picatinny Arsenal, Dover, NJ and Natick Research, Development and Engineering Center, Natick, MA

(U) FY 1989 Accomplishments:

- **(U)** This project continued to fund the activities and functions discussed in Paragraph B for the AMC Major Subordinate Commands and Laboratories

(U) FY 1990 Planned Program:

- **(U)** This project continues to fund the activities and functions discussed in Paragraph B for the AMC Major Subordinate Commands and Laboratories

(U) FY 1991 Planned Program:

- **(U)** This project continues to fund the activities and functions discussed in Paragraph B for the AMC Major Subordinate Commands and Laboratories.

(U) Project M4ZZ — Base Operations — Corps of Engineers: Funds base operations at Waterways Experiment Station, Vicksburg, MS; Cold Regions Research and Engineering Laboratory, Hanover, NH and Engineer Topographic Laboratories, Ft. Belvoir, VA.

(U) FY 1989 Accomplishments:

- **(U)** This project continued to fund the activities and functions discussed in Paragraph B for the Corps of Engineers RDTE,A Laboratories

(U) FY 1990 Planned Program:

- **(U)** This project continues to fund the activities and functions discussed in Paragraph B for the Corps of Engineers RDTE,A Laboratories
- **(U)** The increase between FY1989 and FY1990 reflects a transfer from PE 0602784A — Military Engineering Technology to support base operations accounts at Waterways Experiment Station, Vicksburg, MS; and to fund the FY 1990 civilian pay raise and annualization of the FY 1989 civilian pay raise. The remaining increase provides for security service support, an ADP communications networking system, and technical library modifications

(U) FY 1991 Planned Program:

- **(U)** This project continues to fund the activities and functions discussed in Paragraph B for the Corps of Engineers RDTE,A Laboratories
- **(U)** The increases identified for FY 1990 extend into FY 1991; also funded is the FY 1991 civilian pay raise

(U) Work Performed By: Subordinate Commands and other activities of the US Army Materiel Command and the Corps of Engineers RDT&E activities.

(U) Related Activities: PE #0605894A (Real Property Maintenance — RDT&E) finances all other functional activities related to operating and maintaining Army RDT&E installations. There is no unnecessary duplication of effort within the Army or the Department of Defense.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0605898A**

PE Title: **Management Headquarters (Research and Development)** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
HH02 Army Management Headquarters Activities (AMHA)					
	11060	14458	15297	Cont	Cont
PE TOTAL	11060	14458	15297		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides the funding for Management Headquarters activities at the US Army Medical Research and Development Command (MRDC) and the US Army Laboratory Command (LABCOM) that (1) develop policy and guidance; (2) perform long-range planning, programing and budgeting; (3) provide the management and distribution of resources; and (4) conduct program performance review and evaluation for the Research, Development, Test and Evaluation (RDTE), Army appropriation. Provides salaries and related personnel benefits for authorized civilian personnel and the associated administrative support (temporary duty travel, operating supplies and equipment). The Management Headquarters program is heavily dependent on the civilian workforce and associated support contractor operations. HQ LABCOM Technology Planning and Management Directorate and the Patent Office activities and functions were transferred to this project effective FY 1990. This was a zero sum transfer from Operations and Maintenance, Army (OMA) appropriation.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project HH02 — Army Management Headquarters Activities (AMHA)

(U) FY 1989 Accomplishments:

- **(U)** Continued operation of the RDT&E management headquarters activities at US Army Medical R&D Command, Ft. Detrick, Maryland and US Army Laboratory Command, Adelphi, Maryland. The FY 1989 program, as appropriated by Congress, was insufficient to sustain headquarters operations. Reprogramings were required to restore the program to minimum essential level.

(U) FY 1990 Planned Program:

- **(U)** Funds minimum essential operation of the RDT&E management and headquarters activities at US Army Medical R&D Command, Ft Detrick, Maryland and US Army Laboratory Command, Adelphi, Maryland
- **(U)** Increase between FY 1989 and 1990 is due to zero sum transfer of funds from Operations and Maintenance, Army Appropriation to RDTE,A for transfer of the Technology Planning and Management and Patent Office functions at HQ LABCOM

(U) FY 1991 Planned Program:

- **(U)** Continue minimum essential operation of the RDT&E management and headquarters activities at US Army Medical R&D Command, FT Detrick, Maryland and US Army Laboratory Command, Adelphi, Maryland

Program Element: **#0605898A**

PE Title: **Management Headquarters (Research and Development)** Budget Activity: **#6**

(U) Work Performed By: The US Army Medical R&D Command, Ft. Detrick, Fredrick, Maryland and the US Army Laboratory Command, Adelphi, Maryland

(U) Related Activities: This program funds headquarters administrative and management activities only. There is no duplication of effort within the Army or the Department of Defense

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 AMENDED RDTE DESCRIPTIVE SUMMARY

Program Element: **#0708011A**

PE Title: **Industrial Preparedness** Budget Activity: **#6**

A. (U) RESOURCES: ($ in Thousands)

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
DE50 Communications & Electronics	1974	4680	5159	Cont	Cont
DE51 Other Procurement	5472	5938	6572	Cont	Cont
DE60 Aircraft	323	1084	3512	Cont	Cont
DE61 Missiles	1064	2892	4358	Cont	Cont
DE62 Weapons & Tracked Combat Vehicles	3743	5498	3920	Cont	Cont
DE63 Ammunition	5421	4245	2746	Cont	Cont
DE64 Tactical Support Vehicles	699	296	441	Cont	Cont
DE66 Industrial Modernization Incentives Program	1104	- 0 -	- 0 -	—	—
PE TOTAL	19800	24633	26708		

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides improvements to manufacturing processes, techniques, and equipment to bridge the gap between research and development and full-scale production, reduces U.S. reliance on foreign technology, and assists in rebuilding the Defense Industrial Base. As such, it is c) of the key elements of the Army Total Quality Management Program in the Production Phase of the Acquisition Cycle. Starting in FY 1990, Technology Thrust Areas are being defined to focus resources on high payoff technologies in which Army resources can be leveraged through cooperative efforts and world class centers of excellence can be developed to enhance Army weapon system production. These projects are expected to result in a "factory floor" application of manufacturing technologies in commercial plants producing Army materiel and at arsenals, depots, ammunition plants, and test facilities. The Army Industrial Modernization Incentives Program (IMIP) effort will be funded with Procurement Appropriation resources starting in FY 1990 and beyond.

C. (U) JUSTIFICATION FOR PROJECTS:

(U) Project DE50 — Communications and Electronics: Electronics manufacturing is characterized by rapidly evolving technical performance of end products and intense competition from foreign sources. Implementation of advanced technology into the manufacture and remanufacture processes reduces the costs of ownership and allows the Army to take maximum benefit of end item technology. Thrust areas on soldering and microelectronics manufacturing and Night Vision-Electro Optics have been formed to coordinate Army efforts and focus resources. Tasks being pursued emphasize the exploitation of technology to improve test and diagnostic capabilities, process control of plating, soldering and assembly operations, the manufacturing processes for infra-red focal plane arrays and large scale integrated circuits for Army applications.

(U) FY 1989 Accomplishments:

- **(U)** Continued efforts in wiring harnesses, printed circuit card plating, and thermal imaging systems

Program Element: **#0708011A**

PE Title: **Industrial Preparedness** Budget Activity: **#6**

- (U) Constructed probes and created software to adapt automated test equipment to monolithic microwave integrated circuits
- (U) Adapted ultraviolet curable conformal coating systems to repair Army printed wiring assemblies
- (U) Established soldering Thrust Area for the resolution of technical problems and demonstration of advanced technology and standards for soldering electronic components. Began technical review and rewrite of standards and specifications on soldering to incorporate new procedures and technology in soldering. Organized soldering microfactory
- (U) Finalized technical parameters for computer controlled laser welding for communications-electronics equipment racks

(U) FY 1990 Planned Program:

- (U) Continue efforts in wiring harness testing, printed circuit card plating, automated test equipment for monolithic microwave integrated circuits, and ultraviolet curable coating systems to repair Army printed wiring assemblies
- (U) Initiate efforts to improve crystal growth and manufacturing capability for basic integrated circuit materials
- (U) Initiate Night Vision/Electro Optics Thrust Area to improve the yield of materials and processes used to manufacture high performance seekers and sensors used by missiles and target acquisition systems
- (U) Initiate Microelectronics manufacturing Thrust Area to coordinate enhancement of manufacturing processes essential to the quality production of electronic circuits and equipment
- (U) Begin investigation of opportunities to apply advanced technology to the automated production of batteries with Army applications
- (U) Continue Soldering Thrust Area work in establishing a science base for critical soldering standards, proveout of advanced techniques and problem resolution from production lines. Coordinate efforts with Industry, Academia and other Government Agencies
- (U) Complete and demonstrate laser welding for electronics racks

(U) FY 1991 Planned Program:

- (U) Complete wiring harness test technology and printed circuit plating with industry-DOD demonstrations for technology transfer
- (U) Continue efforts in automated test equipment for monolithic microwave integrated circuits, and ultraviolet curable conformal coating system to repair Army printed wiring assemblies
- (U) Continue effort to improve crystal growth and manufacturing capability for basic integrated circuit materials such as galium arsenide and potassium titanate phosphate
- (U) Continue exploration of advanced techniques to improve the yield of materials and processes used to manufacture high performance seekers and sensors used by missiles and target acquisition systems
- (U) Continue to apply advanced technology to the automated production of batteries with prominent Army applications
- (U) Continue Microelectronics Manufacturing Thrust Area to coordinate enhancement of manufacturing processes essential to the quality production of electonic circuits and equipment
- (U) Continue Soldering Thrust Area work in critical soldering standards, proveout of advanced techniques and problem resolution from production lines. Provide demonstration and technology transfer to Industry.

Program Element: **#0708011A**

PE Title: **Industrial Preparedness** Budget Activity: **#6**

(U) Project DE51 — Other Procurement: This project supports technology thrust areas in chemical defense, environmentally acceptable treatment process and nondestructive evaluation. Other technologies being advanced by this project include the processes of material and weapons systems testing which support a wide variety of weapons systems; basic combat support and individual soldier support materials.

(U) FY 1989 Accomplishments:

- (U) Established initial work for Chemical Defense Material Thrust Area. Completed prototype for automatic agent testing system for high flow filters used against toxic gases from battlefield weapons to insure safety and effectiveness in use. Began to develop manufacturing processes for monoclonal antibodies required to detect T-2 toxin which has wide ranging application to biotechnology production
- (U) Continued to develop processes for mats and bridge decks
- (U) Developed production methods for heat stable enzymes used in immuno-chemical detection devices for chemical and biological agents and toxins to broaden the production base, reduce cost and increase competition
- (U) Continued Materials Testing Technology to respond to emerging Army inspection requirements for material properties and suitability for use of or verification of materials in weapon systems production
- (U) Initiated the application of state-of-the-art technology of abrasive jet cutting systems to improve safety and productivity at Toole Army Depot in demilitarizing munitions
- (U) Established engineering assessments for methods and technology to improve quality and productivity of Army depot rebuild operations and automated sandblasting processes to the refurbishment components
- (U) Initiated environmentally acceptable treatment process Thrust Area to examine alternative production processes and material formulations to limit the use of volatile organic compounds (paints, solvents, coatings, etc.) used in production and rebuild

(U) FY 1990 Planned Program:

- (U) Expand efforts in the Chemical Defense Material Thrust Area. Complete development of manufacturing processes for monoclonal antibodies required to detect T-2 toxin with application to M272 water test kits and M256 agent detector kits and potential wide ranging applications to biotechnology production
- (U) Continue to develop production methods for heat stable enzymes used in detection devices for chemical and biological agents and toxins, and initiate production technology for advanced sorbents
- (U) Continue Environmentally acceptable treatment process Thrust Area to examine alternative production processes and material formulation to limit the use, collection and environmental protection required from volatile organic compounds (paints, solvents, coatings, etc.) used in the treatment, coating and rebuild of equipment
- (U) Continue to enhance Testing Technology to respond to emerging Army inspection requirements for material properties and suitability for use of or verification of materials in weapon systems production
- (U) Expand effort to enhance current production methods for medium duty landing mats and heavy duty membrane materials
- (U) Initiate non-destructive evaluation thrust area with tasks impacting the printed wiring boards and advanced image processing techniques
- (U) Initiate development of advanced manufacturing processes for support to the individual soldier such as stitchless seams for garments, and meal packets

Program Element: #0708011A
PE Title: **Industrial Preparedness** Budget Activity: #6

(U) FY 1991 Planned Program:

- (U) Continue efforts in the Chemical Defense Material Thrust Area
- (U) Continue to develop production methods for heat stable enzymes used in detection devices for chemical and biological agents and toxins, and production technology for advanced sorbents
- (U) Initiate efforts for manufacturing detector receptor proteins
- (U) Continue Environmentally Acceptable Treatment Process Thrust Area to examine alternative production processes and material formulation to limit the use, collection and environmental protection required from volatile organic compounds (paints, solvents, coatings, etc.) used in the treatment, coating and rebuild of equipment
- (U) Continue non-destructive evaluation thrust area completing tasks impacting the quality of adhesive bonded joints, printed wiring boards and continuing advanced image processing techniques
- (U) Continue to enhance testing technology to respond to emerging Army inspection requirements for material properties and suitability for use of or verification of materials in weapon systems production
- (U) Expand effort to enhance current production methods for medium duty landing mats and heavy duty membrane materials
- (U) Continue development of advanced manufacturing processes for support to the individual soldier such as stitchless seams for garments, and meal packets

(U) Project DE60 — Aircraft: Manufacturing technology advances are expected to produce significant benefits to the Army aircraft programs and US aerospace industry. High performance helicopters utilize advanced composite materials, precision engine parts and high technology mission equipment packages. Technology crosses several thrust areas rather than concentrate on aircraft as a commodity.

(U) FY 1989 Accomplishments:

- (U) Completed the prove out of laser balancing technology for removing material from rotating components of aircraft engines (T-53 and T-55) to improve quality and decrease manufacturing labor time
- (U) Initiated broad investigation of technological gaps in precision gear manufacturing industry

(U) FY 1990 Planned Program:

- (U) Initiate efforts to develop advanced processes for manufacture of complex aircraft parts using composites as part of the Composites/Adhesive Bonding Thrust Area
- (U) Initiate solution to wet riveting and fayed surface sealing

(U) FY 1991 Planned Program:

- (U) Continue efforts to develop advanced processes for manufacture of complex aircraft parts using composites as part of the Composites/Adhesive Bonding Thrust Area
- (U) Complete solution to wet riveting and fayed surface sealing

(U) Project DE61 — Missiles: State-of-the-art technology associated with missile power, flight, target acquisition, control and lethality requires parallel advances in manufacturing technology to facilitate the transition from hand made development prototypes to full quantity production. Dramatic improvement in cost and product quality are attributable to these investments. This project will expand in FY 1990 to encompass technology used cooperatively between the Army and industry with resources focused on missile seeker Technology Thrust Areas.

Program Element: #0708011A
PE Title: **Industrial Preparedness** Budget Activity: #6

(U) FY 1989 Accomplishments:

- (U) Expanded Robotized Wire Harness Assembly System to twisted pairs
- (U) Initiated refinement of advance manufacturing process to produce large scale quantities of hybrid/monolithic millimeter transceivers (94 GHz) applicable to fire-and-forget missile seeker applications which are uneconomical with small quantity techniques

(U) FY 1990 Planned Program:

- (U) Complete robotized wire harness effort with definition and specification of generic equipment for variety of wire types and characteristics. Conduct industry demonstration
- (U) Design pilot production line and high volume test equipment in hybrid/monolithic millimeter transceivers (94 GHz)
- (U) Initiate investigations into advanced manufacturing techniques to reduce the cost of fiber optically controlled missiles
- (U) Establish initial capability to enhance inertial measurement techniques for robotic applications to manufacturing processes
- (U) Initiate improvement of manufacturing processes to integrate focal plane array technology into advanced missile seekers and sensors

(U) FY 1991 Planned Program:

- (U) Continue advances in pilot production line and high volume test equipment in hybrid/monolithic millimeter transceivers (94 GHz)
- (U) Complete the process description of advanced manufacturing techniques to reduce the cost of fiber optically controlled missiles
- (U) Continue to enhance inertial measurement techniques for robotic applications to manufacturing processes
- (U) Continue improvement of manufacturing processes to integrate focal plane array technology into advanced missile seekers and sensors

(U) Project DE62 — Weapons and Tracked Combat Vehicles: This project provides manufacturing improvements in the areas of heavy materials forming, assembly and remanufacturing technology. It covers a wide spectrum of areas such as gun tubes, machining, metallurgy, welding, casting, and computer controls of balancing and plating processes. These tasks will be integrated by proposed thrust areas such as machine tools, welding and composites commencing in FY 1990.

(U) FY 1989 Accomplishments:

- (U) Initiated development of advanced laser balancing system
- (U) Initiated process which will set the parameters on chemistry and physical properties of cast armor
- (U) Continued welding task to utilize lost foam coating techniques
- (U) Continued computerized control of tool wear and quality of machining operations
- (U) Continued computerized measuring and recording system of surface finishes
- (U) Initiated a computed-based automated process control system to monitor techniques, levels of plating as well as a variety of union component metal finishing techniques with a capability of storage and retrieval information
- (U) Initiate application of expert systems to engineering tools for manufacturing analysis, design and planning
- (U) Initiated effort to use the high rate sputtering technique which will allow metallic coatings to be deposited at substrate temperatures as low as 70 degree centigrade
- (U) Completed a task on induction heating of a varying diameter preform

Program Element: **#0708011A**
PE Title: **Industrial Preparedness** Budget Activity: **#6**

(U) FY 1990 Planned Program:

- (U) Initiate Optics Thrust Area to integrate and focus manufacturing technology efforts supporting the advancement of production arrangements efficiency and quality for the American Precision Optics Manufacturers Association (APOMA). Cooperation with academia and industry associations is expected to leverage Army funding in this area. Areas of technology applications extend to spherical modular grinding, polishing and advanced processes
- (U) Optics Thrust Area tasks include:
  - Initiate computer numerical control multi-axis optic manufacturing with closed loop feedback
  - Process for fire control Optical Glass
  - Initiate critical parameters of lens grinding and polishing
- (U) Initiate Welding of Metallics Thrust Area to coordinate and enhance emerging technology, equipment and procedures to insure quality joining characteristics for welded parts with heavy applications for armor, tactical vehicles, construction and for specialty metals in high technology applications
- (U) Continue to develop engineering tools to support manufacturing analysis, design and planning
- (U) Initiate efforts to reduce cost and increase quality in the rebuild/overhaul of combat vehicle power trains and assemblies by improved process applications, advance equipment and computer assisted modeling and management

(U) FY 1991 Planned Program:

- (U) Continue Welding of Metallics Thrust Area to enhance quality joining characteristics for welded parts with applications for armor and tactical vehicles, and for specialty metals in high technology applications
- (U) Continue to enhance US manufacturing base capabilities to produce precision optics. Establish methods for processing optic quality glass and lens making operations
- (U) Continue to initiate efforts to reduce cost and increase quality in the rebuild/overhaul of combat vehicle power trains and assemblies

(U) Project DE63 — Ammunition: This project provides improvement in processes, inspection systems, handling, and manufacturing of ammunitions. It also heavily involves the processes and methods to increase safety and better meet environment procedures that are required by law. In so doing, the quality of the end items is increased and the overall process costs are reduced.

(U) FY 1989 Accomplishments:

- (U) Continued a pilot test study for the conversion of the existing batch guanidine crystallization to continuous processes
- (U) Developed an Army owned, cold forge process employing High Energy (HE) Rate Forming for the manufacture of Shaped Charge Liners
- (U) Completed effort to replace visual X-ray inspections of HE loaded shells with a real time image amplification X-ray system incorporating digital analysis and automatic acceptance
- (U) Continued to conduct studies to replace the visual method of effluent replacement with the feasibility of complete automation of TNT facilities
- (U) Initiated engineering of a sampling system to provide a tested operational system of sampling nitroglycerine that is safe from hazards
- (U) Initiated engineering effort for the reduction of the many diverse assembly operations to a few standard tasks which can be efficiently mechanized to current state-of-the-art for small charge explosives

Program Element: **#0708011A**
PE Title: **Industrial Preparedness** Budget Activity: **#6**

- (U) Initiated a Thrust Area for Advanced Processing Techniques for Energetic Materials

(U) FY 1990 Planned Program:

- (U) Complete demonstration of a system for sampling nitroglycerine safely
- (U) Continue effort to mechanize assembly of operations for mine clearing line charges (MCLIC)
- (U) Initiate enhancement of process control, handling, packaging and inspection technologies at Army ammunition plants
- (U) Continue efforts in the Thrust Area for Advanced Processing Techniques for Energetic Materials. This project will investigate and establish an alternate method for manufacturing magnesium-teflon pyrotechnic mixes to eliminate the use solvents, reduce processing times, and enhance operator safety
- (U) Execute tasks for development of machine-tool for welded banding of projectiles and test ductile cast M-864 rounds in response to Congressional direction

(U) FY 1991 Planned Program:

- (U) Continue the evolution of process control, handling, packaging and inspection technologies at Army ammunition plants
- (U) Complete effort to mechanize assembly operations for MCLIC
- (U) Continue efforts in the Thrust Area for Advanced Processing Techniques for Energetic Materials
- (U) Continue efforts towards reducing cost and environmental impact of producing explosive substances

(U) Project DE64 — Tactical Support Vehicles: This project provides improvements in many depot areas such as inspection of engines and engine components. It also involves use of modern technology to repair and regrind steel components. It will further adapt tools such as computer analysis and laser inspections to rebuild operations. In so doing, the end items will be returned to the user at lowest cost. Some of these efforts will fit into thrust areas such as welding of metallics and composites/adhesive bonding.

(U) FY 1989 Accomplishments:

- (U) Initiated a project that will adapt technology to repair and return cracked diesel cylinder heads and blocks to a re-usable condition and return to the user
- (U) Continued engineering of system to integrate automated inspection techniques utilizing a coordinated measuring machine to prequalify tactical vehicle engine blocks for reboring of cylinders
- (U) Continue to integrate crankshaft regrinding equipment capable of "in-process" determination of condition of main and rod bearing journals and performing grindings
- (U) Continue to investigate and analyze procedures for repairing and painting of composites on tactical wheeled vehicles. It will establish the testing, repair processes and facilities needed.

(U) FY 1990 Planned Program:

- (U) Complete procedures for repairing and painting of composites on tactical wheeled vehicles to establish testing, repair processes and facilities needed

(U) FY 1991 Planned Program:

- (U) Initiate integration of crankshaft regrinding equipment capable of "in-process" determination of condition of main and rod bearing journals and performing regrindings

Program Element: **#0708011A**

PE Title: **Industrial Preparedness** Budget Activity: **#6**

- **(U)** Continue to enhance the production and rebuild of tactical vehicle engines, transmissions and major structures by applying technology for automation of tasks, inspection and process control

(U) Work Performed By: This project provides for performance of technical tasks and acquisition of related materiel by contract utilizing both private and Government agency contractors. Contractors have included: Hughes Aircraft Corp; El Segundo, California; Chamberlain Mfg Co; Niles, Illinois; South West Research; Oklahoma; Microwave Assoc; Boston, Massachusetts; and Native Amer Services Assoc; Huntsville, Alabama. In-house work has been performed at Ft Belvoir, Virginia; Watervliet Arsenal, New York; Edgewood Arsenal, Maryland; Rock Island Arsenal, Illinois; and Tooele Army Depot, Salt Lake City, Utah. Other government agencies include the Department of Energy and the Bureau of Mines.

(U) Related Activities: This DOD program encompasses efforts in all three Services. The Army contribution to this effort is entitled Manufacturing Methods and Technology. All three Services are members of the DOD Manufacturing Technology Advisory Group (MTAG). There is no unnecessary duplication of effort within the Army or the Department of Defense for the Manufacturing Methods and Technology Programs.

(U) Other Appropriation Funds: ($ in Thousands) Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

DEPARTMENT OF THE ARMY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, ARMY
MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES FUNDED BY RDT&E, ARMY APPROPRIATION

PART 1. UTILIZATION OF SECTION 2353, TITLE 10 AUTHORITY

Specialized R&D facilities and/or equipment determined to be necessary for the performance of a contract for a Military Department for research and development may be constructed by or furnished to the contractor and funded from appropriations available for research, development, test and evaluation. The Congress enacted this legislation, now 10 USC 2353, in 1956. This policy is executed through DOD Directive 4275.5. Under this policy, the Secretaries of the Military Departments or their designees, and the Directors of Defense Agencies may approve facilities projects up to $3,000,000; the Under Secretary of Defense for Acquisition approves projects exceeding $3,000,000. The Congress is notified in advance of starting any project involving construction, regardless of the dollar amount. The table below provides a summary listing of all such projects accomplished in FY 1988 and planned in FY 1989, FY 1990 and FY 1991.

Facility/Equipment	RDT&E PE Number	Contractor/ Location	Total Obligational Authority (Thousands of Dollars) FY 1989	FY 1990	FY 1991
		SECTION I			
		Projects Accomplished or Underway			
		Negative			
		SECTION II			
		Projects Planned or Projected			
		Negative			

MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES FUNDED BY RDT&E, ARMY APPROPRIATION

PART 2. UTILIZATION OF RDT&E APPROPRIATION FOR FACILITIES AT GOVERNMENT-OWNED/ GOVERNMENT-OPERATED INSTALLATIONS

The RDT&E appropriation may finance the development, design, purchase, and installation (including directly related foundations, shielding, environmental control, weather protection, structural adjustments, utilities and access) of equipment or instrumentation required for research, development, test and evaluation activities. The table below provides a summary listing of all such projects for the installation of equipment, where the cost of installation is $200,000 or more, accomplished in FY 1988 and planned in FY 1989, FY 1990, and FY 1991.

Facility/Equipment	RDT&E PE Number	Location	Total Obligational Authority (Thousands of Dollars) FY 1989	FY 1990	FY 1991
SECTION I					
Projects Accomplished or Underway					
Armor/Anti-Armor Technology Containment Fixture	0605602A	APG,MD	355	0	0

The Armor/Anti-Armor Technology Containment Fixture, which has been named as "superbox," is an igloo-shaped, steel containment vessel big enough to hold a main battle tank. Depleted uranium (DU) ammunition will be fired through the igloo entrance at targets in the dome of the igloo. The targets will range from heavy armor plate to a fully-loaded, battle-ready tank. Recent improvements in heavy armor technology make testing of the penetration effects of DU ammunition against heavy armor a high priority requirement.

The superbox will protect the environment from both noise and the heavy metal debris that will result from the impact when the ammunition hits the target.

SECTION II

Projects Planned or Projected

Negative

PART 2. SUPPORTING NARRATIVE STATEMENT:

ARMOR/ANTI-ARMOR TECHNOLOGY CONTAINMENT FIXTURE (SUPERBOX)

a. DESCRIPTION:

The Superbox, a Depleted Uranium (DU) Containment Fixture will be a state-of-the-art, environmentally-safe, test fixture for effective testing of DU materials in a manner compliant with government regulations to protect the public, workers, and the environment. The proposed location of this fixture is in the Ford's Farm area of the U.S. Army Aberdeen Proving Ground (USAAPG). This is an area that has been previously used for DU firing in an enclosure and has been monitored for several years for emissions to the environment with favorable results.

b. MAJOR ITEMS INCLUDED IN PROJECT:

The fixture will consist of an eighty-four foot hemispherical containment vessel of one-inch thick carbon steel and a sixty-foot flight tunnel, both mounted on a one-hundred foot octagonal, six-foot thick slab. This enclosure will be capable of withstanding the blast effects of 100 pounds high explosive (HE) equivalent and the absorption of 650 pounds of burning propellant. To further ensure the integrity of the vessel a 40' x 40' x 25' high fragmentation shield of four-inch thick steel will be housed in the enclosure preventing fragments from penetrating the outer shell. The vessel will incorporate a complete air-filtration system including extensive air-monitoring equipment, control instrumentation, and a 99.97% efficient filter train. To clear solid DU waste from the test area following each test, the vessel will contain an asset protection/fire suppression system and a washdown system. Consequently, the fixture will house a liquid-filtration system and a holding tank approved for radiological waste. Two instrumentation enclosures are necessary to monitor each test and to ensure proper data collection. In order to power the fixture, an electrical enclosure, including a 500 KVA generator, is an intricate part of the Superbox.

c. REQUIREMENTS FOR THE FIXTURE:

PL 99-661, November 1986, mandated DOD survivability and lethality testing of major systems and munitions programs. This fixture is required to comply with the law.

With the advent of reactive armor and heavy armor, the Army does not have the capability for testing either the new armor systems or the projectiles being developed. Future systems requiring tests are Bradley, Abrams, and Heavy Force Modernization. Environmental constraints require the need for a target enclosure capable of withstanding the equivalent of 100 lbs TNT equivalent explosives. Existing enclosures can only withstand about 20 lbs exposure levels. Moreover, no enclosures exist that can be used to test full-sized, fully-loaded armor vehicles. Without tests, the quality of armor/ammunition systems and research into improved systems cannot be accomplished. Planned operational date is March 1990.

MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES FUNDED BY RDT&E, ARMY APPROPRIATION

PART 3. UTILIZATION OF RDT&E APPROPRIATION FOR MINOR CONSTRUCTION

For in-house installations, construction projects in support of R&D for $200,000 or less are funded from RDT&E appropriations. Such expenditures are authorized by 10 USC 2805 and the applicable provisions of the current DOD Appropriations Act. Under this procedure, project approval at this level is authorized by the Major Command concerned, or delegated to R&D installation commanders as appropriate. The table below provides a summary total of such minor construction accomplished in FY 1988, and the estimated amounts planned for FY 1989, FY 1990 and FY 1991. All minor construction must result in a complete and usable facility. In no event are two or more minor construction projects or minor and major construction projects to be contrived to form a usable facility.

SUMMARY OF MINOR CONSTRUCTION FUNDED BY RDT&E, ARMY
(Dollars in Thousands)

FY 1989	FY 1990	FY 1991
$9,536	$17,337	$10,068

APPENDIX A
RDTE CONGRESSIONAL DESCRIPTIVE SUMMARIES MAILING LIST

FICHE	PRINT	ADDRESS
—	1	USD (Policy), DUSD(P&R), Pentagon, Room 1C469, Washington, DC 20310
—	2	OSD, ATTN: DOT&E, Pentagon, Room 3E318, Washington, DC 20310
—	1	ASD (RA), Pentagon, Room 3E325, Washington, DC 20310
—	1	ASD (C3I), Pentagon, Room 3C200, Washington, DC 20310
—	1	ASD (ISP), Pentagon, Room 1D469, Washington, DC 20310
—	1	ASD (ISA), Pentagon, Room 4B938, Washington, DC 20310
—	1	ASD (LA), Pentagon, Room 3D918, Washington, DC 20310
—	2	ASD (SO/LIC-RDA), Pentagon, Room 1A670, Washington, DC 20310
—	2	ASD (FM&P)RM&S/PPBS S&L, Pentagon, Room 4C761, Washington, DC 20310
—	1	ASD (HA), Pentagon, Room 3E321, Washington, DC 20310
—	1	ASD (PA&E), Pentagon, Room 2E313, Washington, DC 20310
—	1	ASD (PA), Pentagon, Room 2E757, Washington, DC 20310
—	15	JCS (J-8), Pentagon, Room 1E963, Washington, DC 20310
—	1	HQDA (SAUS-OR), Pentagon, Room 2E660, Washington, DC 20310
—	1	HQDA (SAIL), Pentagon, Room 2E614, Washington, DC 20310
—	1	HQDA (SARDA), Pentagon, Room 2E673, Washington, DC 20310
—	1	HQDA (SAFM-CA), 1900 Half Street, S.W., Washington, DC 20324-2500
—	1	HQDA (SFIS-API), Hoffmann 1, Room 1012, Alexandria, VA 22331-0302
—	4	HQDA (DACS-DPD), Pentagon, Room 3C738, Washington, DC 20310
—	1	HQDA (DACS-DMP), Pentagon, Room 1C460, Washington, DC 20310
—	7	HQDA (SAIS-PPG), Pentagon, Room 1D679, Washington, DC 20310
—	6	HQDA (DACS-DPA), Pentagon, Room 3C747, Washington, DC 20310
—	1	HQDA (DACS-DMO), Pentagon, Room 3C567, Washington, DC 20310-0200
—	2	HQDA (DACS-A3), Pentagon, Room 2D741, Washington, DC 20310
—	1	HQDA (ASNS-OPM-S), Pentagon, Room 2B486, Washington, DC 20310
—	1	HQDA (DAMI-CIS), Pentagon, Room 2D481, Washington, DC 20310
—	1	HQDA (DAMI-PBB), Pentagon, Room 2E477, Washington, DC 20310
—	2	HQDA (DAPE-ZXO), Pentagon, Room 2D735, Washington, DC 20310
—	2	HQDA (DALO-RMP), Pentagon, Room 1E565, Washington, DC 20310
—	1	HQDA (DALO-ZA), Pentagon, Room 3E560, Washington, DC 20310
—	10	HQDA (DAMO-ZR), Pentagon, Room 3D526, Washington, DC 20310
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—	2	Commander, US Army Medical R&D Command, ATTN: SGRD-PR, Fort Detrick, Frederick, MD 21701-5012
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